Proceedings of the

International Conference on

"Recent Trends in Environment, Technology & Economy"

SWAYAZAS 2017

10th & 11th February 2017

Organized by

Department of M.Sc. EVS, M.Sc. CS & IT and MCOM

SIES (Nerul) College of Arts, Science & Commerce,

NAAC re-accredited 'A' Grade

Plot No. C, Sector V, Nerul, Navi Mumbai

In association with

Bombay Natural History Society

Chief Editor

Prof. Koel Roy Choudhury

Principal & Chairperson

Sharayu Prakashan

B-7/ 501, Vijay Park, Kasar vadavali, Ghodbunder Road,Thane (W) 400615,

Contact: Mob. 7506707761, Email-ashtikarcd@gmail.com, / Sharayu1954@gmail.com/

www.mngtguru.com

"Recent Trends in Environment, Technology & Economy"
(Proceedings)
10th & 11th February 2017
Organized by
Department of M.Sc. EVS, M.Sc. CS & IT and MCOM
SIES (Nerul) College of Arts, Science & Commerce,
NAAC re-accredited 'A' Grade
Plot No. C, Sector V, Nerul, Navi Mumbai
In association with
Bombay Natural History Society

Prof. Koel Roy Choudhury
Principal & Chairperson

Publisher:
Sharayu Prakashan
B-7/501, Vijay Park, Kasarvadavali,
Ghodbunder Road, Thane (West) 400615.
Mobile : 7506707761
E-mail : ashtikarcd@gmail.com/sharayu1954@gmail.com

Cover Design : Mrs. Swati Pawar

Published and Printed by:
Mrs. Sharayu, Chandrashekhar Ashtikar
Printed at, Shree Ganesh Enterprises, A-111,
Amargian Ind. Estate, Opp. S.T. Workshop,
Khopat, Thane (W) 400601

ISBN 978-81-933083-9-4

INDEX

Recent trends in Environment, Technology and Economy: How Technology such as Lean Six Sigma can Help?

By S.V.Viswanathan
Joint Hon Sec SIES
& Research Scholar, Tantia University

Abstract:
Environment management has become a key strategy and technological tool available for ensuring a healthier life for not only for human beings but all living beings too including flora & fauna.

Lean Six Sigma (LSS) are improvement tools when applied & implemented correctly, as projects, by Project teams will give break through results. This is irrespective of the functions and industries they are in. In short in Environment Management (EM) and Energy conservation LSS has been successfully applied giving good results.
This paper lists different type of tools available for usage through LSS and lists projects that can be formed to have breakthrough results.
With help of literature study, it is also seen the type of improvements that have been done.
Key words: *Lean six Sigma, Lean, Six Sigma, Technology, Environment Management*

Introduction

Lean Six Sigma as usage for Environment Management:

A research was conducted to find the major impact of Lean Six Sigma (LSS) on manufacturing Specialty Chemicals in selected industrial zones of Maharashtra. The research found organizations adopting Lean, Six Sigma (SS) & Lean Six Sigma (LSS) as part of their business strategy for continuous improvements for increasing profitability, competitiveness and gaining substantially. LSS use the best of Lean and Six Sigma and hence is popular.

As part of this doctoral research program a study was done based on questionnaire feedback of 74 organization of Speciality Chemical Manufacturers in selected zones of Maharashtra that included water treatment chemicals which reveal that usage of Lean Six Sigma help in breakthrough results that can improve organizations, global competitiveness and cost effectiveness.

Hypothesis of the Study:

Hypothesis 01:

H_{01}: Lean Six Sigma has less or no impact on improvement processes on Speciality Chemical manufacturing as compared to other improvement processes

$H_{11:}$ Lean Six Sigma has significant impact on improvement processes on Speciality Chemical manufacturing as compared to other improvement process**es**

Hypothesis 02:

H_{02}: Lean Six Sigma has no significant impact on Cycle time in Speciality Chemical manufacturing.

H_{12}: Lean Six Sigma has significant impact on Cycle time and reduces cycle time in Speciality Chemical manufacturing.

- **Hypothesis 03:** Population growth leading to increased consumption & strain on natural resources
- Consumerism and urbanization rising need for convenience
- Water & energy and hence more power to sustain economic growth with greater efficiency of water usage.
- Climate change (Increasing awareness about industrial pollution).

LSS is done through projects with help of project teams. A typical Project Charter is as below.

India has emerged as a manufacturer and supplier of Speciality chemicals and had a major impact on the Global Speciality chemical industry. This paper brings out the basic Lean Six Sigma quality tools that are used in improvement projects that are also applied for environment projects and are as follows in the chart:

H_{03}: Lean Six Sigma has no significant impact on inventory in Speciality Chemical manufacturing.

H_{13}: Lean Six Sigma has significant impact on inventory and reduces inventory in Speciality Chemical manufacturing.

Hypothesis 04:

H_{04}: LSS has no significant impact on defects in Speciality Chemical manufacturing.

H_{14}:LSS has significant impact on defects and reduces defects in Speciality Chemical manufacturing.

Hypothesis 05:

H_{05}: LSS employs DMAIC (Define, Measure, Analyse, Improve & Control) in improvement process with less or no significant results in Speciality Chemical manufacturing.

PROJECT CHARTER *Project Title:*

Business Case:	**Team Roles** Master Black Belt: : Black Belt: Team Leader: Team Members:
	Project Scope: Conflicting CTQ:
Problem Statement **Present Status:** **Target:**	
Goal Statement & Estimated Benefit:	**Project START TIME** **Project End Point**
Financial Impact (In Rs. Lakhs) Estimated Actual Revenue Enhancement Expense Reduction Loss Reduction Cost Avoidance Total	**Project Timeline** Signature Team leader Black belt Master Black

H_{15}: LSS employs DMAIC (Define, Measure, Analyse, Improve & Control) in improvement process with significant results in Speciality Chemical manufacturing.

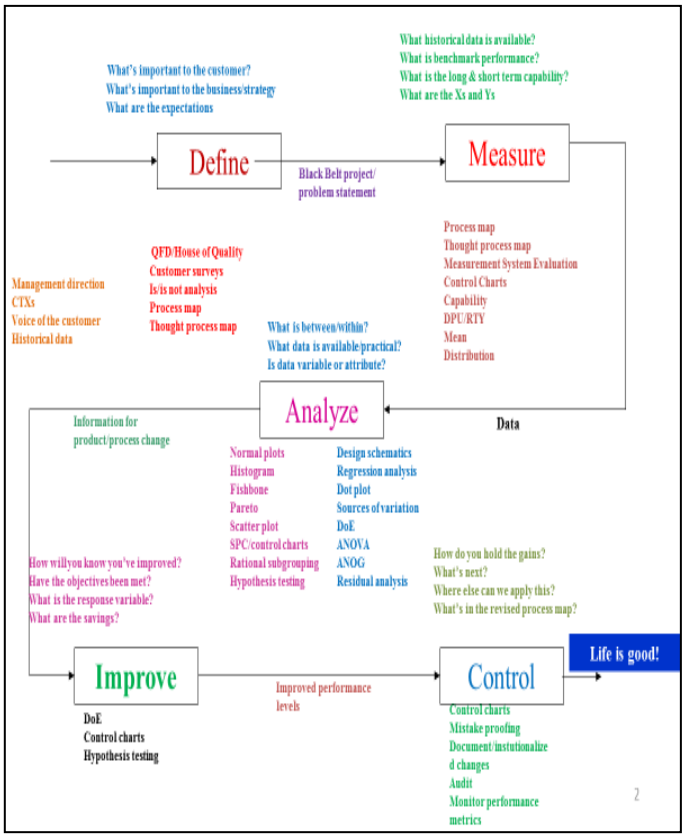
Hypothesis 6:

H_{06}: LSS has less or no great impact on competitiveness in Speciality Chemical manufacturing.

H_{16}: LSS makes a great impact on competitiveness and improves competitiveness in Speciality Chemical manufacturing.

The study was conducted on the basis of empirical data collected through primary method. SPSS 16.0, Statistical tools, was used for analysis and observations noted.

Further literature study of 118 studies reveal the usefulness of LSS which take the best of Lean and Six Sigma, in improvement programs.



Mega trends having an impact on the specialty chemicals industry are:

Six Sigma

A Six Sigma expert with Project teams uses qualitative and quantitative techniques to drive process improvement. Some of the statistical and graphical tools commonly used in improvement projects are listed below.

DMAIC (Define, Measure, Analyze, Improve & Control)

Define: Defining the problem or improvement opportunity through a project:

- Project charter to define the scope, team members, schedule. direction, and the case for top management approval
- Voice of the customer to understand feedback from current and future customers indicating offerings that satisfy, delight, and dissatisfy them
- Value stream mapping to provide an overview of the process from start to finish at the customer, and analyzing what is required to meet customer needs

Measure: Measuring the process performance:

- A process map for recording the activities performed as part of a process
- Capability analysis to assess the ability of a process to meet specifications
- Pareto chart to analyze the frequency of problems or causes

Analyze: Analyzing processes to determine root causes of variation, defects, or performance:

- Root cause analysis to uncover causes of bad process and their effects.
- Failure mode and effects analysis for identifying possible product, service, and process failures
- Multi-vary chart to detect different types of variation within a process

Improve: Improving process performance by addressing root causes:

- Design of experiments (DOE) to solve problems from complex processes or systems where there are many factors influencing the outcome and where it is impossible to isolate one factor or variable from the others
- Kaizen event to introduce rapid change by focusing on a narrow project and using the ideas and motivation of the people who do the work

Control: Controlling the improved process and sustaining the performance:

- Standardize the process and make control plan to document what is needed to keep an improved process.
- Use of statistical process control (SPC) for monitoring process behavior
- Use of Visual Management to create a workplace suited for visual control
- Mistake proofing (poka-yoke) to make errors impossible or immediately detectable

Six Sigma team leaders use project management tools such as Andon Chart, Gantt charts and team engagement tools like brainstorming and nominal group technique.

Lean

Lean uses tools such as follows

Five "S"

5S is to Organize work area and is listed in Japanese as **Seiri**meaning **Sort**or eliminate that which is not needed**, SeitonSet in Order**or organize remaining items**, SeisoShine**or clean & inspect work area**, SeiketsuStandardize**or ensure the

standardizing the procedures for the above**&Shitsuke**or **Sustain**or ensure regularly applying the standards.Some have added a sixth S Viz. **Safety**i.e. to ensure safety of all processes and facilities.**5S e**liminates wastes that results from a poorly organized work area. There are typically seven wastes listed as Defects, Over production, Inventory, Waiting, Over processing, Transportation & Unnecessary motions. Some have added a 8th waste Viz. non utilization of human potential.

Andon

Andon is a Visual feedback system typically in a manufacturing plant floor that indicates production status, alerts when assistance is needed, and empowers operators to stop the production process. In EM arena displays such as Air Quality Index, pollution levels are mentioned at prominent places first to highlight the factual live data and as a display to highlight improvement required forward. Thus, Andon help in real-time communication for immediate attention to problems for urgent attention and redressal.

Bottleneck Analysis

Bottleneck Analysis identifies that part of the process or system which brings in inefficiency or limits the performance of the process. Essentially in EM projects it is very important to analyze these and find solutions for improvement that help in eliminating the weakest link or problem areas needing immediate attention for strengthening to ensures overall efficiency or productivity.

Continuous Flow

Continuous Flow means a process flow is smooth without any buffers or idle time inbetween the steps of process. This eliminates some forms of waste such as inventory, waiting time and transport.

Gemba

Gemba means the Work or Real Place where action is there. The Japanese way of doing is to spend time on the shop floor workplace or where action is there. In EM this calls for physical verification of the site in question. Gemba **p**romotes a deep and thorough understanding of real-world issues – by first-hand observation and by talking with the concerned stake holders.

Heijunka (Level Scheduling)

It is a form of production scheduling that purposely manufactures in much smaller batches by sequencing (mixing) product variants within the same process.**Heijunkar**educes lead times (since each product or variant is manufactured more frequently) and inventory (since batches are smaller).

HoshinKanri (Policy Deployment)

Hoshin Kanri **a**lign the strategic goals of the company with the tactical plans of middle management & the actions on the shop floor. **HoshinKanrie**nsures that progress towards strategic goals is consistent and thorough by eliminating the waste that comes from poor communication and inconsistent direction.

Jidoka (Autonomation)

Jidoka is design equipment to partially automate the process (partial automation is typically much less expensive than full automation) and to automatically stop when defects are detected.

ByJidoka, workers can frequently monitor multiple stations reducing labor costs. Quality issues can be detected immediately by this and thereby improving quality.

Just-In-Time (JIT)

Just-In-Time is to pull parts through production or process based on customer demand instead of pushing parts on projected demand. JIT relies on tools, such as Continuous Flow Heijunka, Kanban, Standardized Work and Takt Time. JIT is highly effective in reducing inventory levels, space requirements and improves cash flow.

Kaizen (Continuous Improvement)

Kaizen is a strategy where employees work together proactively to achieve regular, incremental improvements in the

manufacturing process. Kaizen combines the collective talents of a company to create an engine for continually eliminating waste from manufacturing processes.

Kanban (Pull System)

Kanban is a method of regulating the flow of goods both within the factory and with outside suppliers and customers. Based on automatic replenishment through signal cards that indicate when more goods are needed. Kanban eliminates waste from inventory and overproduction. Can eliminate the need for physical inventories.

KPIs (Key Performance Indicators)

KPIs are metrics designed to track and encourage progress towards critical goals of the organization. The best manufacturing KPIs: are aligned with top-level strategic goals for achieve those goals, are effective at exposing and quantifying waste (OEE is a good example), are readily influenced by plant floor employees who can drive results.

Muda (Waste)

Muda means waste in Japanese. Anything in the manufacturing process that does not add value from the customer's perspective is Muda. The elimination of Muda (waste) is the primary focus of lean manufacturing.

Overall Equipment Effectiveness (OEE)

Overall Equipment Effectiveness is a framework for measuring productivity loss for a given manufacturing process. Three categories of loss are tracked:Availability (e.g. down time); Performance (e.g. slow cycles); Quality (e.g. rejects). OEE provides a benchmark/baseline and a means to track progress in eliminating waste from a manufacturing process. 100% OEE means perfect productionmanufacturing only good parts with no down time.

PDCA (Plan, Do, Check, Act)

PDCAis an iterative methodology for implementing improvements:

- Plan (establish plan and expected results/develop a hypothesis)
- Do (implement plan&run experiment)
- Check (verify expected results achieved/evaluate results)
- Act (review and assess; do it again/refine your experiment; try again)

PDSA (Plan, Do, Study, Act)

PDSA applies a scientific approach to making improvements. Unlike PDCA we have PDSA where S stands for study where we study after every implementation.

Poka-Yoke (Error Proofing or zero defects)

This is where by design errors are avoided & mistake proofing/ zero defects are ensured.

Root Cause Analysis (RCA)

Root Cause Analysis is a problem solving methodology that focuses on resolving the underlying problem instead of applying quick fixes that only treat immediate symptoms of the problem. A common approach is to ask why five times – each time moving a step closer to discovering the true underlying problem. RCA helps to ensure that a problem is truly eliminated by applying corrective action to the "root cause" of the problem.Fish bone diagram, 5 why analysis are tools of RCA.

Single-Minute Exchange of Dies (SMED)

Single-Minute Exchange of Diesisa reduced setup (changeover) time i.e. to less than 10 minutes. The techniques include converting setup steps to be external (performed while the process is running); simplify internal setup (e.g. replace bolts with knobs and levers); eliminate non-essential operations; create Standardized Work instructions. SMED enables manufacturing in smaller lots, reduces inventory, and improves customer responsiveness.

Six Big Losses

Six Big Losses are Six categories of productivity loss that are almost universally

experienced in manufacturing such as breakdowns, Setup/Adjustments, Small Stops, Reduced Speed, Startup Rejects, Production Rejects. **Six Big Losses** provides a framework for attacking the most common causes of waste in manufacturing.

SMART Goals

SMART Goals are: Specific, Measurable, Attainable, Relevant, and Time-Specific.

goals that ensure goals are effective.

Standardized Work

Standardized Work is best practices procedures that are documented including the time to complete each task. These are livingdocuments that are easy to change. Standardized Work **e**liminates waste by consistently applying best practices and forms a baseline for future improvement activities.

Takt Time

Takt Time is **t**he pace of production that aligns production with customer demand and is given as Planned Production Time / Customer Demand.**Takt Time p**rovides a simple, consistent and intuitive method of pacing production. Is easily extended to provide an efficiency goal for the plant floor i.e. Actual Pieces / Target Pieces.

Total Productive Maintenance (TPM)

TPM is a holistic approach to maintenance that focuses on proactive and preventative maintenance to maximize the operational time of equipment. TPM blurs the distinction between maintenance and production by placing a strong emphasis on empowering operators to help maintain their equipment. TPM **c**reates a shared responsibility for equipment that encourages greater involvement by the stake holders. In the right environment, this can be very effective in improving productivity by increasing up time, reducing cycle times, and eliminating defects.

Value Stream Mapping (VSM)

Value Stream Mapping is a tool used to visually map the flow of production or process in an office environment. VSM Shows the current and future state of processes in a way that highlights opportunities for improvement. VSM exposes waste in the current processes and provides a roadmap for improvement through the future state.

Visual Management

Visual Management areVisual indicators, displays and controls used throughout manufacturing plants to improve communication of information.**Visual Management** makes the state and condition of processes easily accessible and very clear – to everyone.

Application of LSS in EM includes projects of improvements or pollution reduction due to air, water, soil, noise, radiation, transport controlling, etc.

Projects could also be on cost reduction, effective use of infrastructure, promote efficiencies, compliances and wastes reduction.

Other projects such as environment performance evaluation, Life Cycle Assessment, overall environmental impact of its products and services etc.

Gaps found in the study:

1. Not much literature study are done in this field in Maharashtra
2. There is lack of awareness of LSS with MSE's
3. LSS being top driven, lack of it results in failures
4. There is no standard LSS processes.

Some typical Lean six sigma projects:

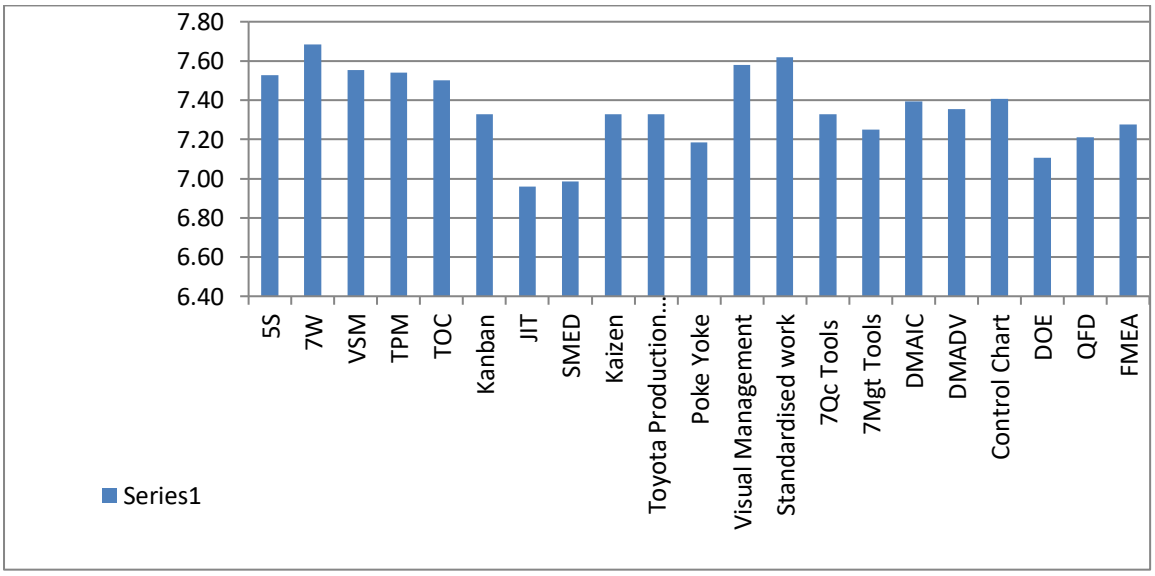
Inventory reduction, Delivery Performance improvement, Local exhaust ventilation improvement, Continuous process improvement, Process safety, Business value improvements, Functional excellence, Improvement in margins, Commercial

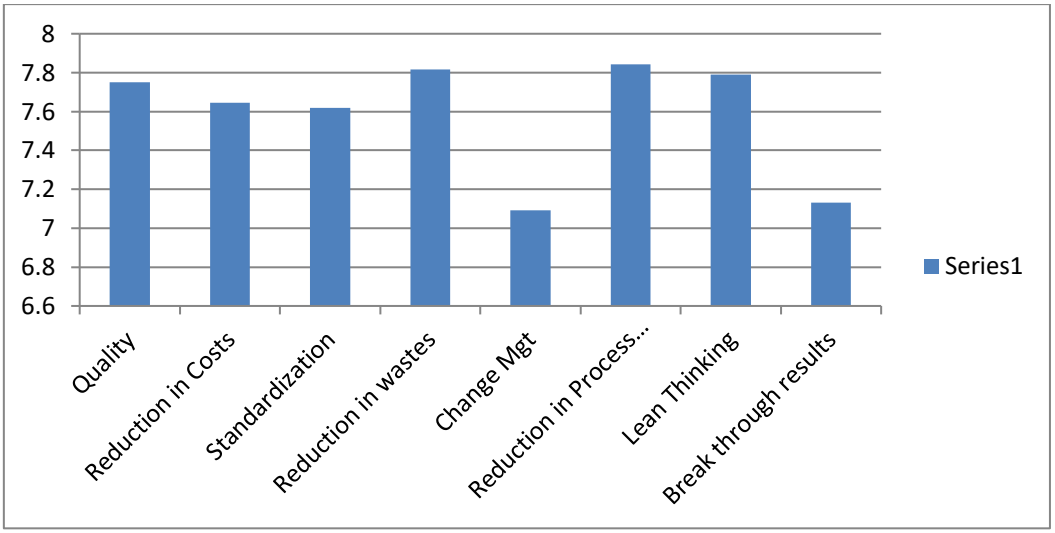
excellence, Streamlining the schedule process, Improve visibility & quality of information, Reduction in working capital & inventory

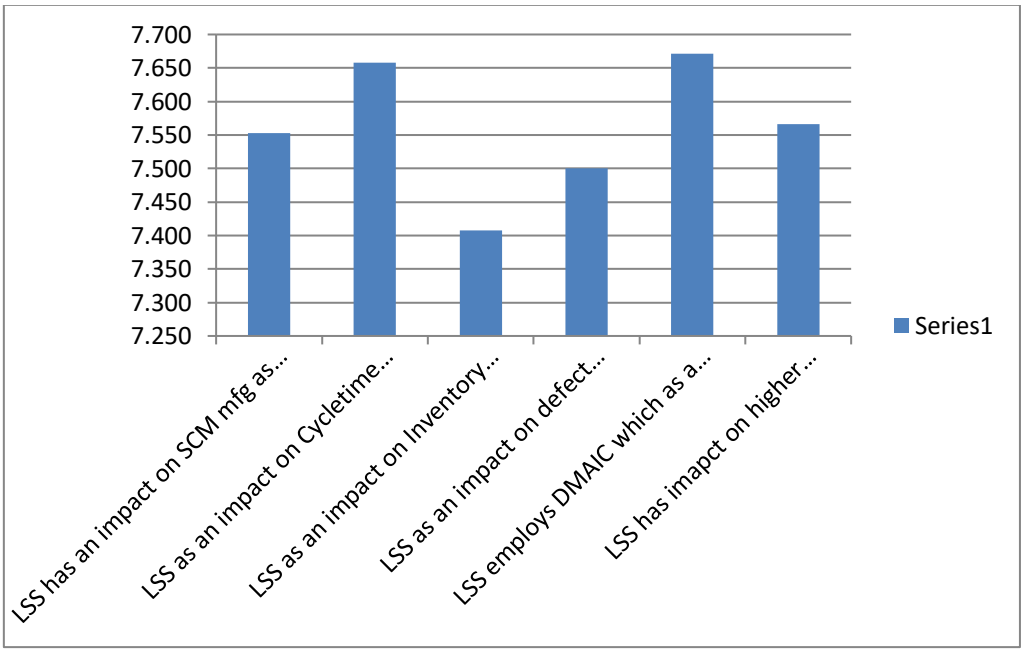
buffers, Supply chain & working capital improvement, Reduction in days sales outstanding, Profit improvement, Waste water treatment, Improved asset utilization, Benchmarking capability and identifying improvement opportunities, Return on assets, Yield improvement, Better service quality, Operational improvement, Innovation and new product, Improvement in per capita consumption, Improved export competitiveness, Improvement in downstream process, Improved productivity & reliability, Improvement in operating margin, Improvement in automation, Improved raw material flow, Improvement in quality, Increase energy efficiency, Improved preventive maintenance, Improvement in strength, Cleaner production, Facility improvements, Lower production costs, Return on invested capital, Improving chemical synthesis, Exceed working capital improvement goal, Improved communication, Improving demand meeting, Improvement in labour productivity, Lean implementation, Improve well performance in oil industry, Improvement for health & safety, 5S implementation, Low emission and improving air quality, Improve delivery performance,

Conclusion

As per the SPSS 16.0 analysis done on the survey data the following can be concluded Lower operating expenses, Improved operational efficiency, Capacity improvement, Improving & managing ESSH policies, procedures & practices, Improve environmental performances, Improvement in thermal stability, Improvement in packaging, Costs savings, Total customer satisfaction improvement, Improvement of general physical properties, Near term cash flow improvement, Long term growth option, Cell efficiency, Reducing the overall power requirement, Improvement of infrastructure, Customer satisfaction index, Customer penetration rate, Customer winning rate, Supply chain flexibility, Reduction in lead-time, Quality across the board, Total cost for each process, Improvement in SCM, Timely deliveries, Application of Lean Six sigma from order to delivery cycle, Study the causes of poor performance through scatter diagram, Application of SPC tools to improve processes, HR excellence through application of LSS, Application of FMEA in process, Reduce chemical inventories, Use of Value stream mapping to eliminate non value added activities.




8
7.8
7.6
7.4
7.2
7
6.8
6.6
Quality
Reduction in Costs
Standardization
Reduction in wastes
Change Mgt
Reduction in Process...
Lean Thinking
Break through results
Series1


7.700
7.650
7.600
7.550
7.500
7.450
7.400
7.350
7.300
7.250
LSS has an impact on SCM mfg as...
LSS as an impact on Cycletime...
LSS as an impact on Inventory...
LSS as an impact on defect...
LSS employs DMAIC which as a...
LSS has imapct on higher...
Series1

a. LSS has more impact on manufacturing as compared to other improvement processes
b. LSS has an impact on reduction of cycle time
c. LSS has an impact on inventory reduction
d. LSS has an impact on defect reduction
e. LSS has an impact on improvement processes through DMAIC
f. LSS helps organization be competitive.

A. The following LSS tools have an impact on Speciality Chemical Manufacturing 5S, 7W, VSM, TPM, TOC, Kanban, JIT, SMED, Kaizen, TPS, Poka-Yoke, Visual Management, Standardized work, 7Qc Tools, 7Mgt Tools, DMAIC, DMADV
B. Control Chart, DOE, QFD, FMEA. They help in improving the process
C. The following major factors are impacted due to usage of LSS in Speciality Chemical Manufacturing: Reduction in Inventory, Increase in Quality, Reduction in Cycle time, Lean Thinking, Reduction in Costs, Standardization of processes, Reduction in wastes
D. The following major factors are impacted due to usage of LSS in Speciality Chemical Manufacturing: Change Management, Reduction in rejections, and Reduction in process variation, Reduction in Costs, and Break through results.

The Survey was followed by talking to industrial experts who confirmed that the Industry does have good margins due to the special nature of the industry and focused work. The conclusions are as follows:

a. Application of improvement methodology such as LSS with breakthrough results helps Speciality Chemical Manufacturers to be globally competitive.
b. These organizations culturally change once they adopt LSS.
c. Employees are highly conscious of the importance of breakthrough improvements and sustaining the same.
d. Lean tools have been easy to apply while Six Sigma tools take a little bit more time. Big opportunity exists for SMEs for improvements by use of LSS.
e. The industry consciously applies 5S & Visual management especially since chemicals are involved & they readily see the advantage of ensuring discipline.
f. Many of the organizations who do labour jobs for MNCs adopt LSS
g. There is good impact on the bottom line of these organizations who are adopting LSS
h. The average sigma level of the surveyed organization was found to be 3sigma which is at the lower level of industry average, indicating a big opportunity for improvements and gain. The shift from Sigma level 3 to 4 may give a gain of 20 to 30% of the turn over on the bottom line.

Recommendations

It is found LSS gives a good impact on the bottom line of organizations and there is a tremendous opportunity exists for Indian companies for application of LSS and in particular Specialty Chemical Manufacturers in Maharashtra to ensure their global competitiveness, profitability and penetrate more market. This opportunity they should take full advantage by raising the industry average of 3 sigma level to higher.Based on the survey conducted and interviews done it is clear people who apply LSS get the benefit and people who do not apply are the laggards. The industrial average as per the survey is 3 which is an average Indian productivity clearly

implying a phenomenal growth possible in both profit and competitiveness. Companies will get great benefits, many folds if they move to higher six sigma level.Industries must change culturally and will need tremendous support from the top management both in the form of training as well as investments, mentoring and handholding.Further focused research can be done in every sector under Specialty Chemicals manufactures in India, which seems to be in the nascent stage and will help them become globally competitive and add value to the Prime Ministers campaign of Make in India.

Abbrevations:

5S: Five S
7W: Seven Wastes
DMAIC: Define, Measure, Analyze, Improve and Control
DOE: Design of Experiment JIT: Just in Time
EM: Environment Management
LSS: Lean Six Sigma
SMED: Single Minute Exchange of Dies
SME: Small Medium Enterprises
FMEA: Failure Mode Effect Analysis
SCM: Supply Chain Management
SPC: Statistical Process Control
TOC: Theory of Constraints
TPM: Total Productive Maintenance
TPS: Toyota Production System
TQM: Total Quality Management
VSM: Value Stream Mapping

Bibliography

1. Andersson, R., Eriksson,H. &Torstensson,H. (2006), Similarities and differences between TQM, Six Sigma and Lean, The TQM Magazine, Publisher Emerald Group Publishing, UK Vol. 18 (3), pp. 282-296
2. Amar, K. & Douglas, D.(2008), A Review of Six Sigma Implementation Frameworks and Related Literature, Journal of IMECS, Vol. 2, pp.19- 21
3. Begam,S.M., Swamynathan, R and Shekkizar, J. (2013), "Current Trends on Lean Management – A review", International Journal of Lean Thinking, Vol. 4 (2)
4. Bhamu, Jaiprakash, Sangwan, K.S. (2014) "Lean manufacturing: Literature review and research issues", International Journal IJOPM Vol.10, pp.315
5. Belekoukias, Ioannis., Garza-Reyes, J.A. & Kumar, V. (2014) "The impact of lean methods and tools on the operational performance of manufacturing organizations", International Journal of Production Research Volume 52 (18)
6. Benbow, D.W. & Kubiak, T.M. (2005), The Certified Six Sigma Handbook, Pearson publications, USA pp.251-262.
7. Joshua, R. V.and Gamm, L. D. (2009), "A critical review of the research literature on Six Sigma, Lean and Studer Group's Hardwiring Excellence in the United States: the need to demonstrate and communicate the effectiveness of transformation strategies in healthcare", Journal of Implement Sci. Vol. 4 (35)
8. Kiemble, M.J., Schmidt, S.R.. &Berdine, R.J.(1999), "Basic Statistics Tools for Continuous Improvement", Publisher AIR Academy Press, UK pp.1-45
9. Knowles, G., Whicker, J.L., Femat, H., and Canales, F.D. (2005), "A conceptual model for the application of Six Sigma methodologies to supply chain improvement", International Journal of Logistics: Research and Applications Vol. 8, (1), pp51–65

3. Assarlind,

Achieving Validity in the Teaching of Environmental Studies: A Pre Service Teacher Training Module

Dr. Vidhya Satish* & Ms. Rashmi Pradhan
SIES Institute of Comprehensive Education, Sion (W), Mumbai
vidhyas@sies.edu.in

Abstract:
Education plays a pivotal role in environmental protection and conservation.Environmental Science as it is called in the early years deals with science, social sciences and environment related knowledge. The National Policy on Education (1986) states that there is a tremendous need to create an awareness of the environment. And, the child is recognized as the genesis point of change. Hence it becomes imperative that this aspect needs to be integrated into our educational system. If we need to create an impact and bring about an attitudinal change in the end user, the child in this context, a cascading methodology needs to be adopted. The child is imparted relevant, contemporary environment related information by the teacher. For the teacher to be well educated in this area, the pre service training offered needs to be sound and robust in its approach. With one leading to another, the onus of preparing the future citizens of our country rests in the hands of pre service and in-service training opportunities. At SIES Institute of Comprehensive Education (SIES ICE), Sion, Mumbai all efforts are taken to prepare the teacher to become the change agent and/or a catalyst in providing quality, contemporary and accurate information that she can pass on to her children with regard to environmental education. Understanding the world around is one of the goals of preschool education. The Position Paper on Science Education by the National Focus Group (2006) clearly reiterates that the aim of science or environmental education is to provide validity- ***cognitive, content, process, historical, environmental and ethical****. The present paper examines how this aim has been achieved in pre service teacher training at the SIES Institute of Comprehensive Education with regard to teaching of environmental education.*

Introduction:

One of the important objectives of Early Childhood Care and Education is introduce children to the world around them, help develop positive interactions with the surroundings and foster love and respect for the same. For successful implementation of Environmental education in the classroom, the teacher is the key resource. It is also known that the creativity, motivation and vision of the teacher provides opportunities, spaces and platforms that help the child to interact with the environment (Dehadra, V, 2017). The teacher's literacy in this regard is related to her possessing the relevant knowledge, skills, understanding and also a deep desire to 'environmentalize' the curriculum. The teacher, thus assumes the central role and teacher education both at the pre service and in-service level attains great importance. The UNESCO thus describes the teacher preparation with regard to Environmental Education as the **"Priority of Priorities".** It is the teacher who analyzes, interprets and implements the correct knowledge to her children.

Objectives of Environmental Education in Early Childhood:

The *rationale* for Environmental Education during the early years is based on two premises:

a) Very young children must develop a sense of respect and care towards the natural environment in the early years or be at a risk of not developing such attitudes.

b) Positive interactions with the natural environment are vital to child's development, especially to the development of good health. These interactions not only aid learning but also the quality of life in a person's lifetime.

The *specific objectives* of environmental education in early childhood years are as follows:

1. To increase awareness about the environment, develop sensitivity and consciousness of preservice (student) teachers towards the environment, its problems and their solution and prevention.

2. To familiarize pre-service teachers with the need, the significance, the goals, objectives and guiding principles of environmental education.

3. To acquaint pre-service teachers with essential knowledge about the environment and its allied problems.

4. To orient pre-service teachers with the fundamental concepts with regard to the environment.

5. To enable the trainee teacher to integrate environmental education with other subjects.

6. To familiarize pre-service teachers with different teaching methodologies with a primary focus on a hands-on approach such as problem-solving approaches, experiential learning methods, project based approaches, enquiry based learning methodologies with respect to teaching of environmental education.

7. To orient the teacher trainees with relevant and contemporary activities that foster skills and concepts related to environment education.

8. To offer various opportunities for the teacher trainees to develop lesson plans and teaching-learning materials with regard to environmental education.

9. To orient pre-service teachers with evaluation methods in order to understand student learning as well gauge her own teaching strategies and effectiveness with respect to environmental education.

10. To enable the trainee teacher to develop strategies for planning, implementation, management and evaluation of environmental curricula.

Environmental Studies (EVS) is a dynamic body of knowledge that leads to newer experiences. Following the above mentioned objectives, the pre service teachers are trained specifically to make the study of EVS interesting and relevant. The study by itself is structured and can be taught in a step-wise manner. An early childhood professional deals with the children who are at a very tender age and are yet to fully develop their physical, emotional, cognitive and language skills.

Hence, a preschool educator plays a very important role in developing the above skills and to build a foundation for future learning. It becomes the responsibility of the child's teacher along with the parents to introduce the surrounding environment to the child and to pass on the related information. This, however needs to be done with care as the child will form his concepts, his perception, likes, dislikes and his relationship with the environment based on this information.

An educator will be able to deliver the information effective only if they are well versed with the process of how children will understand and learn about their environment. The position paper on Science Education by the National Focus Group (2006) clearly reiterates that the aim of science of

environmental education is to provide validity in the curriculum which is the essence of this paper. Validity can be looked into in terms of ***cognitive, content, process, historical, environmental and ethical***, to ensure that the curriculum offered to a preschool child who is an active member of the future generation is in the right perspective. At SIES ICE we strive to train our preservice teachers to teach environmental science based on the validity criteria that is discussed as under.

How is *cognitive validity* achieved in imparting the EVS curriculum during preservice training process? The development of cognition in children involves the different processes that are adopted by them to think and interact with their environment. Cognition primarily involves thinking, reasoning, and problem solving skills. For effective cognition to develop, children must be given optimum curricular opportunities to explore and test variety of ideas (Catron & Allen, 1993). By *cognitive validity* it is inferred that the content taught, the methodologies and the pedagogical practices adopted are developmentally appropriate especially, age appropriate. Developmentally appropriate curriculum fosters learning. When the child is able to understand and make meaning of the environment related content taught, it encourages learning and makes it concrete.

The preservice teachers undergo an extensive training in child development through lectures, workshops, methods of child study especially the case study method. They are introduced to the cognitive theories by philosophers and learn about learning theories as well as the milestones in children's cognitive development. Further, they are provided withlearning opportunities to reinforce their knowledge during their internship. This helps them to plan the lesson keeping in mind the age appropriateness, in other words, the cognitive ability of the children. They also base the content of environment lesson on the child's previous knowledge and understanding of the topic.

Not only do students take specific EVS lessons, but also carry out special activities related to environment that are planned and executed keeping age appropriateness and learning levels in mind. They are guided to use simple but scientifically relevant language while conducting lessons and preparing games and activities. The trainees are dissuaded from using language and themes that are beyond the comprehension of children.

How is *Content validity* ensured in the EVS curriculum?Content validity requires that the curriculum must deliver content that is not only significant but also scientific. Often, the content is simplified to help the learner understand better. But it should not be made so trivial that it lacks to convey the meaning or is flawed. Children at this stage, explore their surroundings and display curiosity about various things. The environmental studies for a preschooler will include the natural, physical, social factors and the phenomena that the child sees or experiences in his immediate environment. The trainee teachers are guided to plan the content in relationship with the daily life activities that are of pertinent interest to the child and should convey factual information. Simplification of the contents so that it is within the cognitive reach of the child is important but not at the cost of making the content fluid and lacking meaning. Factual information needs to be provided to develop a scientific temper and outlook. Care should also be taken to maintain scientific facts and not to manipulate the essential information, when simplifying the content.

While teaching EVS, the content is taken in a step-by-step manner. EVS content flows from known to unknown, familiar to unfamiliar, and concrete to abstract following the maxims of education. It begins with the understanding of

the physical self, family, then moves on to the understanding of the Indian community and then to non-Indian community. Knowledge of the physical environment, natural environment leads to understanding of the physical forces. To ensure content validity the trainees are encouraged to check the facts by researching, experimenting and verifying the data available.

Ensuring *process validity* in the EVS curriculum. "*Man's mind stretched to a new idea never goes back to its original dimensions"* said Oliver Wendell Holmes Jr. *Process validity* ensures that the curriculum nurtures the natural curiosity and creativity of the child. It encompasses the strategies, methods and processes that validates the accumulation of accurate scientific knowledge. It is this criterion which aids the child in 'learning to learn' about our environment. While the 'what' being taught is of extreme importance, 'how' it will be taught is of equal importance. This reiterates the fact that the process plays a vital role in the learning process. For children to get interested in the learning of environmental science, the process needs to involve a variety of activities and experiments that will nurture their natural curiosity. *Process validity* is acquired through adopting different methods of learning such as experimentation, discovery method, experiential learning, and demonstrations with a focus on "**hands-on approach**". Trainee teachers are put through a rigour that focusses on scientific skills and concepts. For example, to teach the ill effects of plastic accumulation, students are sent around the campus to collect articles that are strewn around. In the current scenario, it is a given that around 75% of the articles collected are made out of plastic and the problems with its disintegration can be easily explained. Along with the hands-on approach, various activities such as *dramatization, street plays, puppetry, songs, stories, rhymes, poems, games and activities* are adopted to provide concrete learning of the environmental sciences.Thus when the trainees are equipped with different teaching methodologies and various aids it is not difficult to attract the attention of children to the topic. *"Tell me and I forget. Teach me and I remember. Involve me and I learn"*said Benjamin Franklin. Thus the method or approach towards teaching environmental science should aim to generate scientific knowledge and help the children understand its significance by proper involvement.

The process of learning environment science also develops in children, scientific thinking, and skills like *observation, matching, comparing, sequencing, questioning, data gathering, analyzing, data graphing, understanding cause and effect, formulation of hypotheses, making predictions, understanding measurement,* and *relationships and patterns*. It also develops logical thinking process and problem solving. These skills are the pre requisites for building a foundation for future learning. When processes become interesting, the final product is equally rewarding else it will lead to dislike and disinterest in children (Kaushik & Sharma,19.

***Historical validity* in the EVS curriculum**. Environmental education is about learning the age old proven theories as well as contemporary information. *Historical validity* requires that the EVS curriculum have a historical perspective. This helps the learner understand and appreciate its evolution over a period of time as certain concepts of environment and science have evolved with time. Environmental learning also involves the study of social factors and their influence on the development of environment science.

The trainees are given exposure to different EVS topics as a part of project method. The Project-based approach propounded by John Dewey follows an integrated method of teaching. All the aspects of a topic is

presented in an interesting manner with its focus on its relevance over a period of time. The presentations focus on the journey of any topic from the past to the present. For example, if the project based approach centers around the topic "village life", the trainee teachers depict the village of yesteryears and its current state giving them a personal understanding to represent the growth and progress of any enterprise over a period of time.

Ensuring *environmental validity* in the curriculum. Environmental validity refers to the fact that the content that is being taught to children is contemporary and contextual. It needs to be related to the Indian as well as the non-Indiancontext. The concept of the world as a global village is rising. It is an essential function of education to enable and empower the learner.The learner has to been enabled with the knowledge in its broader context. All knowledge thus needs to be integrated and made relevant. The trainees are urged to conduct lessons and activities that are contemporary and related to the children's direct environment and also those that relate to both Indian and non-Indian contexts leading to *environmental validity*. The lessons that they conduct are based on topics that children can relate. As mentioned earlier, when knowledge moves from known to unknown, assimilation of the content also becomes easier and is stress-free.

Preservice teachers must first learn to appreciate the integration of science, technology and the society. When they are convinced, they would easily pass it on to their children. Trainees use technology very well to prepare their teaching learning material. They are given Information and Communication Technology (ICT) training and it is also part of the theory component. *Power point presentations*, *Videos* and *filmshows* are screened to ensure that technology is well utilized. The learner also needs to understand the application of knowledge and develop skills to deal with various issues related to science, technology and society. It will in turn help the child understand science in relationship with the real life challenges.

Promoting *ethical validity* through the EVS curriculum. Any learning will be useful only when it is value based. *Ethical validity* of the environmental science curriculum is an exemplary criterion that should not be overlooked under any situation. It ensures that the curriculum promotes values of *honesty*, *objectivity*, *cooperation*, *care*, *concern* and *preservation of the environment.* Values such as *freedom from fear* and *prejudice* need to be instilled in the minds of children through various activities in a preschool classroom.

The trainees are always encouraged to promote values. Be it a story narration event, a puppet show or a street play or even a simple presentation, trainees are motivated and taught to sensitize the children to the concern for life and preservation of the environment. The trainees are encouraged to observe their immediate environment and instill values in their lessons, based on this observation. They are also given opportunities to display values in every activity they carry out. One such presentation is the festival presentation where they are expected to bring out the true essence behind celebrating the festivals. The festival of RakshaBandhan can be celebrated by tying a rakhi to the trees. It is a promise to save the trees. It is through such activities that children develop love and respect for the environment. It is a platform to showcase group cohesiveness.

Conclusion: The model that is adopted at SIES Institute of Comprehensive Education for the teaching of environmental science is one that is age-appropriate, activity-oriented, value-based, contemporary, technology-aided,

experiential and demonstrative. The trainee teachers are provided ample opportunities as part of training to understand the need and importance of an environmental science curriculum that uplifts the natural curiosity in a child, quenches the thirst for scientific exploration, triggers the scientific temper and outlook in a child. The Position Paper on Teaching Learning of EVS by the Karnataka D.Ed Curriculum Framework, 2012 states that environmental education and its effective implementation calls for a change in the mindset of teachers. From mere *content transmitters* they need to travel the path of being *facilitators* and *co-learners*. To achieve this, classroom practices need to change from *'transmission of content'* to '*transaction of content'* leading to '*transformation of behaviours'* in children. All efforts are thus undertaken to achieve this at the SIES Institute of Comprehensive Education, Mumbai.

References

1) Catron, C.E., & Allen, J. (1993). *Early Childhood Curriculum.* Macmillan. New York.

2) Dehadra, V. (2017, November – January). Let us understand the world around us, *Navtika7*(4) 30-40.

3) DSERT (2012). *Position Paper on Teaching –Learning of Environmental Studies (EVS) at the Primary School Level* (Chairperson: M.J. Ravindranath). Bengaluru

4) Harlen, W., &Elstgeest, J. (1992). *UNESCO Source Book for Science in the Primary School*. National Book Trust. N.Delhi.

5) Kaushik, V.K., & Sharma S.R. (19)*Teaching Science in Elementary Schools.* Anmol Publications. N.Delhi.

6) NCERT (2006). *Position Paper on Teaching of Science* (Chairperson: Arvind Kumar). N. Delhi.

Comparative Study of the Effect of Various PGPB on the Growth of *Avicennia Marina* Seedlings in Cocopeat

Joseph Dona[1*], Yadav Mamta [2], KumbharSushila [3], Agavale Vishal [4], Thakare D.B.[5]

1* – Assistant Professor, Microbiology Dept, VES College of Arts, Science and Commerce, Sindhi Society, Chembur, Mumbai – 400 071

2, 3, 4 - S.Y.B.Sc. students, Microbiology Dept, VES College of Arts, Science and Commerce, Sindhi Society, Chembur, Mumbai – 400 071

5 – Retired Associate Professor and Head, Microbiology Dept, KBP College, Vashi, Navi Mumbai – 400 703

*Main and Corresponding author

ABSTRACT:

Mangroves are unique coastal ecosystems of great ecological and economic value. Coastlines throughout the world are facing serious problems of coastal erosion and the threat of rising sea levels due to global warming. Mangroves are buffers between the land and the sea, which are very important in maintaining the coastline and reducing air pollution, especially in polluted coastal cities such as Mumbai and Navi Mumbai. Though the benefits of maintaining healthy mangroves are well-known, they are under constant threat due to urban development programs. In Navi Mumbai, hundreds of acres of mangroves will be razed in the near future for the construction of the Navi Mumbai International Airport as well as the 'Mumbai Trans Harbour Link'. In order to reverse the destruction by such programs, mangrove restoration projects have been proposed that involve growing the mangrove seedlings in nurseries and subsequently transplanting them in other areas. Growth of mangrove seedlings can be enhanced by inoculating them with PGPB (plant growth promoting bacteria), which promote plant growth by various mechanisms such as provision of nutrients, production of plant growth hormones and anti-fungal activities. Though inoculation with PGPB is a well-known practice in agriculture, and PGPB specific to mangroves have been discovered, not much work has been carried out in this area in Navi Mumbai.

The aim of our work was to screen PGPB from mangroves in Navi Mumbai and verify their growth promotion efficacy by plant inoculation experiments. Forty three isolates obtained from various mangrove sites in Navi Mumbai were screened for their plant growth promoting activities, and three isolates showing a range of activities were selected for the current study. The three selected cultures were tested singly and in combinations for their ability to promote the growth of seedlings of Avicennia marina, the dominant mangrove species in Navi Mumbai. Seedlings of the plant were grown for 2.5 months in cocopeat enriched with the cultures. The results were encouraging as the inoculated plants, especially those inoculated with N14 and N14+N15, showed considerable improvement in their physical growth as well as chemical composition compared to the control plants. These bacteria have good potential to be developed into biofertilizers to promote plant growth in compensatory mangrove restoration projects in Navi Mumbai.

Key words: *Mangroves, Avicennia marina, PGPB, cocopeat, reforestation, Navi Mumbai*

INTRODUCTION:

Mangroves are a valuable ecological and economic resource, being important nursery grounds and breeding sites for birds, fish,

crustaceans, shellfish, reptiles and mammals; a renewable source of wood; accumulation sites for sediment, contaminants, carbon and nutrients, offer protection against coastal erosion and diminish the impact of tsunamis. Despite the well-known benefits of maintaining healthy mangroves, they are highly threatened ecosystems and at present are disappearing at an alarming rate. Habitat destruction through human encroachment has been the primary cause of mangrove loss. (Newton C. M. Gomes et al, 2010; Alongi, 2002; Kathiresan K, Bingham L, 2001).

The rapidly expanding coastal city of Mumbai is an ongoing example of loss of mangrove species with more than 10,000 hectares - 40 per cent - of its mangrove ecosystems lost in the past decade. In Navi Mumbai, the proposedNavi Mumbai International Airport (NMIA) is to be built on 1,405 hectares of land. 90 per cent of the site earmarked for the airport is wetland, of which 170 hectares are covered with dense and lush mangroves (Hiranandani, Levitt, 2010). The project will see the destruction of over 400 acres of mangroves and around 1,000 acres of mudflats. To compensate for the loss, the Environment Ministry has asked CIDCO to come up with a 245-hectare mangrove park, besides regeneration of mangroves at Kamothe (310 hectares) and Moha Creek (60 hectares), in addition to a mangrove park at Waghivali Island (Hiranandani, Levitt, 2010). Besides, the 'Mumbai Trans Harbour Link' (MTHL)

envisages construction of a 6 lane road bridge across the Mumbai Harbour, between Sewri and Chirle, which would affect around 10,000 sq. m. of mangroves. A compensatory mangrove restoration plan, amounting to Rs. 25 crore, is proposed with the help of Forest department. (Ministry of Environment, Forest and Climate Change, Government of India, 2016)

These plans for mangrove regeneration involve growing the mangrove seedlings in nurseries and subsequently transplanting them in new areas. Although mangroves in the tropics can regenerate themselves or be restored using low-technology propagule planting, arid mangroves (areas having limited or no access to fresh water) can seldom regenerate, and if they do, it happens very slowly. To conserve arid tropical mangrove ecosystems, maintenance and restoration of the microbial communities is required. It has been proposed that mangrove rhizosphere bacteria be used as a tool to enhance reforestation with mangrove seedlings. This can be done by inoculating seedlings with plant-growth-promoting bacteria participating in one or more of the microbial cycles of the ecosystem (Bashan, Holguin, 2002)

Considerable studies have been carried out on PGPB associated with mangroves (Ravikumar et al, 2012, Ravikumar et al, 2010, Sahoo and Dhal, 2008; Gupta et al, 2007; Holguin et al 2001; Vacquez et al, 2000). However, not much has been studied on this area in Navi Mumbai. The objective of this study was to evaluate the ability of PGPB isolated from mangroves in Navi Mumbai for their ability to promote the growth of mangrove saplings by growing the plants in the presence of these bacteria and comparing their growth with that of un-inoculated controls. The study was also aimed at comparing the effects of the selected isolates and their combinations on the plant, in order to find out the most effective culture combination that can be developed into a biofertilizer to enhance mangrove reforestation programs in the region.

MATERIALS AND METHODS:

Isolation and selection of cultures: The cultures used in the current study were selected after several levels of screening.Forty three bacterial cultures were isolated from mangrove soils in Vashi, Nerul and Belapur in

Navi Mumbai and Mahim in Mumbai and tested for various plant growth promoting activities in vitro. Six of these isolates, which exhibited many PGP activities, were further evaluated for their ability to enhance growth of mangrove plants. Three cultures which showed good enhancement of plant growth were selected for the current study. These cultures (named N5, N13 and N14) exhibited a variety of PGP activities such as nitrogen fixation, phosphate solubilization, IAA production, extracellular enzyme production and anti-fungal activity in vitro. In this study, they were used to inoculate plants in various combinations in order to determine the best inoculum for enhancing plant growth. The 7 culture combinations used were: N5, N13, N14, N5+N13, N5+N14, N13+N14, N5+N13+N14

Collection of mangrove seedlings: Newly germinated seedlings of the grey mangrove *Avicennia marina* were collected from NhavaSheva near the northern part of JNPT port. Healthy seedlings of comparable size and maturity were selected and washed several times with tap water to remove the mud sticking to them.

Preparation of culture inocula: One slant of each test culture was inoculated in 150 ml of medium and incubated on shaker at R.T for 48 hours. 10 ml of this broth culture was then inoculated in 20ml of sterile nutrient broth containing 3% NaCl. In the case of combination cultures, equal amounts of each culture were added to make a total culture volume of 10 ml. The flasks, each containing a total volume of 30 ml, were then incubated on shaker at 28◦C for 24 hours.

Preparation and inoculation of the cocopeat:

The cocopeat was packed into nursery bags that hadbeen punched with holes to allow water to pass through. Each bag contained 300g of twice-autoclaved sterile cocopeat containing 1% starch and 0.5% calcium phosphate. Each ‘test’ bag was inoculated with 30 ml of culture broth, while each control bag was inoculated with 30 ml of sterile nutrient broth containing 3% NaCl. Three bags were maintained for the control and three for each for seven test cultures.

Planting of the seedlings: Three newly germinated seedlings of*Avicennia marina* of comparable size and weight were washed thoroughly and sown in each bag. Thus there were a total of 24 bags, each containing 3 seedlings. The bags were placed in an area where sunlight was easily available and surrounded by a net to prevent pigeons from eating the newly developed leaves. The plants were watered twice a day with tap water. After a month, Hoagland’s mineral solution was used for watering instead of tap water.

Fig.1: Seedlings of *Avicennia marina* collected and planted in cocopeat

Evaluation of plant growth:

Physical parameters:The number of surviving seedlings, stem length, number of leaves, leaf length and leaf width were measured every 10 days for each seedling. The average root length, maximum root length, number of primary roots, wet weight and dry weight of shoots, roots and entire seedlings were studied at the end of 70 days, after uprooting the plants, taking care not to break the roots. The roots were washed carefully to remove the cocopeat sticking to them (S. Ravikumar et al, 2012).

Chlorophyll content: 0.5g of fresh plant leaf sample was weighed and homogenized in the dark using a mortar and pestle with 10 ml of chilled 80% acetone. Homogenized sample was centrifuged for 10,000 rpm for 15min at 4ºC. The absorbance of the supernatant was measured at 663.2 and 646.8 nm in a u.v. visible spectrophotometer using 80% acetone as the blank. The Chlorophyll-a and Chlorophyll-b content was quantified using the appropriate formulae (NayekSumanta et al, 2014).

Protein content:The pellet obtained after chlorophyll estimation was re-suspended in 5 mL 1:1 ethanol: ether (v: v) to remove lipids. The suspension was centrifuged at 10,000 rpm for 15min at 4ºC. The pellet was resuspended in 5 ml 0.1N NaOH and allowed to dissolve for 15 minutes. (Smith et al., 1985) The protein content was determined by Lowry's method (Lowry et al, 1951).

Starch content: 0.1 to 0.5g of the sample was homogenized in hot 80% ethanol to remove sugars and then centrifuged. The residue was washed repeatedly with hot 80% ethanol and then dried well over a water bath. 5.0mL of water and 6.5mL of 52% perchloric acid were added to the residue, which was kept at 0°C for 20min and then centrifuged. The residue was extracted several times using fresh perchloric acid and water and the supernatants were pooled. The volume was made up to 100ml. The glucose content in the samples was determined by the phenol sulphuric acid method and these values were multiplied by a factor of 0.9 to arrive at the starch content (Hodge, J E and Hofreiter, B T 1962).

Soluble sugar content: 0.5 g of dry leaf sample was ground with 100% acetone. The sample was then centrifuged and the pellet was suspended in 80% ethanol. The sample was centrifuged and the pellet was washed repeatedly with 80% ethanol to extract the soluble sugars. The supernatants were pooled and the soluble sugar content in it was estimated by the phenol sulphuric acid method (Hansen and Moller, 1975)

Polyphenol content: 0.5 g of the dry leaf sample was ground in 5 ml of chilled 80% ethanol. The sample was centrifuged and the pellet was washed several times with fresh 80% ethanol to extract the polyphenols. The

supernatants were pooled and evaporated to dryness. The residue was dissolved in 5 ml D.W and used as sample. The polyphenol content was determined using the Folin-Ciocalteau reagent with tannic acid as the standard. (Parida A. et al)

RESULTS AND DISCUSSION:

Seven sets of mangrove plants were inoculated with different cultures and one un-inoculated set was maintained as a control. Each set consisted of three bags containing 3 seedlings each. Thus nine seedlings were sown for every set. The seedlings were sown in cocopeat supplemented with starch and calcium phosphate. Cocopeat was used as the growing medium for the plants because it does not contain the nutrients normally present in mangrove soil. It is composed mainly of lignin and cellulose and has low concentrations of available nitrogen (C: N ratio is 104:1), calcium, magnesium and micro-elements. It has a relatively high concentration of sodium and chloride ions due to which it has a high salinity. Besides, it has a very high water holding capacity and can absorb water about half of its volume and 5 to 6 times its weight. (Abad et al, 2002).

Using a nutrient deficient medium for the experiment helped in highlighting the contribution of the PGPB to the nutrition of the plant. The low nitrogen content made it ideal for testing the nitrogen fixing ability of the inoculated PGPB. Starch and calcium phosphate were added to the cocopeat to enable the added PGPB to use their amylase producing and phosphate solubilisation abilities to provide nutrients to the plant. Besides, the high water holding capacity and salinity of the cocopeat made it a good medium for growth of mangroves.

On the first day after planting the seedlings, two of the inoculated bags showed growth of an orange fungus on the surface as well as at the water draining holes. The contaminated soil was carefully separated from the uncontaminated soil below and subjected to isolation on St. Potato dextrose agar. Orange coloured fungal colonies which probably belonged to the rust causing group were isolated. The orange growth reappeared on the surface the next day, but in reduced amounts. The contaminated soil was cleaned once again. Within a week, the fungal growth disappeared completely though no anti-fungal agent was added. Since the test cultures had shown anti-fungal activity during the initial screening process, we can infer that they played an important role in eliminating the fungus from the medium.

Fig.2: Fungal contamination on surface of cocopeat and its elimination

Survival rate of the seedlings:

During the first 20 days, the control seedlings grew very slowly and began to wither and die. This was probably caused by the lack of available nutrients in the cocopeat. However the test seedlings showed better growth and survival rate, suggesting that they received some nutrients due to the activities of the inoculated PGPB. By the 20th day, only four out of the initial nine control seedlings still survived. By this time, the growth of the test seedlings also slowed down and their survival rate began to drop (except for the plants inoculated with N14). This could have been caused by the exhaustion of nutrients and deficiency of essential minerals. This suggests that the test isolates can support the growth of the seedlings in nutrient deficient environments, provided some cheap precursors are continued to be provided to them.

From Day 31 onwards, the plants were watered with Hoagland's mineral solution instead of tap water, so that essential mineral nutrients were provided to all the plants. After that, the survival rate stabilized and the plants began to grow normally (Fig.3).

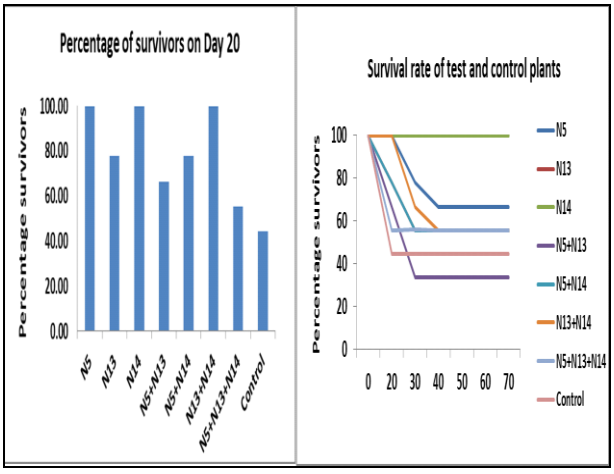


Fig. 3: Survival rate of the seedlings

fect of PGPB on the physical growth of the plant:

The plants were monitored for their stem length, number of leaves, leaf length and leaf width every 10 days. All the test plants (except those inoculated with N13 and N5+N13+N14) showed a higher growth rate of the stem compared to the control plants (Fig.5).

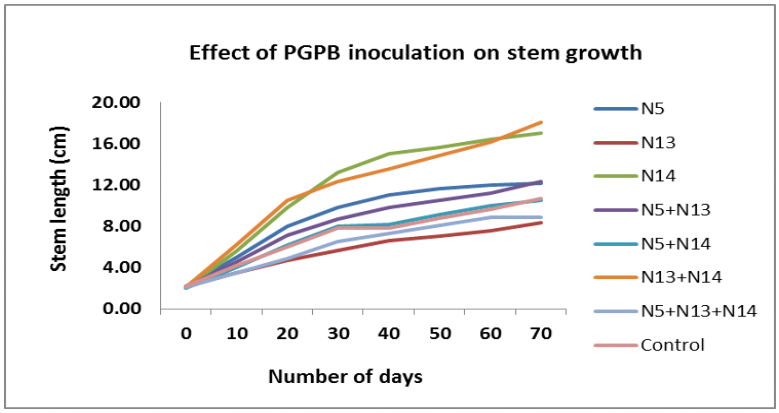


Fig 5: Effect of PGPB inoculation on stem growth

As seen in Fig. 6, the leaf number was also consistently higher in case of the test plants as compared to the controls (except in case of plants inoculated with N5+N13+N14).

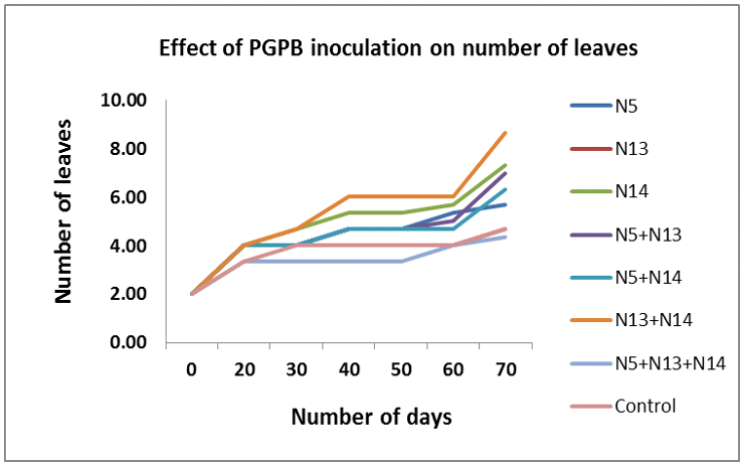


Fig. 6: Increase in number of leaves over 70 days

The remaining parameters were analysed when the plants were uprooted after a 70 day growth period. The plants were uprooted carefully without breaking the roots, which in turn were washed gently to remove the cocopeat sticking to them. At this point, the inoculated plants were visibly bigger and showed greater vigour than the control plants (Fig. 4).

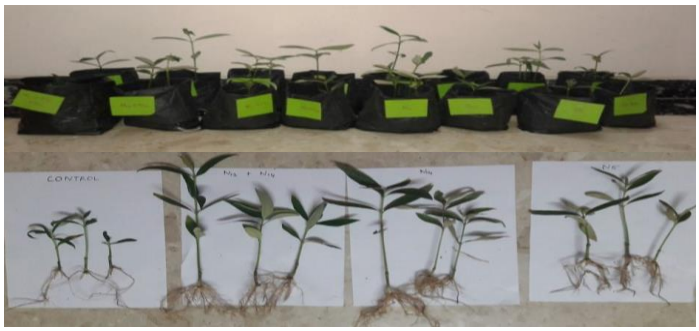


Fig.4: Seedlings after growth for 70 days (Control plants are to the extreme right in the upper half of the picture)

The plants were then analysed for the remaining parameters. Most of the test cultures showed a positive effect on the physical growth of the plant (Table 1 and 2, Fig. 7 and 8). The pure culture N14 and the dual culture N13+N14 were the most effective in promoting plant growth. The pure culture N13 enhanced the values of some parameters while decreased the values of others. The triple culture N5+N13+N14 showed a negative effect on the physical growth of the plant in almost all the characteristics tested.

Table 1: Effect of PGPB inoculation on plant shoots and leaves:

Culture	Percentage increase/decrease in value of test v/s control					
	Shoot length (cm)	Leaf no	Leaf length (cm)	Leaf width	Shoot wet weight (g)	Shoot dry weight (g)
N5	14.03	21.34	38.78	21.43	71.43	96.67
N13	-21.93	0.00	14.29	-7.14	-2.12	-18.33
N14	59.33	57.03	51.02	21.43	198.94	218.33
N5+N13	15.59	49.89	46.94	35.71	166.14	151.67
N5+N14	1.59	35.62	18.37	7.14	110.05	78.33
N13+N14	68.70	85.58	38.78	7.14	209.52	235.00
N5+N13+N14	-17.21	-7.21	18.37	-7.14	-25.93	-46.67

Table 2: Effect of culture inoculation on plant roots:

Culture	Percentage increase/decrease in value of test v/s control					
	No. of primary roots	Average root length	Wet weight of the roots	Dry weight of the roots	Wet weight of the plant	Dry weight of the plant
N5	33.33	4.48	66.67	123.81	70.33	96.43
N13	6.67	-21.60	17.54	14.29	2.44	-14.29
N14	26.67	46.56	85.96	166.67	172.76	192.86
N5+N13	20.00	67.68	47.37	114.29	138.62	132.14
N5+N14	46.67	24.64	43.86	66.67	94.72	67.86
N13+N14	26.67	45.28	101.75	114.29	184.55	192.86
N5+N13+N14	20.00	-40.32	-21.05	-33.33	-24.80	-46.43

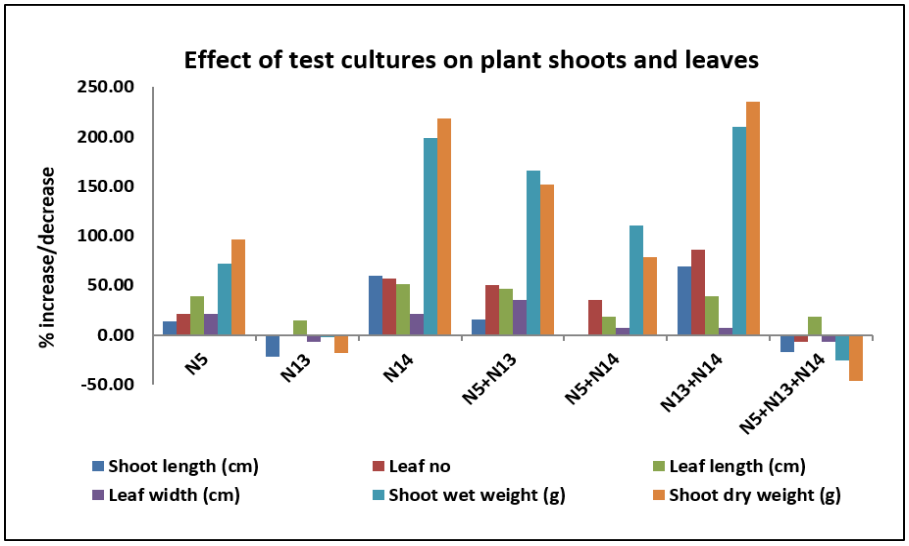


Fig.7: Effect of culture inoculation on plant shoots and leaves

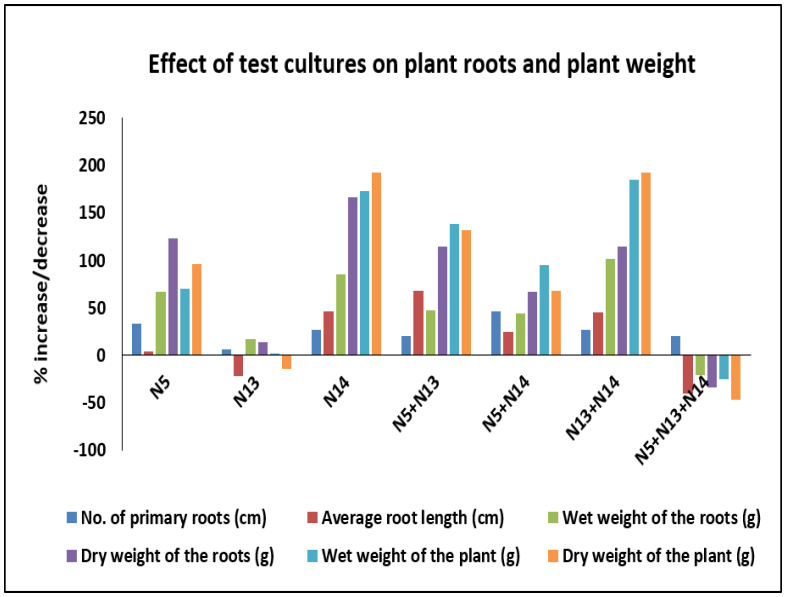


Fig. 8: Effect of culture inoculation on plant roots and plant weight

Effect of PGPB on chemical composition of the plant:

The plants were tested for their protein, polyphenol, soluble sugar, starch, and chlorophyll and carotenoid contents. The results depicted in Table 3 and 4 and Fig. 9 and 10 show that the cultures N13 and N13+N14 showed the greatest improvement in the chemical composition of the plants. Further, the protein content of the plants was enhanced by all the cultures. N13 and N5+N14 showed the highest increase of 261% and 193% respectively. The polyphenol content was enhanced by N13, N5+N14 and N5+N13+N14. There was no noticeable effect of culture inoculation on the soluble sugar content. The starch content was increased by the cultures N5 and N13+N14. The pigment (chlorophyll a, chlorophyll-b and carotenoid) contents were increased by N13+N14 and N5+N13+N14

Table 3: Effect of PGPB inoculation on chemical composition of the plant

	Leaf protein content (mg/g)	Polyphenol content (mg/g)	Soluble sugar conce (%)	Starch conce (%)
Control	0.30	0.41	0.09	1.28
N5	0.61	0.31	0.04	1.68
N13	1.08	0.60	0.05	1.14
N14	0.67	0.26	0.02	0.74
N5+N13	0.68	0.27	0.04	1.23
N5+N14	0.87	0.36	0.07	0.87
N13+N14	0.36	0.49	0.12	1.41
N5+N13+N14	0.34	0.60	0.07	1.01

Table 4: Effect of PGPB inoculation on leaf pigment content

	Chlorophyll a content (mg/g)	Chlorophyll b content (mg/g)	Carotenoid content (mg/g)
Control	1.15	0.43	0.24
N5	0.82	0.31	0.19
N13	0.40	0.15	0.12
N14	1.04	0.40	0.25
N5+N13	0.23	0.09	0.09
N5+N14	0.72	0.25	0.20
N13+N14	1.56	0.07	0.28
N5+N13+N14	1.35	0.48	0.34

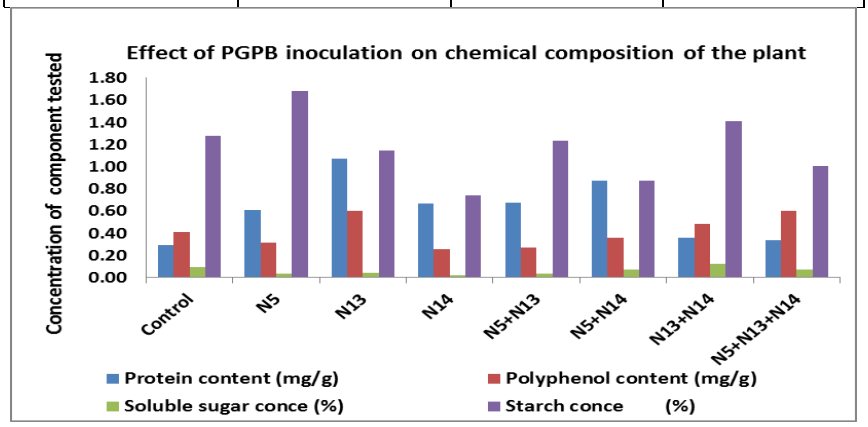


Fig.9: Effect of PGPB inoculation on chemical composition of the plant

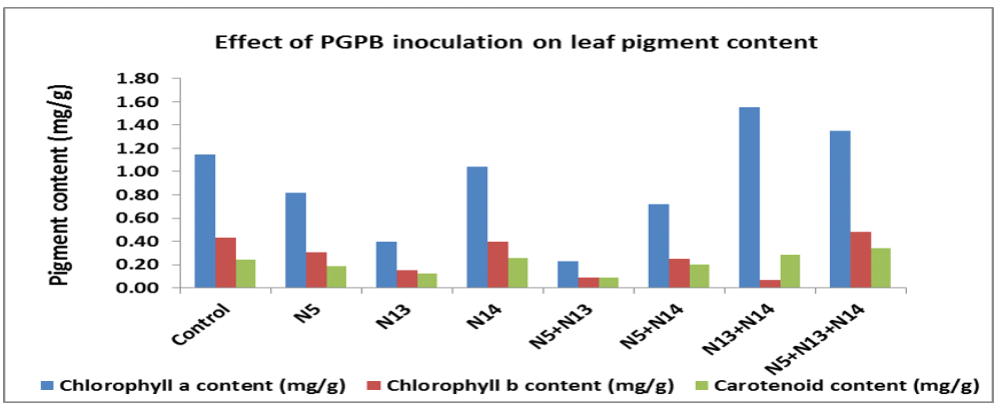


Fig.10: Effect of PGPB inoculation on pigment content of the leaves

SUMMARY:

1. The mixed culture N13+N14 showed an increase in the values of almost all the physical and chemical growth parameters tested. It showed a remarkable increase of 200% in weight of the shoot as well as the protein content of the plant. Thus we can conclude that it was the most effective combination of the cultures tested and should be studied further for development into an effective inoculant.

2. The pure culture N14 also had an excellent effect on the physical growth of the plant, showing an increase in the values of all the physical parameters tested. It increased the weight of shoots by 200% and the protein content of the plant by >125%. Thus we can conclude that N14 is also a good inoculant for growth promotion of the plant.

3. The pure culture N5 and its combinations with N13 and N14 also improved all the physical growth parameters of the plant and increased the concentration of a few chemical components, but not as effectively as N14 and N13+N14.

4. The pure culture N13 had very little effect on the plant, showing a positive effect in some parameters and negative in others. However, it enhanced the effect of both N5 and N14 when grown in combination with each of them.

5. The triple culture combination of N5+N13+N14 proved to be deleterious to the physical growth of the plant as it showed a negative effect on the values of almost all the parameters tested. However, it increased the polyphenol and pigment contents of the plant.

CONCLUSION:

PGPB have been shown to enhance the growth of mangrove plants in various studies carried out previously (Ravikumar et al, 2012, Ravikumar et al, 2010, Sahoo and Dhal, 2008; Gupta et al, 2007; Holguin et al 2001; Vacquez et al, 2000). The objective of this study was to evaluate the ability of selected PGPB isolated from mangroves in Navi Mumbai for their ability to promote the growth of seedlings of the mangrove species *Avicennia marina.* The study was also aimed at comparing the effects of the selected isolates and their combinations on the plant. This was implemented by growing the seedlings in culture-enriched cocopeat and comparing their growth with that of control plants grown in uninoculated medium. Most of the cultures used in the study were found to enhance the growth of the mangrove seedlings. The most effective inocula were the dual culture N13+N14 and the pure culture N14.

Since cocopeat (a nutrient deficient medium) was usedinstead of mangrove soil as the medium for plant growth, we can infer that the test cultures will be able to enhance the growth of mangroves in nutrient deficient, non-mangrove soils, which are likely to be found in areas allocated for mangrove reforestation programs. Besides, since the cultures were isolated from Navi Mumbai, they are already adapted to the environmental conditions of the area. Thus the cultures have good potential for development into biofertilizers that can be used in compensatory mangrove reforestation programs in Navi Mumbai.

Future plans include identification of the cultures by 16S rRNA sequencing and optimization of conditions for large scale production of the cultures. Different carrier materials for culture formulation, alternative methods of plant inoculation and ideal

conditions for storage of the cultures can also be investigated.

ACKNOWLEDGEMENTS:

We thank the management of V.E.S College and K.B.P College for their unstinting support and provision of all the facilities required to carry out our work. We also thank the staff of the Microbiology department of V.E.S College for their invaluable encouragement and support.

REFERENCES:

1. **Abad M1, Noguera P, Puchades R, Maquieira A, Noguera V.** 2002. Physico-chemical and chemical properties of some coconut coir dusts for use as a peat substitute for containerised ornamental plants. Bioresour Technol. 2002 May;82(3):241-5.
2. **Alongi DM**. 2002. Present state and future of the world's mangrove forests. Environmental Conservation. **29** (3): 331–349
3. **Bashan Yoav, Holguin Gina.** 2002. Plant growth-promoting bacteria: a potential tool for arid mangrove reforestation. Trees. **16**:159-166
4. **Government of India, Ministry of Environment, Forest and Climate Change**, F.No.11-65/2012-IA.111
5. **Holguin Gina, Vazquez Patricia, Bashan Yoav.** 2001. The role of sediment microorganisms in the productivity, conservation and rehabilitation of mangrove ecosystems: an overview. BiolFertil Soils. **33**:265–278
6. **Gomes N., Daniel F.R., Pinto F. N., Egas C., Almeida A., Cunha A., Mendonca-Hagler L, Smalla K.** 2010. Taking Root: Enduring Effect of Rhizosphere Bacterial Colonization in Mangroves. PLoS One Biodiversity. **5**(11): e14065
7. **Gupta, N., Das, S. and Basak U.C.** 2007. Useful extracellular activity of bacteria isolated from Bhitarkanika mangrove ecosystem of Orissa coast. Malaysian Journal of Microbiology. **3**(2): 15-18
8. **Hansen J, Moller I.B**. 1975. Percolation of starch and soluble carbohydrates from plant tissue for quantitative determination with anthrone. Anal Biochem**68**: 87-94.
9. **Hiranandani A., Levitt T.** 2010, 1st June. Mangroves v/s airport: Mumbai's development battle. The Ecologist.
10. **Hodge, J E and Hofreiter, B T**. 1962 In: Methods in Carbohydrate Chemistry (eds Whistler, R L and Be Miller, J N) Academic Press New York.
11. **Kathiresan K, BinghamL**. 2001. Biology of Mangroves and Mangrove Ecosystems. Advances in Marine Biology **40**: 81-251
12. **Lowry O.H., Rosebrough N.J., Farr A.L., Randall R.J.** 1951. Protein measurement with the Folin Phenol reagent. J BioiChern 193: 265-275
13. **Mohr H., Schopfer P.** 1995. Chapter 16:Metabolism of water and inorganic ions. Plant physiology. Springer. Pg.261
14. **NayekSumanta, Choudhury ImranulHaque, JaisheeNishika and Roy Suprakash**. 2014. Spectrophotometric analysis of Chlorophylls and Carotenoids from commonly grown Fern species by using various extracting solvents. Research Journal of Chemical Sciences. 4(9), 63-69
15. **Parida A, Das A.B, Das Premananda**. 2002. NaCI Stress Causes Changes in Photosynthetic Pigments, Proteins, and

Other Metabolic Components in the Leaves of a True Mangrove, Bruguieraparviflora, in Hydroponic Cultures. Journal of Plant Biology. **45**(1) : 28-36

16. **Ravikumar S, Ignatiammal S. T., Gnanadesigan M., Kalaiarasi A.** 2012. Effect of saline tolerant Azospirillum species on the growth parameters of mangrove seedlings. J.Environ.Biol. **33**: 933-939

17. **Ravikumar S, S. Shanthy, A. Kalaiarasi, S. Sumaya.** 2010.Bioinoculation of halophilicphosphobacteria for vigorous seedlings of Rhizophoramucronata. Applied Science Research.**2** (6):261-266

18. **Sahoo K, Dhal NK.** 2009. Potential microbial diversity in mangrove ecosystems: a review. Indian Journal of Marine Sciences. **38** (2)**:**249-256.

19. **Shukla Jai Prakash**. 2014. Technologies for sustainable rural development having potential of socio-economic upliftment. Allied Publishers Pvt. Ltd. Pg.140

20. **Smith, P.K., Krohn R.I., Hermanson G.T., Mallia A.K., Gartner F.H., Provenzano M.D., Fujimoto E.K., Goeke N.M., Olson B.J., and Klenk D.C.** 1985. Measurement of Protein Using Bicinchoninic Acid. Analytical Biochemistry 150:76-85.

Economic Importance and Ecological Services of Indian Mangroves

Gayathri N., [1]* Bagkar P.[2]

[1]Department of Zoology, the D.G. Ruparel College of Arts, Science and Commerce, Mahim (West), Mumbai 400 016

[2]Department of Biotechnology, Ramnarain Ruia College, Matunga (East), Mumbai 400 019

*E-mail: gayathri.n@ruparel.edu

Abstract:

Mangroves are highly productive biologically diverse coastal resources which are interface of land and sea. Mangrove forests are capable of thriving in highly saline environment, conditions in which only few species thrive. They stabilize the coastline and check erosion. Mangroves are sources of highly valued food and medicinal plants and provide sites for fishery/aquaculture and eco-tourism. A vast majority of Indian population lives in the coastal area, and most of the communities depend on the mangroves for their livelihood. They are essential to our socio-economic development. In the current scenario, conservation of mangroves is not only important for sustainability of the complex ecological niche nurtured by it but also vital for interconnectivity of the marine and land ecosystems. This review highlights both the economic and ecological aspects of the mangroves with consideration of various habitat types. Factors affecting productivity of the mangrove along with the restoration of biodiversity are considered. Conservative and productive approaches need to be applied for mangroves habitats with possible solutions to incorporate amalgamation of both.

Keywords: *Mangroves, ecosystem, biodiversity*

Introduction:

The oxford dictionary defines mangrove as tree or shrub which grows in tidal, chiefly tropical, coastal swamps, having numerous tangled roots that grow above ground and form dense thickets. They are among the most productive ecosystems on the earth. Mangroves have important ecological and socio-economical functions. They protect and stabilize the coastline by acting as a barrier against natural disasters [Guebas*et al*., 2005; Wells *et al*., 2006; Bahuguna*et al*., 2008], increase soil/sediment accretion [Satyanarayan *et al.,* 2011], trap nutrients and heavy metals [Aksornkoae*et al.,* 1993; Clark, 1998; Tam and Wong, 1999], provide breeding ground for different types of prawns, shellfishes, crustaceans, fishes and amphibians, etc. [Nayak, 2001]. Mangrove provides several important services including maintenance of coastal water quality, reduction in severity of storm, wave and flood damage, etc., as well as storehouse for biological and genetic diversity [Sandilyan, 2007]. Economic services of mangroves include provision of food, fuel and fodder to the coastal communities [Aksornkoae*et al.,* 1993; Guebas, 2000] and employment to local people by collection, processing and marketing of medicinal plant species [Bandaranayake, 1988; Cornejo*et al*., 2005; Pattanaik*et al*., 2008]. 20% of the Indian population depends on the coastal habitats for food and employment [Blasco*et al.*, 1977]. In spite of the ecological and economical services provided by the mangroves, Indian mangroves are threatened by various anthropogenic activities and natural calamities which lead to their destruction. The objective of this study is to review the ecological and economical aspects of the mangroves; to throw light on

various threats to different mangrove habitats in India and the effectiveness of its conservation and management strategies.

Distribution and classification of Indian Mangroves:

India stands eleventh in the list of mangrove-rich countries contributing to 2.7% of the global total [Giri*et al*., 2011]. Mangroves in India are one of the most diversified systems on both arid coasts and wetlands. Mangrove wetlands constitute 4871 Km^2 of our coastline, with 2758 Km^2 spread along the east coast, 1147 Km^2 in the west coast and 966 Km^2 in the Andaman and Nicobar islands [FSI, 1999]. Singh and co-workers (2012) have classified mangroves along the Indian coast in three different categories on the basis of their density as '*very dense*' which accounts for 1403 Km^2, '*moderately dense'* which accounts for 1658.12 Km^2 and '*open mangroves'* which accounts for 4662.56 Km^2. On the basis of spatial and temporal variations of environmental factors, major mangrove wetlands of India are classified as tide-dominated (Sundarbans and Mahanadi), river-dominated (Pichavaram and Muthupet), drowned-river valley type (Gujarat) [Selvam, 2003].

Mandal and Naskar (2008) have classified the Indian mangroves on the basis of habitat diversity and geographical characters. Classification under habitat diversity includes Deltaic mangroves (high tidal range with associated strong bi-directional tidal currents), Coastal mangroves (low tidal range) and Island mangroves (commonly found at the mouths where rivers are seen to border the open sea). Classification under geomorphologic characters includes East coast mangrove habitats, West coast mangrove habitats and Andaman & Nicobar and Lakshadweep Islands.

Kathiresan and Rajendran (2005) have classified the mangroves in Indian Ocean region as Over-washed mangroves (small mangrove islands frequently over-washed by tides), fringing mangrove forests (found along the waterways affected by daily tides), Basin mangrove forests (located in the interior of the swamp), Hammock mangrove forests (located in the interior of the swamp but at higher elevation) and Scrub mangrove forests (dwarf stands of the mangroves which exist on flat costal fringes). The Sundarbans along the east coast is one of the largest mangrove forests in India. It supports a luxuriant growth of mangroves and a higher biodiversity whereas the arid regions of Gujarat supports dwarf mangrove stands. This is due to the variations in the environmental conditions such as rainfall, humidity, sediment nature, nutrients, etc.

Economical services of mangroves:

Mangroves act as a source for a vast range of food products like honey, algae, fruits, fishes, prawns, crabs, salt production, etc. The

country has exported 38,177.08 metric tons of natural honey to the world for the worth of Rs. 705.87 crore during the year of 2015-16 (APEDA, INDIA 2015-2016). The Sundarbans provide employment to 2000 people engaged in extracting 111 tones of honey annually and this accounts for about 90% of honey production among the mangroves of India [Krishnamurthy, l990].

Mangroves are a good source of fishery products like fishes, prawns, crabs, molluscs, etc. Diversity of fishes and their number is remarkable in wetland mangroves. Mangroves provide excellent breeding ground for commercial fishery species [Robertson and Phillips, 1995;Yoshiro *et al.,* 1995]. The nutrient rich micro-climate provided by the mangroves is crucial for developmental/life stages of 90% of marine species [Dixon, 1989;

Lucy, 2006; Sandilyan, 2014]. In the Pichavaram mangrove in south India, 74% of the penaeid prawns caught in coastal waters use the mangrove as nursery grounds (Krishnamurty, 1984). One hectare of mangroves can yield 767 Kg of wild fishes and crustaceans, which is more than the yield in extensive system that can yield about 500 kg/ ha/year.

Mangroves, especially *Avicennia, Phoenix* and *Sonneratia* form cheap and nutritive feed for buffaloes, sheep, goats and camels. These animals are allowed to graze in mangrove areas. In Gulf of Kachchh, during famine, mangrove vegetation remains as the only source of fuel and fodder[Untawale and Wafar, 1991; Qasim, l998]. Due to high calorific values, mangrove twigs are used for making charcoal and firewood. One ton of mangrove firewood is equivalent to 5 tons of Indian coal, and it burns producing high heat without generating smoke. Mangrove wood with high content of tannin is used as timber due to its durability. Mangroves are being used for boat building and tannin extraction. The pneumatophores are used to make bottle stoppers and floats. *Nypa* leaves are used to thatch roofs, mats and baskets. Shells of mangrove molluscs are used to manufacture lime.

Ecological services of the mangroves:

Mangroves have a major role to play in the marine ecology. They form the basis of a complex marine food chain, detritus food cycle, filter and assimilate pollutants, stabilize sediments and protect the shorelines from erosion. Indian mangrove ecosystem has a very high biodiversity and is homeland for 920 species of flora and 3091 species of fauna to make total count of 4011 species which is the highest in the world [Bhatt and Kathiresan, 2011]. Marine algae, having 557 species is the most diverse among flora, followed by fungi. Among fauna, other invertebrates have highest number of species (745) followed by insects, finfish, birds, mollusks, etc. [Sahu*et al*., 2015].

Mangrove ecosystems ensure the stability of the coast. They form bio-shelter against cyclones, storms and such natural calamities and secure the coastal regions [McCoy *et al*., 1996]. Mangroves have extensive ability to minimize the damage due to cyclone. The impact of mangroves on human deaths during 1999 super cyclone that struck Odisha was analysed by Das and Vincent [2009]. They reported that villages with wider mangroves between them and the coast experienced significantly fewer deaths than ones with narrower or no mangroves. Another example of the protective effects of mangrove is its role in mitigating the strength of tsunami in Tamil Nadu [Kathiresan and Rajendran, 2005]. The trees standing in the front lines were damaged but well established forests such as the Pichavaram mangrove forest acted as a protective belt slowing down the waves and protecting around 1700 people living in hamlets built inland between 100 to 1000 meters from the mangroves. Mangroves provide breeding grounds and nurseries for several organisms such as fishes and shell fishes, they act as a source of food, and they attract other kinds of wildlife. They offer protection to other associated flora and fauna. The mangrove foliage produces flavonoids that serve as UV-B screen compounds. This ability of mangroves makes the environment free from the deleterious effects of UV-B radiation [Moorthy and Kathiresan, l997].

Carbon Budget is the tolerable quantity of the greenhouse gas that can be emitted in specific amount of time. Mangroves play a significant role in the coastal zone carbon budget. The exchange of carbon between tidal wetlands like mangroves and its ultimate fate in the ocean is an important component in the ocean carbon budget [Twilley*et al*., 1992; Bouillon

et al., 2008]. Increasing carbon dioxide level in the atmosphere results in increasing global mean temperature [Christopher *et al.*, 2006]. India is one of the countries where combustion of fossil fuels contributes to a huge output of CO_2 in the atmosphere. High rate of urbanization and densely populated metro cities further contribute to this effect. Mangroves are known to remove CO_2 from the atmosphere through photosynthesis thereby reducing global warming. They fix greater amounts of CO_2 per unit area than what the phytoplanktons in tropical oceans do [Kathiresan and Bingham, 2001].

Carbon sequestration is the process by which plants remove CO_2 from the atmosphere and stores as biomass. The mangroves are capable of accumulating and storing carbon in the soil in large quantities. They are estimated to be 50 times more potential than tropical terrestrial forests in sequestering carbon [Sahu*et al.*, 2015]. Plantation of mangroves provides great benefits to control global climate change by stabilizing atmospheric carbon. Because the mangroves fix and store significant amounts of carbon, their loss may have impact on global carbon budget.

Threats to Indian Mangroves

Climate change is one of the most important environmental issues impacting mangroves in India & the world. It results in increase in temperature, rising sea level, increasing the frequency of tropical storms and tsunamis. Anthropogenic activities like aquaculture and agriculture expansion, surface runoff from agriculture and aqua cultural ponds, oil spills, cutting of mangroves for timber, fuel and charcoal, urban sewage and pollution are threats to the mangrove ecosystems. Natural calamities, reduction of fresh water and tidal water flows, shoreline erosion, invasive species are also some of the major threats to mangroves [Sahu*et al.*, 2015]. In Sundarbans, due to reduction in fresh water inputs, species such as *Heritierafomes*and *Nypafruticans*are decreasing in number [Bhatt and Kathiresan, 2011]. Over exploitation of the mangrove forest leads to reduction of the forest cover and destruction of biological diversity of the ecosystem. There is a continued decline of the forests due to conversion of land to agriculture, aquaculture, tourism, urban development and overexploitation [Alongi, 2002; Giri*et al.*, 2010]. India has lost 40% of its mangrove area during the last century [Sahu*et al.*, 2015]. In India and Bangladesh, about 1, 50,000 ha of mangroves have been destroyed for agricultural purposes. Aquaculture in mangrove areas is another pressure on regeneration and survival of mangrove seedlings [Shaikh and Srivastava,2013]. It leads to destruction of mangrove patches in various areas. Because of high calorific value of mangrove wood and high strength, mangroves are being destroyed for use as firewood, charcoal and timber [Tarakanadha*et al.*, 2013]. Use of mangrove trees as a source of firewood in coastal India is one of the major kinds of exploitation [Untawale and Wafar, 1991]. Overuse of mangroves for food, fodder, medicine, tannin, etc., are a threat to these ecosystems. Mangrove patches in cities such as Mumbai and Kolkata are affected by discharge of large amounts of solid wastes and effluents from various sources, industrialization and construction activities. Pollution has made the habitats difficult for mangrove survival and growth [Vyas, 2013].

Strategies involved protection of mangrove forest in India:

Under National Forest Policy of 1894, Government restricted forest dwellers from practicing traditional uses of the forest [Dasgupta and Shaw, 2013]. To prevent illegal cutting of trees and encroachment, Government of India promoted Forest Conservation Act of 1980 and its subsequent amendment in 1988 by the GOI. Forest

Conservation Act of 1980 encourages reasonable use of natural forest resources while National Forest Policy of 1988 invites community participation for the regeneration and management of forest through Joint Forest Management (JFM) program. This gives rights to local inhabitants to exploit forest resources to some extent like collection of fuel wood, fodder, fish, shrimp, honey and wax and thus provided mutual benefit to community and forest department [Singh *et al.*, 2010]. M.S. Swaminathan Research Foundation launched a major programme in 1996 to restore mangrove wetlands of the east coast of India in collaboration with the Ministry of Environment and Forests and State Forest Department of Tamil Nadu, Andhra Pradesh, Odisha and West Bengal [Selvam*et al*., 2003]. Mangrove regeneration involving local villagers have received higher success rate than afforestation program of forest department due to choice of appropriate species and planting site based on century old knowledge of local communities [Saravanan, 2005]. Community based restoration of Pichavaram mangrove wetlands was effectively carried out. Use of remote sensing as a monitoring tool for mangrove wetland conservation and restoration programmes will overcome the difficulty of direct and physical monitoring. After Ramsar convention (1971) the legislative protection of mangroves have increased manifold, as it was strongly advocated and incorporated the need of mangrove management into National Forest Policy of India.The authors of this paper have carried out biochemical analysis and study of self restoration capacity of the mangroves in Mira-Bhayandar, Thane (Gayathri and Bagkar, 2016). Our study underlined the remarkable self restoration ability of the microenvironment by the microbial flora present naturally in the mangrove soil when allowed to react to the interfered environment for sufficient buffer period. This strategy is flexible and can adapt to various types of the mangrove/ wetland ecosystems which might be helpful in wide-range mangrove restoration programs.

Conclusion:

Indian coasts suffered considerable loss of the mangrove in last decade. Study reveals that lack of knowledge of the local mangrove species growth condition, soil physiology and microenvironment and lack of manpower are two of the major reasons responsible for the failure of restoration projects. Mangroves have a well established reputation due to their ecological significance although their economic exploitation adds more value to their existence and hence provide reason for their protection by local people and government. Curtail of illegal activities like over exploitation of resources, deforestation, and encroachment need modern technologies like remote sensing and GIS-based approach. The authors also highlighted the ability of the soil micro-flora to regain the physico chemical properties even after certain level of disturbances. Role of the local communities cannot be neglected in the restoration programs.Knowledge of the mangroves habitat growth requirement and their uses are key to a successful restoration and management project. NGOs also can play a significant role in the terms of gathering findings and manpower, an integral component of restoration and management programs. Research work from the different areas should be correlated and strong legislative policies should be incorporated in a management plan.

References:

1) Agriculture and Processed Food Products Export Development Authorty: (APEDA) http://apeda.gov.in/apedawebsite/index.html
2) Aksornkoae S, Paphavasit N, and Wattayakorn G (1993) Mangroves of Thailand: Present status of conservation, use and management. International tropical Timber Organisation, Japan International Association for Mangroves, and International Society for Mangrove Ecosystems.The economic and environment value of mangrove forests and their present state of conservation.International Society for Mangrove Ecosystems, Okinawa, Japan.
3) Alongi DM (2002) Present state and future of the world's mangrove forests. Environmental Conservation 29: 331–349.
4) Bahuguna A, Nayak S, Roy D (2008) Impact of the tsunami and earthquake of 26th December 2004 on the vital coastal ecosystems of the Andaman and Nicobar Islands assessed using RESOURCESAT AWiFS data. Int J App Earth Obs Geo inf 10: 229-237
5) Bandaranayake WM (1998) Traditional and medicinal uses of mangroves. J Mangroves Salt Marshes 2: 133-148.
6) Bhatt JR and Kathiresan K (2011) Biodiversity of mangrove ecosystems in India. In: Towards conservation and management of mangrove ecosystem in India.
7) Bouillon S, Borges AV, Castaneda-Moya E *et. al.* (2008) Mangrove production and carbon sinks: A revision of global budget estimates. Global biogeochem cycles 22:1-12.
8) Blasco F, Caratini C, Chandra S, Thanikaimani G (1977) Main characteristics of Indian mangroves. Proc. Int. SympBiol Mgt Mangroves, Honolulu 1: 71-87.
9) Christopher D, Harley G, Hughes AR *et al.*, (2006). The impacts of climate change in coastal marine systems. Ecology Letters, 9: 228-241.
10) Clark MW (1998) Management implications of metal transfer pathways from a refuse tip to mangrove sediments. Sci Tot Env 222: 17-34.
11) Cornejo RH, Koedam N, Luna AR, Troell M, Guebas FD (2005) Remote Sensing and Ethnobotanical Assessment of the Mangrove Forest Changes in the Navachiste-San Ignacio. J Ecol Soc 10: 16.
12) Das S and Vincent JR (2009) Mangroves protected villages and reduced death toll during Indian super cyclone. Proceddings of the National Academy of science of the united states of the America 106 (18): 7357–7360.
13) Dasgupta R and Shaw R (2013) Changing perspectives of mangrove management in India - An analytical overview. Ocean Coast Manag 80: 107-118.
14) Dixon JA (l989) the value of mangrove ecosystems, Tropical Coastal Area.
15) FSI (1999) State of Forest Report. Dehra Dun, India.
16) Gayathri N and Bagkar P (2016). Bio-chemical analysis and study of self restoration capacity of Mira-bhayandar wetlands using modified winogradsky's column. In: Proc Int Conf on Ecosystem services of wetlands. Pp 53-56.
17) Giri C, Ochieng E, Tieszen LL, Zhu Z, Singh A, Loveland T, Masek J, Duke N (2011) Status and distribution of mangrove forests of the world using earth observation satellite data. Global Ecol Biogeogr 20: 154-159.
18) Guebas FD, Mathenge C, Kairo JG, Koedam N (2000) Utilization of

mangrove wood products around mida creek (Kenya) amongst subsistence and commercial users. Econ Bot 54: 513-527.

19) Guebas FD, Hettiarachchi S, Seen DL, Batelaan O, Sooriyarachchi S, *et al.* (2005) Transitions in ancient inland freshwater resource management in Sri Lanka affect biota and human populations in and around coastal lagoons. CurrBiol 15: 579-586.
20) Kathiresan K and Rajendran N (2005) Coastal mangrove forests mitigated tsunami. Estuarine, Coastal and Shelf Science 65: 601-606.
21) kathiresan K and Ravikumar S (1993) Two endangered species of mangroves in Pichavaram. Indian forester, 119(9), pp.773-776.
22) Kathiresan K (1997) Photosynthetic pigments in tropical mangroves: Impacts of seasonal flux on UV-B radiation and Otherenvironmental attributes. Botanica Marina, 40: 341-349.
23) Kathiresan K and Bingham, BL (2001) Biology of mangrove and mangrove ecosystems.
Advances in Marine Biology **40:** 81-251.
24) Krishnamurthy K (1993) The Mangroves. ENVIS Newsletter, Annamalai University southern India 1: 1-3.
25) Lucy E (2006) Counting mangrove ecosystems as economic components of Asia's coastal infrastructure. Proceedings of International Conference and Exhibition on Mangroves of Indian and Western Pacific Oceans (ICEMAN 2006), Kuala Lumpur, pp. 1-14.
26) McCoy ED, Mushinsky HR, Johnson D, Meshaka WE (1996) Mangrove damage caused by Hurricane Andrew on the south-western coast of Florida. Bulletin of Marine Science 59: 1-8
27) Mandal RN and Naskar KR (2008) Diversity and classification of Indian mangroves: a review. Tropical ecology 49 (2): 131-146.
28) Moorthy P and Kathiresan K (1997) Influence of UV-B radiation on hotosynthetic and biochemical characteristics of a mangrove RhizophoraapiculataBlume.
Photosynthetica, 34(3): 465-471.
29) Nayak S and Bahuguna A (2001) Application of remote sensing data to monitor mangroves and other coastal vegetation of India.Ind J Mar Sci 30: 195-213.
30) Pattanaik C, Reddy CS, Dhal NK (2008) Phytomedicinal study of coastal sand dune species of Orissa.Ind J Traditional Knowledge 7 (2): 263-268.
31) PurvajaR (1995) Interactions between greenhouse gas, nutrient, major and trace elements in the Pichavaram mangroves of South India. Ph D thesis, Anna University, Chennai.pg. 256.
32) Qasim SZ (1998) Mangroves In: Glimpses of the Indian Ocean (University Press, Hyderabad), 123-129 p
33) Robertson AI and Phillips MJ (1995) Mangroves as filters of shrimp pond effluent: Predictions and biogeochemical research needs. Hydrobiologia 295: 311-321.
34) Sahu SC, Suresh HS, Murthy IK, Ravindranath NH (2015) Mangrove Area Assessment in India: Implications of Loss of Mangroves. J Earth SciClim Change 6: 280.
35) Sandilyan S (2007) Mangrove - The evergreen emerald forest. Eco News 13:21.
36) Sandilyan S (2014) Impacts of climate change on Indian mangroves: a review paper. Global J Envi Res 8 (1): 1-10.
37) Saravanan KR, Ilangovan K, Khan AB (2008) Floristic and macrofaunal

diversity of Pondicherry Mangroves, South India. Tropical Ecology 49 (1): 91-94.

38) Selvam V (2003) Environmental classification of mangrove wetlands of India.CurrSci 84 (6): 757-765.
39) Shaikh MHA and Srivastava RK (2013) Status of mangrove conservation and management in Karnataka: In Mangroves in India: their biology and uses: 7178.
40) Singh A, Bhattacharya P, Vyas P, Roy S (2010) Contribution of NTFPs in the livelihood of mangrove forest dwellers of Sundarban. J Hum Ecol 29: 191-200.
41) Singh AK, AbubakarAnsari, Dinesh Kumar and Sarkar UK (2012). Status, Biodiversity and Distribution of Mangroves in India: An overview. International Day for biological diversity marine biodiversity, Uttar Pradesh Biodiversity Board, 60: 59-67
42) Tam NFY and Wong YS (1999) Mangrove soils in removing pollutants from municipal wastewater of different salinities. J Environ Qual 28: 556-564.
43) Tarakanadha B, Singh BT, Rao KS (2013) Coastal vegetation of Nellore district, Andhra Pradesh, East Coast of India: In Mangroves in India: their biology and uses: 233-244.
44) Twilley RR, Chen RH, Hargis T (1992), Carbon sinks in mangrove forests and their implications to the carbon budget of tropical coastal ecosystems.Water Air Soil Pollution, 64: 265–288.
45) Untawale AG and Wafar S (1991) Socio-economic significance of mangroves in India.Proc Symposium on significance of mangroves.Pp.33-56.
46) Vyas P (2013) Sundarban Biosphere Reserve, India: Conservation and management of mangrove ecosystem: In: Mangroves in India: their biology and uses.
47) Wells S, Ravilious C, Corcoran E (2006) In the Front Line: Shoreline Protection and other Ecosystem Services from Mangroves and Coral Reefs. UNEP/ Earthprint, England.
48) Yoshiro M, Michimasa M, Motohiko K, Phan NH (1997) Mangroves as a coastal protection from waves in the Tong King delta. Vietnam. Mangroves and Salt Marshes 1: 127-135.
49) Zheng DZ, Li M, Zheng SF, Liao B, Chen Y (2003) Headway of study on mangrove recovery and development in China. SciTechnol Guangdong Prov. 19: 10-14.

Air Pollution Induced changes on the leaf morphology of some plants growing in Tarapur Industrial Area (MIDC), Maharashtra

Manohar Rathinam* And Swaranjit Kaur Cheema
Department of Botany, G.N.Khalsa College, Matunga, Mumbai 400019. India
Email: *jaronm8@gmail.com

Abstract
The industrial air pollution is a major environmental issue particularly in the developing countries like India. Therefore the present study deals mainly with the effect of air pollution on the morphological changes in the leaf of the ten plant species selected namely Acacia auriculiformis, Artocarpus heterophyllous, Azadirachta indica, Cassia siamea, Ficus benghalensis, Ficus religiosa, Mangifera indica, Polyalthia longifolia, Terminalia catappa and Thevatia nerifolia growing in Tarapur, Maharashtra Industrial Development Corporation (MIDC) and Tarapur Atomic Power Station Colony (TAPS). The parameters examined were leaf length, breadth, petiole length, leaf area, stomatal frequency and stomatal index. The results revealed that all the plant species in polluted site (MIDC) exhibited reduction in the leaf length, breadth, petiole length, leaf area, stomatal frequency and stomatal index as compared with the control site (TAPS). The reduction in growth in all the parameters from season to season was observed. The overall reduction during different seasons at polluted site with respect to that of non polluted site were found to be maximum during summer followed by rainy season lowest was observed in winter season. Thus present findings show that this could be mainly due to the exposure of plants to air pollutants coming from various industries as the dust particulates remain in the atmosphere for varying length of period and get deposited especially in the leaf surface and thus affect the foliar morphology.
***Key words**: Air pollution, Tarapur, foliar morphology, stomatal index*

Introduction

Air pollution is more complex than most other environmental challenges. Many heavily populated and industrialized areas face a serious problem of air pollution and have become a major threat to the survival of plants in the industrial areas (Gupta and Mishra, 1994). Trees in the urban environment can improve air quality through filtering and uptake of gases and particles (Beckett et al. 2000). Exposure to pollution endangers these trees. Air pollution may result in changes in foliar anatomy and morphology and may cause visible injury (Ghouse et al. 1980; Jahan and Iqbal 1992; Pandey and Agrawal 1994; Verma et al. 2006; Joshi and Swami 2007). Of all other parts leaf is the most sensitive part to be affected by air pollutants. The leaves from trees near air pollution sources can even be 'coated' with particulates (Ricks and Williams 1974; Lerman and Darley 1975). This leads to reduced photosynthesis due to stomatal occlusion (Williams et al. 1971). The various pollutants either adhere to the plant surface or enter the leaf through the cuticle or stomata, where physiological and structural responses are induced. Stomata are believed to represent a major site of pollutant penetration in some plants. Stomatal structure, frequency and distribution have been assumed to be significant variables affecting plant sensitivity and overall leaf resistance. Destructive atmospheric phytotoxins emitted by various factories effect leaf structure and increase the rate of leaf abscission. Plants provide an enormous leaf area for impingement, absorption and accumulation of air pollutants. They reduce the pollutants level in the environment to a various extent (Lui and Ding, 2008; Escobedo et al, 2008) Plants act as the scavengers for many air borne particulates in the atmosphere (Joshi and Swami, 2007). Air pollution in Tarapur industrial area is rising to an alarming state since last decades due to bulk

drug manufacturing units, chemical manufacturing units, steel plants and some textile plants. Therefore the present study was mainly designed to analyze the effect of air pollution induced changes on the leaf morphology of some plants growing in Tarapur Industrial Area (MIDC),

Material and Methods

Study area

Tarapur is a census town in Palghar district (earlier Palghar was taluka and has recently notified as district) of Maharashtra State, India. Located at 17.7º N, 75.47º E at an elevation of 456 meters (1496 feet). Tarapur MIDC in-house major Industrial Estate of Maharashtra Industrial Development Corporation which includes bulk drug manufacturing unit's especially chemical manufacturing units, steel plants and some textile plants.

Sample Collection

Leaf samples were collected from MIDC Tarapur for polluted site (PS). A site nearby with similar ecological conditions, Tarapur atomic power station colony (TAPS) was selected as the control site (CS). Fresh leaves were collected in the morning hours from identified trees. They were brought to the laboratory in polythene bags. Samples are preserved in refrigerator for other analysis.

Plants: Plant species selected namely *Acacia auriculiformis, Artocarpus heterophyllous, Azadirachta indica, Cassia siamea, Ficus benghalensis, Ficus religiosa, Mangifera indica, Polyalthia longifolia, Terminalia catappa and Thevatia nerifolia.*

Methods

1) **Leaf area (mm^2):** Leaf area measurements

were carried out by using graph paper, leaf outline was drawn. Then the leaf area was calculated by counting the number of bigger and the smaller squares (Agarwal S K, 2005). Average of 10 leaves was then calculated.

2) **Length and breadth of the leaf (cm):** Length and breadth of leaf parts were measured with the help of thread and measuring scale. Leaf breadth was measured in upper, middle and lower part and average of three was taken as final breadth. Measured were taken for ten leaves and the mean value was noted.

3) **Petiole length (cm):** Petiole length was measured with the help of a meter scale for 10 leaves and the mean value was noted.

4) **Stomatal index:** Leaves were washed carefully with water and clear epidermal peels were obtained by boiling a piece of leaf with chloral hydrate solution. Boiled leaves were washed thoroughly with water epidermis was peeled. Each epidermal surface was then stained with saffranin, mounted in glycerin on a slide and observed under (10×40) X. Images were photographed with Magnus microscopic camera attached to the computer and cells were counted using ImageJ software (http://rsb.info.nih.gov/nih-image/). The stomatal index was calculated by using the formula defined by Salisbury (1927, 1932)

Stomatal index = [S/(S+E)] X 100

Where, S = number of stomatal cells per unit area, E= number of epidermal cells per unit area to be affected by air pollutants and reduction in leaf length, breadth, area, petiole length and stomatal index of the plants in industrial area witnessed the bad effects of the air atmosphere. Similar observations in many plants were also reported by Bhatti & Iqbal, 1988; Bhatia 2006, Rao 2006 and Stevovic et al, 2010.

Result and discussion:

The results described in table No. 1 – 3, revealed that there was slow growth in all the investigated parameters in all the plant species at MIDC(Polluted site) as

compared to that of TAPS(Control site) which might be due to the adverse effect of air pollution in the industrial area. Of all the plant parts, leaf is the most sensitive part

Table No.1 Effect of air pollution on average Leaf length(cm), Leaf breath(cm), Petiole length(cm), Leaf area(cm) and Stomatal index(abaxial surface) of different plant species growing at MIDC(Polluted site) and TAPS(Control site) of Tarapur during rainy season.

Sr.No	Plants↓	Parameter →	Leaf length(cm)	Leaf breath(cm)	Petiole length(cm)	Leaf area(cm)	Stomatal index
1	*Acacia auriculiformis*	MIDC(PS)	18.04±3.13	1.86±.22	0.43±.07	22.30±3.99	8.87±1.47
		TAPS(CS)	19.16±1.61	1.67±.14	0.50±0.00	27.25±3.05	10.61±1.06
		%Reduction	5.85%	-11.38%	14.00	18.17%	16.40%
2	*Azadirachta indica*	MIDC(PS)	6.53±1.78	1.37±.16	0.10±0.00	7.50±1.43	9.31±.54
		TAPS(CS)	11.50±.73	1.96±.09	0.20±0.00	15.60±1.78	10.05±.93
		%Reduction	43.22%	30.10%	50%	51.92%	7.3%
3	*Artocarpus heterophyllous*	MIDC(PS)	14.50±.83	6.11±.56	1.37±.16	68.05±10.68	17.35±2.24
		TAPS(CS)	17.98±2.06	7.05±.61	2.42±.37	87.70±16.77	18.87±2.78
		%Reduction	19.35%	13.33%	43.39%	22.41%	8.06%
4	*Cassia siamea*	MIDC(PS)	5.99±.63	1.93±.10	0.03±0.00	9.70±1.86	8.13±3.55
		TAPS(CS)	7.43±.39	1.79±0.04	0.03±0.00	9.75±1.23	8.50±2.82
		%Reduction	19.38%	-7.82%	0%	0.51%	4.35%
5	*Ficus benghalensis*	MIDC(PS)	14.18±0.97	7.68±.48	2.56±0.32	81.00±9.09	11.75±1.18
		TAPS(CS)	17.97±3.12	10.02±1.01	3.23±.24	124.50±11.24	15.65±1.58
		%Reduction	21.09%	23.35%	20.74%	34.94%	24.92%
6	*Ficus religiosa*	MIDC(PS)	26.86±2.17	9.35±1.00	9.69±1.08	123.50±34.17	12.82±1.82
		TAPS(CS)	30.75±1.60	12.85±1.00	9.46±0.47	205.90±19.42	13.91±1.90
		%Reduction	12.65%	27.24%	-2.43%	40.02%	7.84%
7	*Mangifera indica*	MIDC(PS)	19.40±2.40	3.46±2.43	2.59±0.62	44.30±9.92	13.97±1.77
		TAPS(CS)	21.72±3.22	3.91±0.79	2.44±0.18	61.90±21.89	19.82±2.74
		%Reduction	10.68%	11.51%	-6.15%	28.43%	29.52%
8	*Polyalthia longifolia*	MIDC(PS)	19.84±1.82	2.86±0.45	0.55±0.45	44.40±8.66	12.96±3.86
		TAPS(CS)	22.11±1.71	4.37±0.37	0.61±0.12	61.90±19.66	14.67±1.42
		%Reduction	10.27%	34.55%	9.84%	28.27%	11.66%
9	*Terminalia catappa*	MIDC(PS)	23.33±1.95	11.52±1.77	1.79±.39	208.70±43.62	16.07±4.38
		TAPS(CS)	28.64±2.80	10.56±1.11	1.30±0.19	233.10±	19.57±2.24
		%Reduction	18.54%	-9.09%	-37.69%	10.47%	17.88%
10	*Thevatia nerifolia*	MIDC(PS)	11.48±1.35	0.20±0.4	0.30±0.00	8.05±2.05	9.27±1.19
		TAPS(CS)	15.78±0.80	1.25±0.46	0.20±0.00	14.80±2.82	14.26±3.19
		%Reduction	27.25%	84.00%	-50%	45.61%	34.99%

Table No. 2 Effect of air pollution on average Leaf length(cm), Leaf breath(cm), Petiole length(cm), Leaf area(cm) and Stomatal index(abaxial surface) of different plant species growing at MIDC(Polluted site) and TAPS(Control site)of Tarapur during winter season.

Sr.No	**Plants↓**	**Parameter →**	**Leaf length(cm)**	**Leaf breath(cm)**	**Petiole length(cm)**	**Leaf area(cm)**	**Stomatal index**
1	*Acacia auriculiformis*	MIDC(PS)	15.75±1.31	2.02±0.28	0.40±0.00	*26.16*±5.21	9.36±1.23
		TAPS(CS)	24.41±2.45	1.77±0.20	0.40±0.00	*36.85*±4.80	11.78±0.96
		%Reduction	35.48%	-14.12%	0%	29.01%	20.54%
2	*Azadirachta indica*	MIDC(PS)	6.31±0.74	1.40±0.15	0.20±0.00	6.25±1.25	10.10±1.25
		TAPS(CS)	7.52±0.77	1.59±0.159	0.30±0.00	6.80±0.75	10.89±1.75
		%Reduction	16.09%	11.95%	33.33%	8.09%	7.25%
3	*Artocarpus*	MIDC(PS)	14.43±0.60	5.90±0.55	1.43±0.09	62.50±6.21	15.15±3.32

	heterophyllous	TAPS(CS)	*18.92*±1.37	7.39±0.44	2.40±0.21	*98.70*±6.83	16.50±0.20
		%Reduction	23.73%	20.16%	40.42%	36.68%	8.18%
4	*Cassia siamea*	MIDC(PS)	5.35±0.67	1.92±0.08	0.20±0.00	7.71±1.60	10.63±2.97
		TAPS(CS)	6.64±0.69	1.95±0.13	0.30±0.00	11.85±2.45	15.37±2.06
		%Reduction	19.43%	1.54%	33.33%	34.94%	30.84%
5	*Ficus benghalensis*	MIDC(PS)	15.50±1.33	9.11±0.34	2.65±0.20	102.85±12.29	16.39±2.68
		TAPS(CS)	19.15±1.65	9.69±0.84	3.10±0.45	134.70±21.76	18.08±2.28
		%Reduction	19.06%	5.99%	14.52%	23.65%	9.35%
6	*Ficus religiosa*	MIDC(PS)	26.64±1.33	9.04±0.89	8.73±0.92	109.45±16.77	10.65±2.01
		TAPS(CS)	24.24±1.13	10.30±0.98	8.29±1.89	127.95±18.91	17.05±2.78
		%Reduction	-9.90%	12.23%	-5.31%	14.46%	37.54%
7	*Mangifera indica*	MIDC(PS)	18.43±1.84	3.47±0.32	1.84±0.46	46.70±9.54	16.52±1.64
		TAPS(CS)	22.54±4.06	3.55±0.63	2.42±0.61	60.25±25.46	18.49±0.60
		%Reduction	18.23%	2.25%	23.97%	22.49%	10.65%
8	*Polyalthia longifolia*	MIDC(PS)	18.44±1.90	2.96±0.43	0.56±0.07	44.50±6.75	10.76±2.80
		TAPS(CS)	24.23±1.44	4.04±0.32	0.67±0.11	73.05±8.12	12.47±4.74
		%Reduction	23.90%	26.73%	16.42%	39.08%	13.71%
9	*Terminalia catappa*	MIDC(PS)	23.67±3.46	11.41±1.13	1.55±0.13	206.85±45.76	16.62±2.16
		TAPS(CS)	26.15±3.91	12.81±1.71	1.57±0.50	254.60±68.47	17.65±1.87
		%Reduction	9.48%	10.93%	1.27%	18.75%	5.84%
10	*Thevatia nerifolia*	MIDC(PS)	13.99±1.15	0.86±0.06	0.30±0.00	10.90±1.20	10.84±0.81
		TAPS(CS)	15.28±1.04	1.00±0.10	0.20±0.00	14.65±2.07	12.85±0.20
		%Reduction	8.44%	14%	-50%	25.60%	15.64%

Table No.3 Effect of air pollution on average Leaf length(cm), Leaf breath(cm), Petiole length(cm), Leaf area(cm) and Stomatal index(abaxial surface) of different plant species growing at MIDC(Polluted site) and TAPS(Control site) of Tarapur during summer season.

Sr.No	**Plants↓**	**Parameter →**	**Leaf length(cm)**	**Leaf breath(cm)**	**Petiole length(cm)**	**Leaf area(cm)**	**Stomatal index**
1	*Acacia auriculiformis*	MIDC(PS)	16.25±1.50	2.07±0.30	0.40±0.00	*26.95*±8.10	10.92±0.42
		TAPS(CS)	22.57±1.48	2.04±0.20	0.40±0.00	*37.50*±6.29	12.16±0.32
		%Reduction	28%	-1.47%	0%	28.13%	10.20%
2	*Azadirachta indica*	MIDC(PS)	7.22±0.37	1.27±0.15	0.20±0.00	7.30±0.98	8.53±0.72
		TAPS(CS)	7.72±0.36	1.55±0.10	0.20±0.00	7.85±0.94	10.55±0.44
		%Reduction	6.48%	18.06%	0%	7.01%	19.15%
3	*Artocarpus heterophyllous*	MIDC(PS)	15.82±0.94	6.52±0.59	1.63±0.21	79.40±10.09	17.51±0.64
		TAPS(CS)	*17.3*±1.89	6.95±0.61	2.18±0.30	*87.00*±16.67	18.66±3.39
		%Reduction	8.55%	6.19%	25.23%	8.74%	6.16%
4	*Cassia siamea*	MIDC(PS)	5.68±0.77	1.63±0.12	0.30±0.00	6.95±1.42	7.33±0.71
		TAPS(CS)	6.33±0.26	1.74±0.04	0.20±0.00	7.45±0.80	11.18±0.94
		%Reduction	10.27%	6.32%	-50%	6.71%	34.44%
5	*Ficus*	MIDC(PS)	16.28±1.45	9.14±0.47	3.30±0.49	108.25±13.43	13.68±2.13

	benghalensis	TAPS(CS)	18.17±1.74	9.20±0.72	3.58±0.72	118.40±16.1	17.35±4.10
		%Reduction	10.40%	0.65%	7.82%	8.57%	21.15%
6	*Ficus religiosa*	MIDC(PS)	19.89±2.33	7.61±0.31	4.17±0.70	71.60±10.19	10.21±0.70
		TAPS(CS)	22.23±2.52	9.82±1.06	5.59±0.70	117.45±28.10	11.39±1.48
		%Reduction	10.53%	22.51%	25.40%	39.04%	10.36%
7	*Mangifera indica*	MIDC(PS)	20.27±1.96	4.18±0.39	1.72±0.27	66.70±10.11	13.58±0.83
		TAPS(CS)	26.33±3.06	3.92±0.34	2.60±1.00	76.05±14.22	14.56±0.78
		%Reduction	23.02%	-6.63%	33.85%	12.29%	6.73%
8	*Polyalthia longifolia*	MIDC(PS)	21.14±1.68	3.25±0.37	0.60±0.00	57.40±6.40	10.66±0.94
		TAPS(CS)	22.57±1.08	3.78±0.40	0.64±0.15	68.20±7.33	13.49±0.91
		%Reduction	6.34%	14.02%	6.25%	15.84%	20.98%
9	*Terminalia catappa*	MIDC(PS)	25.35±3.06	11.98±0.77	1.33±0.17	237.45±38.73	15.45±1.65
		TAPS(CS)	33.49±3.49	12.10±0.66	1.48±0.50	306.05±48.86	17.60±0.60
		%Reduction	24.31%	0.99%	10.14%	22.41%	12.22%
10	*Thevatia nerifolia*	MIDC(PS)	11.60±0.95	0.75±0.08	0.20±0.00	6.25±0.47	11.20±1.52
		TAPS(CS)	15.12±0.96	0.98±0.10	0.20±0.00	16.40±2.39	12.29±0.91
		%Reduction	23.28%	23.47%	0%	61.89%	8.87%

Results pertaining to the study of different morphological and anatomical attributes of the ten plant species are described and discussed as under:-

Rainy season The leaf length showed minimum percentage reduction in *Polyalthia longifolia* (10.27%) and maximum percentage reduction in *Azadirachta indica* (43.22 %) with respect to control site than the polluted site. Leaf breadth showed minimum percentage reduction in *Mangifera indica* (11.51%) and maximum percentage reduction in *Thevatia nerifolia* (84%) with respect to control site than the polluted site. Whereas increases in percentage were observed in *Cassia siamea* (7.82%), *Terminalia catappa* (9.09%) and *Acacia auriculiformis* (11.38%) with respect to control site than the polluted site. Petiole length showed no percentage reduction in Cassia siamea (0%) and maximum percentage reduction in *Azadirachta indica* (50%) with respect to control site than the polluted site. Whereas increases in percentage were observed in *Ficus benghalensis* (2.43%), *Mangifera indica* (6.15%), *Terminalia catappa* (37.69%) and *Thevatia nerifolia* (50%) with respect to control site than the polluted site. The atmospheric pollutants after making their entry through stomata of leaf causes reduction in leaf size of plants due to damage of photosynthetic tissues. (Iqbal and Shafiq, 1999, Shafiq and Iqbal, 2003, 2005) Minimum reduction percentage in leaf area was observed in *Terminalia catappa (10.47%) and* maximum percentage reduction in *Azadirachta indica* (51.92 %) with respect to control site than the polluted site. Therefore it has been proved from the above result that leaf surfaces were badly affected by air pollutant as leaf area remains small at pollutant site with respect to non-polluted site (Qadir and Iqbal, 1991). Similarly reduction in leaf area growing in vicinity of heavy pollutants was also observed in many other plant species by Bhatti and Iqbal (1998). Minimum reduction percentage of Stomatal index was observed in Cassia siamea (4.35) and maximum in Thevatia nerifolia (34.99) with respect to control site than the polluted site. Similar results were reported by Tiwari et al, 2008.

Winter season

The leaf length showed minimum percentage reduction in *Thevatia nerifolia* (8.44%) and maximum percentage reduction in *Acacia auriculiformis* (35.48 %) with respect to control site than the polluted site whereas increase in percentage was observed in *Ficus religiosa* (9.90%). Leaf breadth showed minimum percentage reduction in *Cassia siamea* (1.54%) and maximum percentage reduction in *Polyalthia longifolia* (26.73%) with respect to control site than the polluted site. Whereas increase in percentage was observed in *Acacia auriculiformis* (14.12%) with respect to control site than the polluted site. Petiole length showed minimum percentage reduction in *Terminalia catappa* (1.27%) and maximum percentage reduction in *Artocarpus heterophyllous* (40.42%) with respect to control site than the polluted site. Whereas increase in percentage were observed in *Ficus religiosa* (5.31%), Minimum reduction percentage in leaf area was observed in *Azadirachta indica* (8.09 %) *and* maximum percentage reduction in *Polyalthia longifolia* (39.08%) with respect to control site than the polluted site. Minimum reduction percentage of Stomatal index was observed in *Terminalia catappa* (5.84%) and maximum in *Ficus religiosa* (37.54%) with respect to control site than the polluted site.

Summer season

The leaf length showed minimum percentage reduction in *Polyalthia longifolia* (6.34) and maximum percentage reduction in *Acacia auriculiformis* (28%) with respect to control site than the polluted site. Leaf breadth showed minimum percentage reduction in *Terminalia catappa* (0.99%) and maximum percentage reduction in *Thevatia nerifolia* (23.47%) with respect to control site than the polluted site. Whereas increase in percentage was observed in *Acacia auriculiformis* (1.47%) with respect to control site than the polluted site. *Acacia auriculiformis*, *Azadirachta indica*, and *Thevatia nerifolia* showed zero percent reduction in Petiole length and maximum percentage reduction in *Ficus religiosa* (25.40%) with respect to control site than the polluted site. Whereas increase in percentage were observed in *Cassia siamea* (50%), Minimum reduction percentage in leaf area was observed in *Cassia siamea* (6.71%) *and* maximum percentage reduction in *Thevatia nerifolia* (61.89%) with respect to control site than the polluted site. Minimum reduction percentage of Stomatal index was observed in *Artocarpus heterophyllous* (6.16%) and maximum in *Cassia siamea* (34%) with respect to control site than the polluted site.

Conclusion

Plants naturally cleanse the atmosphere. They absorb the pollutants through their leaves as they have a large surface area and they function as an efficient device to trap the pollutants. Results obtained from the present study provide evidence that. The pollutants affect the morphology of the plants with respect to leaf length, breadth, petiole length, leaf area, and stomatal index. Species which are sensitive such *Cassia siamea and Thevatia nerifolia* can be used as bioindicator to air quality. Tolerant species like *Polyalthia longifolia*, Terminalia *catappa*, and Ficus benghalensis can be planted around the MIDC (Tarapur) area because they have the ability to absorb air pollutants and reduce environmental pollution. To mitigate and reduce air pollution in the industrial area, further planning of the landscape can be undertaken.

References

1. Agarwal,S,K. Environmental monitoring. A P H Publishing Corporation. 2005; 204-205
2. Beckett, K.P., Freer, P.H., Taylor, G., 2000. Effective tree species for local air-quality management. Journal of Arboriculture. 26 (1), 12-19

3. Bhatia, S.C. 2006. Environmental Chemistry. CBS Publishers and Distributors.
4. Bhatti, G.H., M.Z. Iqbal. 1988. Investigations into the effect of automobile exhausts on the phenology, periodicity and productivity of some roadside trees. Acta Societatis Botanicorum Poloniae., pp: 57.
5. Escobedo, F.J., Wagner, J.E., Nowak, D.J., Dele Maza, C.L., Rodriguez, M., Crane, D.E., 2008. Analyzing the cost effectiveness of Santiago, Chiles policy of using urban forests to improve air quality. Journal of Environment Management. (86), 148–157.
6. Ghouse AKM, Iqbal M, Khan, S, Khan, A.H. 1980. Comparative study on the structure of vascular cambium in some Verbenaceae. Phytomorphology, 30: 32-40.
7. Gupta A K, Mishra R M; Effect of lime kilnos air pollution on some plant species. Air Pollution Research. 1994; 13(1):1-9.
8. Rao, C.S. 2006. Environmental Pollution Control Engineering. New Age International Publication. Revised Second Edition.
9. Lui, Y.J., Ding, H., 2008. Variation in air pollution tolerance index of plants near a steel factory, Implication for landscape plants species selection for industrial areas, WSEAS Transaction on Environment and Development, 4, 24-32.
10. Jahan, S, Iqbal, M.Z, 1992 Morphological and anatomical studies of leaves of different plants affected by motor vehicles exhaust. Journal of Islamic Academic Science. 5:21–23
11. Joshi, P., Swami, A., 2007. Physiological responses of some tree species. Under road sides automobile pollution stress around city of Haridwar, India, The Environmentalist, 27, 365-374.
12. Iqbal, M.Z., Shafiq, M, 1999. Impact of vehicular emission on germination and growth of Neem (*Azadirachta indica*) tree. Hamdard Medicus., XLII: 65-69.
13. Pandey,J ., Agrawal,M.,1994 Evaluation of air pollution phytotoxicity in seasonally dry tropical urban environment using three woody perennials New Phytologist, 126, pp. 53–61
14. Qadir, S.A., Iqbal, M.Z. 1991. Growth of some plants raised from polluted and unpolluted seeds. International Journal of Environmental Studies. 39: 95-99.
15. Ricks, G.R, Williams, R.J.H, 1974. Effects of atmospheric pollution on deciduous woodland part 2: effects of particulate matter upon stomatal diffusion resistance in leaves of *Quercus petraea* (Mattuschka) Leibl. Environmental Pollution. 6:87–109.
16. Salisbury, E.J. 1927 On the causes and ecological significance of stomatal frequency with special reference to the woodland floor. Philosophical Transaction of the Royal Society B., 216, 1-65.
17. Salisbury, E.J. 1932. The interrelations of soil climate and organisms and the use of stomatal frequency as an integrating index of relation of the plant. Bech. Bot. Zbl.**99**, 402-420.
18. Shafiq, M., Iqbal, M.Z, 2003. Effects of automobile pollution on the phenology and periodicity of some roadside plants. Pakistan Journal. Botany, 35: 931-938.
19. Shafiq, M., Iqbal, M.Z. 2005. The impact of auto emission on the biomass production of some roadside plants. International Journal of Biology and Biotechnology, 2: 93-97.
20. Stevovic, S., Mikovilovic, V.S, Calic-Dragosavac, D, 2010. Environmental impact on morphological and anatomical structure of Tansy. African. Journal of Biotechnology. 9(16): 2413-2421.
21. Tiwari, S., Syed, K., Sikka, J., Joshi, O.P, 2008. Air pollution induced changes in foliar morphology of two species of Cassia

at Indore city (India). Journal of Environmental Research and Development. Vol.2 No.3:406-412.

22. Verma, R. B., Mahmooduzzafar, T. O. Siddiqi and M. Iqbal (2006). Foliar Response of *Ipomea pes-tigridis* L. to Coal-Smoke Pollution, Turkish Journal of Botany. 30(5):413-417.
23. Williams RJH, Lloyd MM, Ricks GR. Effects of atmospheric pollution on deciduous woodland I: Some effects on leaves of *Quercus petraea* (Mattuschka) Leibl. Environmental Pollution. 1971; 2:57–68.

REFREES

Ecological Protection of Costal Zones in India with Special Reference to Mangroves in Mumbai

Asha R Kadam
Assit Professor (Dept of E V S)
Chetana's H S College of Commerce and Arts
Bandra (E), Mumbai 400051
ashakadam2279@gmail.com

Abstract:

The coastal zone is an important and critical region for India. This region is densely populated and stretches over 7500km with the Arabian Sea on the west and the Bay of Bengal on the east. It is inhabited by more than a 100 million people in nine coastal states. Major estuarine areas located along the Indian coasts extend to about 2.6milion hectares. Ecosystems such as coral reefs, Mangroves, Estuaries and deltas are rich in Biodiversity. These ecosystems play a crucial role in fishery production in addition to protecting the coastal zone from by wave action and Tsunami. There are sea ports located in costal zones that are economic engines of international and national trade and commerce in India. Future climate change in the costal zones is likely to be manifested through the worsening of some of the existing coastal zone problems. Some of the main climate related problems in the context the Indian coastal zones are erosion flooding subsidence, deterioration of coastal ecosystem such as mangroves and Stalinization. In many cases these problems are either caused by sea level rise and tropical cyclones.

This paper is going to focus on following objects.

1. Impact of climate change on coastal zones in India.
2. Climate related coastal hazards – Future scenario.
3. History of mangroves in Mumbai.
4. Economical and Ecological Importance of mangrove for Mumbai.
5. Challenges to Mangroves in Mumbai.
6. Government efforts o protect Mangroves.

Impact of Climate Change on Coastal Zone in India

A rise in sea level has significant implications on the coastal population and agricultural performance of India. A variety of impacts are expected which include

1. Land loss and population displacement
2. Increase flooding of low lying coastal areas
3. Agricultural impacts (like loss of yield and employment) resulting from flooding by sea water, Stalinization and land loss
4. Impacts on coastal agricultural
5. Impacts on coastal tourism, particularly the erosion of sandy beaches.

The coastal ecosystems sustain a higher density of human population. But the pressure on coastal areas has been growing due to migration from inland to the coastal zone making it vulnerable to the increased frequency and intensity of natural and human interventions.

Three of the four regions (Mumbai, Kolkata and Chennai) are situated in the coastal states making these regions vulnerable to the increased frequency and intensity of climate change hazards.

Climate – related coastal hazards future scenario.

The past observations on the mean sea level along the Indian coast show a long term rising trend of about 1.0mm/ year. However the recent data suggests a rising trend of 2.5mm/year in the sea level along India coastline. A one metre sea level rise is projected to displace approximately 7.1 million people in India and about 5764kms of land area will be lost along with 4200kms of roads.

An increase in the frequency of severe cyclonic storms is likely under the climate change scenario; this may enhance the vulnerability of these districts that are already ranked as vulnerable under the current climate scenario.

History of Mangroves in Mumbai

Mumbai historical records indicate that there were several islands around Mumbai during 1670. However the Britishers who were ruling the country identified the importance of these islands for commercial purpose. They deforested the fringing mangroves and reclaimed these islands into one continuous landmass, which later come to be a known as "Greater Bombay". Since then the development and increasing population pressure rapidly increased and being the coastal area, it took the toll of mangroves land during the process a few mangroves patches are still left in the heart of the city. Which proves that today's megacity had a luxuriant past of mangroves forest. Major mangroves are seen today in Mumbai along the Vasai creek, Thane creek, Manori & Malad, Mahim-Bandra, Versova, Sewree, Mumbra-Diva and few more places.

Mangroves community of Mumbai.

In the early nineties, perhaps over 37sq.km. of mangroves existed in Mumbai, largely in the thane creek, Mahim, Versova, Gorai and Ghodbunder, with sporadic patches in places such as Bandra, Malabar Hill and Colaba.

Mumbai has probably lost 40 percent of all its mangroves in the past decade or so, largely because of reclamation for housing, slums, sewage treatment and garbage dumps. Growing industrial areas along the coastlines and discharge of domestic and industrial sewage are polluting these areas. Fortunately, thanks to the Godrej family, still there exists excellent mangrove forest in Vikhroli (link). Around 20 out of the 35 species of true mangroves found in India have been identified along the Maharashtra coast and 15 species of these are found in Mumbai. Because of the high salinity of the soil, something likes 60 percent of Mumbai mangroves comprise Avicennia marina. Nor surprisingly this species also tolerates pollution including heavy metals such as lead, mercury and chromium, all found in significant concentrations in the Mithi River.

Economical and Ecological Importance of Mangroves for Mumbai

The word Mangroves" is considered to be a combination of the Portuguese word "Mangue" and the English word 'grove'. Mangroves are salt tolerant plants of tropical and subtropical intertidal region of the world. The specific region regions where these plants occurs are termed as " Mangrove Ecosystem". These are highly productive but extremely harbours other plants and animal species.

1) Many studies have highlighted that the presence of mangrove ecosystem on coastline save lives and property during natural hazards such a cyclones, storms, Tsunamis and Erosion.
2) These ecosystems are also well known for their economic importances. They are

breeding, feeding and nursery grounds for many estuaries and marine organisms. Hence these areas are used for captive and culture fisheries.

3) The ecosystem has a very large unexplored potential for natural products useful for medicinal purpose and also for Salt production, Apiculture, Fuel and Fodder etc.
4) By trapping silt, mangroves maintain the integrity of Mumbai shoreline
5) Over 100 thousand fisher folks are directly dependent on fisheries resources around Mumbai. Mangroves provide livelihood for the fish workers by breeding and nursing the Fish, Prawns, Molluscs, and Crabs etc. Hence thus the fisherman (koli) community in Mumbai worship mangroves because they know that these are breeding and nursery grounds for the marine organism on which their substance depends.
6) Coastal biodiversity including the million migratory birds that visit Mumbai are housed by mangroves.
7) Mumbai mangroves can provide a large base for research opportunities for researchers in Botany, Flora and Fauna of Mumbai coastline studies.

Challenges to Mangroves in Mumbai

Rapid developments like housing industrialization, pollution and increasing population of Mumbai has resulted into degradation of mangroves. There are two important creeks Vasai creeks towards North and Thane creek toward South were luxuriant Mangroves patches are still left .

There are following challenges to mangroves in Mumbai-

- Land Reclamation- Most industries, Houses, Developers, Builders are reclaiming the mangroves lands illegally.
- Pollution- There are over 200 non-point sources of industrial and domestics waste discharges that pollute entire water around the city, 6 times more than the assimilation capacity.
- Under the name of so-called development Creeks, Rivers and other water bodies are altered in shapes, size and course.
- Every year over 1000 ton of mangroves wood is cut for fuel wood and to meet other timber demands.

Government efforts to protect Mangroves

Legislation - Mangroves are protected legally under the following Acts in Mumbai.

1) Forest Conversation Act 1980
2) Maharashtra Tree Act of 1984
3) Environmental protection Act 1986
4) Coastal Regulatory zone notification of 1991

In India, a legal protection is afforded to this ecosystem by way of legislation in the form of coastal regulation zone (CRZ)

Recently Mumbai high court has ordered freeze on destruction of mangroves forest in Maharashtra and has banned construction within 50 metres of them. The court has also directed to notify mangroves areas as “Protected forest”. Thus there is already a mechanism provided for management of this ecosystem.

Conclusion:

In India, Mumbai is one of the best examples for the mangroves destruction, due to urbanization. All the seven island of Mumbai were reclaimed and linked to a continuous land mass after destroying mangroves in the process. Mangroves protect coastal areas from Erosion, Storm, and Surge (especially during hurricanes) and Tsunamis because of the uniqueness of mangroves ecosystem and the protection against Erosion that they provide,

They are after the object of conservation programs including national Biodiversity action plan. The mangroves could be face of Mumbai…… Save mangroves, so they can save you. Mangroves can be used to save Mumbai and other coastal areas in India from an ecological disaster, so that we don't become environmental refugees.

References:

1) G.Y.Shitole & Ram Sable "Environmental Degradation Issues and Challenges" Published by "Global Research Publications" New Delhi
2) P.G.Shinde "Environmental studies" Published by "Sheth Publications" Mumbai

The Effect of Air Pollution on Some Biochemical Factors of Some Plant Species & Their Comparative Study

Dr. Ranjeet Kaur
G.N Khalsa College,Matunga ,Mumbai
ranbaj80@gmail.com

Abstract

Air pollution is one of the serious problems faced by the people globally due to its trans boundary dispersion of pollutants over the entire world. But, whatever mode, whether natural or artificial, it is a major concern in to-days developing country like India. The present research is aimed at assessing the air pollution tolerance index of plants at two different locations. The locations selected were Maheshwari Udayaan (located at the centre of four signals route (location 1) and Khalsa College garden (location 2). Plants available commonly in both locations were selected for the present research.

Four physiological and biochemical parameters which are relative water content, leaf pH, Ascorbic acid, and total chlorophyll were used to compute the APTI. Plants responses towards air pollution are assessed by air pollution tolerance index (APTI) value. The plant species having higher APTI value can be given priority for plantation program in urbanize and industrial areas; so as to reduce the effects of air pollution and to make ambient atmosphere clean and healthy.

Present study was conducted for evaluating Air Pollution Tolerance Index (APTI) value of three plant species i.e., Phyllanthus amarus, Codiaeum variegatum and Canna Indica.

Keywords*: APTI, Ascorbic acid, Chlorophyll, Relative water content, pH.*

INTRODUCTION

Most of the urban areas of the world today have high concentrations of air pollutants emanating from different sources viz, motor vehicle, traffic, power generation, residential heating and industry of adjoining areas .These sources are basically resulting from rapid economic growth, industrialization, urbanization with associated increase in energy demands .

Air pollution is a serious problem throughout the world. Rapid industrialization and vehicular traffic especially in the urban areas of India lead to the deterioration of air quality by adding toxic gases and other substances to the atmosphere. All combustion releases gases and particles into the air. These can include sulphur and nitrogen oxides, carbon monoxide and soot particles, as well as smaller quantities of toxic metals, organic molecules and radioactive isotopes. Air pollution can be defined as the human introduction into the atmosphere of chemicals, particulate matter or biological materials that cause harm or discomfort to humans, or other

living organism or damage the environment. Air pollution is one of the severe problem world is facing today.

Air pollutions can directly affect plants via leaves or indirectly via soil acidification. It has also been reported that when exposed to air pollutants, most plant experience physiological changes before exhibiting visible damage to leaves. Even in the kingdom of plants, there is no escaping Darwin's survival of the fittest. Some plants thrive in environments that others would find toxic, these plants can clean-up various sources of manmade pollution; both organic (petrochemical) and inorganic (heavy

metal toxins). Trees remove a significant amount of pollution from the atmosphere as part of their normal functioning. They directly increase the quality of the air in the city and its surrounding area and should be considered an integral part of any comprehensive plan aimed at improving overall air quality [1].

The Indian tree flora comprises of nearly 2000 species belonging to about 800 genera and 150 families of flowering plants. Trees provide a large leaf surface onto which particles are deposited and gases are removed. Pollution is removed by nearly all parts of a tree; the soil, roots and vegetative portions of the tree species. Trees respirate and exchange gases through stomata, or holes, on their leaves; these gases include those necessary for the tree's functioning as well as other gaseous air pollutants. Once inside the leaf, gases diffuse into the spaces between the cells of the leaf to be absorbed by water films or chemically altered by plant tissues. Trees also reduce air pollution by intercepting airborne particles and retaining them on the leaf surface, called dry deposition. Some can be absorbed by the leaf surface itself, although most remain on the and biochemical levels can be understood by analyzing the factors that determine their resistance and susceptibility.

Plants are known to accumulate enormous quantities of water in their growth activity. The weight of green plants is therefore, enormously dependent on the water content. Water as a solvent plays important roles in plant life, ranging from maintenance of body temperature to conduction of nutrient, as solvent and in metabolism. By effecting photosynthesis and translocation, gaseous pollutants may reduce carbon growth, capacity for water and nutrient uptake. Therefore, water is a necessity for plant life. Shortage of water may cause severe stress, while high water content within a plant body will help to maintain its physiological balance under stress conditions such as exposure to air pollution when the transpiration rates are usually high[2].

plant surface. Leaf surfaces are most efficient at removing pollutants that are water soluble including sulfur dioxide, nitrogen dioxide and ozone. Pollutants travel through plants by translocation via the xylem and phloem. Chemical pollutants absorbed by the leaves are translocated to the root areas where they can be broken down by microbes in the soil and pollutants absorbed by the roots can be broken down and translocated to the leaves where they are released into the atmosphere.

Thus Green belts are recommended for containment of air pollution in the human environment, especially in urban and industrial environment.

The screening of effective plants for particulate sink is very essential for air pollution abatement in urban environment. The routine analysis of elements thus needs from foliage of urban trees are essential to understand the level of metal bioaccumulation and its consequence effect on plant. Hence, the present study is concerned with the establishment of air pollution bio monitoring capacity .The response of plants to air pollution at physiological

pH plays vital physiological roles in living organisms. Basically, enzymes which control the biological activities of living organism function well within a given small range of the pH values of their environment. Some enzymatic activities require low pH while some others require higher or even neutral pH to function effectively.

High pH may also increase the efficiency of conversion from hexose sugar to Ascorbic acid, while low leaf extracts PH has also showed good correlation with sensitivity to air pollution. Photosynthetic efficiency was noted to be strongly dependent on leaf pH

Ascorbic acid content is an important parameter that may be used to decide the tolerance of plant to

air pollution, because of

its anti-oxidative properties, as well as its a significant role in light reaction of photosynthesis ,activation of defense mechanism and under stress condition, it can replace water from light reaction .

Chlorophyll is the green pigment found in the chloroplasts (green plastid organelles) in photosynthetic plants. It is the molecule that absorbs sunlight and uses its energy to synthesize carbohydrates from CO_2 and water. This process is known as photosynthesis in which chlorophyll because of its intrinsic ability converts radiant energy (from sunlight) into chemical energy (ATP). The molecules are specifically arranged in and around pigment protein complexes called photo systems which are embedded in the thylakoid membranes of the chloroplasts. The area of the leaf containing chlorophyll appears green due to its selectivity regarding the wavelength of the light it absorbs. Total Chlorophyll (TCh) is another parameter in APTI that is so important. Depletion in Chlorophyll immediately causes a decrease in productivity of plant and subsequently plant exhibits poor vigor[3].

Finding out the APTI values in plants is one of the best and most reliable diagnostic tool to monitor plant‘s tolerance towards air pollution. The results of these studies showed that the plants with higher APTI values were found to be resistant to air pollution. The tree species with higher and low APTI value can serve as tolerant and sensitive respectively. In this study, changes in parameters such as ascorbic acid, total chlorophyll, relative water content and pH of leaf extract were used in evaluating the degree of tolerance to air pollution by the plant species. All these biochemical parameters that are analyzed for APTI plays significant role to determine resistivity and susceptibility of plant species.

MATERIALS AND METHODS

Leaf sample collection

The locations selected were Maheshwari Udayaan (located at the centre of four signals route (location 1) and Khalsa College garden (location 2). Plants available commonly in both locations were selected for the present research.

Extract preparation

Fresh leaves were used according to the standard prescribed methods adopted. Aqueous extract was used for the whole study.

Biochemical parameters

Relative Leaf Water Content (RWC) [4]:

Leaf relative water content was determined and calculated. Fresh weight was obtained by weighing the fresh leaves. The leaves were then immersed in water over night, blotted dry and then weighed to get the turgid weight. The leaves were than dried overnight in an oven at 70^{o}C and reweighed to obtain the dry weight.

RWC is calculated with the formula

$$\frac{FW - DW}{TW - DW} \times 100$$

FW = Fresh weight

DW = Dry weight

TW = Turgid weight

Ph[4]

5g of fresh leaves was homogenized in 10ml deionized water .This was filtered and pH of the leaf extract was determined after calibrating pH meter with buffer solution pH 4 and pH 9.

Total Chlorophyll Content (TCh)[4] .

3g of fresh leaves were blended and then extracted with 10ml of 80% acetone and left for 15 minutes for thorough extraction. The liquid portion was decanted into another test-tube and centrifuged at 2,500rpm for 3 minutes. The supernatant was then collected and the absorbance was taken at 645nm and 663nm using a spectrophotometer. Calculations were done using the formula below.

Chlorophyll a = $12\text{-}7D_X$ 643 – $2.69D_X$ 645 X V mg /g

Chlorophyll b = $22\text{-}9D_X$ 645 – $24.68D_X$ 665 X V mg/g

TCh = Chlorophyll a + b mg/g

Dx = Absorbance of the extract at the wavelength xnm.
V = Total volume of the chlorophyll solution (ml)

Acorbic Acid (Aa) Content Analysis [5]

Ascorbic acid content (expressed in mg/g) was measured using spectrophotometric method. 1 g of the fresh foliage was put in a test-tube, 4 mL oxalic acid - EDTA extracting solution was added, then 1 mL of orthophosphoric acid and then 1 mL 5% sulphuric acid added to this mixture, 2 mL of ammonium molybdate was added and then 3 mL of water. The solution was then allowed to stand for 15 minutes. After which the absorbance at 760 nm was measured with a spectrophotometer. The concentration of ascorbic acid in the sample was then extrapolated from a standard ascorbic acid curve.

Air Pollution Tolerance Index (APTI) Determination [6]

The formula of APTI is given as
APTI = A(T+P) + R /10
A = Ascorbic acid content (mg/g)
T = Total chlorophyll mg/g
P = pH of leaf extract
R = Relative water content of leaf %
On the basis of APTI values, selected plants aerated as follows;
APTI 30 - 100 is considered tolerant plant species.
APTI 17 - 29 is considered intermediate plantspecies.
APTI 1 – 16 is considered sensitive plant species.
APTI < 1 is considered very sensitive plant species.

III. RESULTS OF APTI COMPUTATION

Location 1

Plants	pH	%Relative water content	Ascorbic acid mg/g	Total Chlorophyll content mg/g	APTI
Codiaeum variegatum	6	75.0	2.85	4.9	9.49
Canna Indica	6.2	52.5	7.42	1.5	10.9
Phyllanthus amarus	5	15.9	3.15	15.5	8.0

Location 2

Plants	pH	%Relative water content	Ascorbic acid mg/g	Total Chlorophyll content mg/g	APTI
Codiaeum variegatum	6.2	72.1	2.15	4.2	9.4
Canna Indica	5.8	50.0	7.20	0.9	9.8
Phyllanthus amarus	5.6	13.5	2.75	13.2	8.8

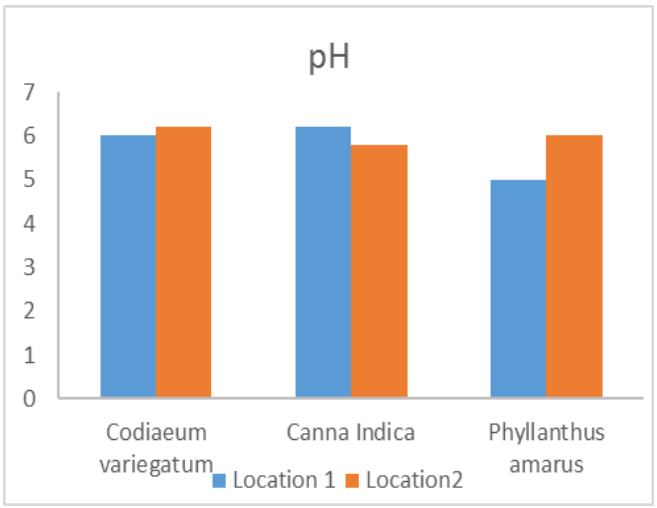


Figure 1 Graph for pH

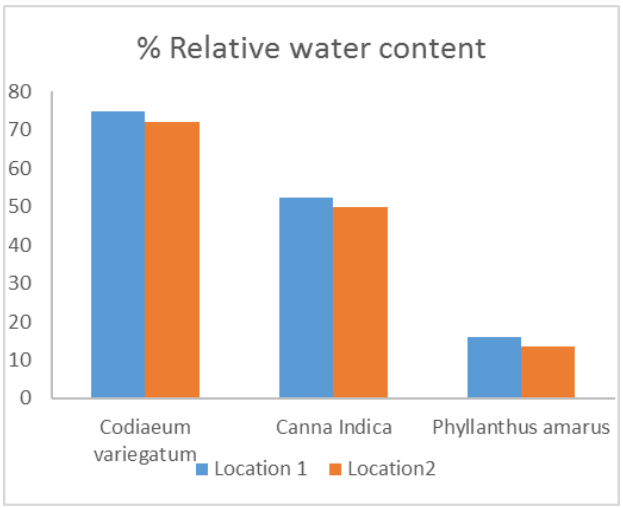


Figure 2 Graph for Relative water content in %

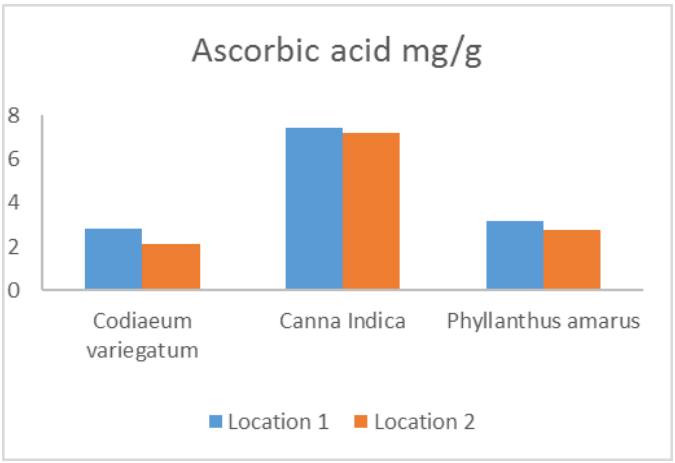


Figure 3 Graph for Ascorbic Acid in mg/gm

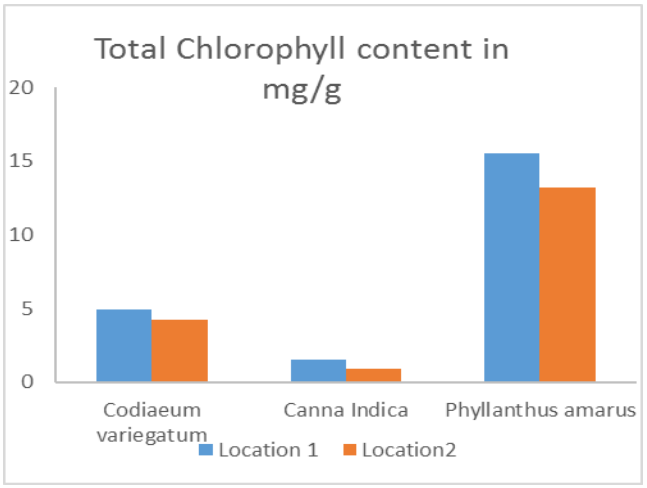


Figure 4 Graph for Total Chlorophyll Content(mg/g)

The pH observed was found to be almost in the same ACIDIC range for all the plant leaves studied at two selected locations. [FIG. 1]

The results of relative water content are shown in the fig.4. In location 1The relative water content was high with *Codiaeum variegatum* while, it was low with *Phyllanthus amarus*. In location 2, the relative water content was high with *Codiaeum variegatum* and low with *Phyllanthus amarus* .The results of ascorbic acid content is shown in the fig.2. In location 1, the ascorbic acid content was found to be high in *Canna Indica* and lowest in, *Codiaeum variegatum.* Same results were found for location 2 plants.

The result of total chlorophyll content is shown in Fig.3. In location 1The total chlorophyll content was found to be high in *Phyllanthus amarus* while, it was low in *Canna Indica* . Same results were found for location 2 plants.

The air pollution tolerance index of plants analysed in both the locations are shown in Fig. 5. The tolerance index for the location 1 (sides of railway junction) is given here in the decreasing order:

Location 1

Phyllanthus amarus < *Codiaeum variegatum* < *Canna Indi*

Location 2

Phyllanthus amarus < *Codiaeum variegatum* < *Canna Indica*

CONCLUSION

Plants that are continuously exposed to pollutants leads to accumulation of pollution, integration of pollutants in to their own system, thereby altering the nature of leaf and make them more sensitive. This sensitivity is measured through various biochemical changes and finally to air pollution tolerance index. In the study, all the plants were found to be sensitive species.

REFERENCES

\Anonymous 2008; Air pollution. http.//en.wikipedia. org/wiki.Air-pollution.

1. Arnon, D. I (1949); Copper Enxymes in Isolated Chloroplasts Polyphenol Oxidase in Beta Vulgaris. Plant Physiol. 24 (1) 1-15.
2. Allen (Jnr), L.H; Boote, K.L. Jones, J.W; Valle, R.R;Acock, B; Roger, H.H; Dahlmau, R.C. (1987); Response of vegetation to rising carbon dioxide photosynthesis, biomass and seed yield of soybeans. Global Biogeochem Cycle 1; 1-44.
3. Singh, A. (1977): Practical Plant Physiology. Kalyari Publishers. New Delhi.
4. Bajaj, K.L; Kaur G. (1981): Spectrophotometric Determination of L. Ascorbic Acid in Vegetables and Fruits. Analyst (106) 117-120.
5. Singh S.K; Rao, D.N; Agrawal, M; Pandey J; Narayan D, (1991); Air Pollution Tolerance index of plants. Journal of Environmental Management 32; 45-55.

A Scientific Review of Concentrated Solar Power Technologies

Chandrashekhar S. More[1], Rushabh S. Mole[1], Ankush A. Nerkar[1], Jitendra B. Satpute[2]

[1]Undergaduate Students, Suman Ramesh Tulsiani Technical Campus, Faculty of Engineering, Khamshet, Pune[2] Assistant Professor, Suman Ramesh Tulsiani Technical Campus, Faculty of Engineering, Khamshet, Pune

Abstract

Aim of the study is to analyze concentrated solar power as available alternating formula to generate high grade energy. After oil shock in 1970, the global energy system is in danger of falling short of hopes and expectation placed upon it. The limited conventional resources and ill effect causing due to their usage dictate the increasing utilization of renewable energy sources. Solar Power is the most likely technology for providing majority of renewable energy, as it is clean, Eco-friendly, abundantly available, reliable and most cost-effective electricity generation technology. The present work explains capability and significant contribution of different concentrated solar power technologies such as solar tower, parabolic trough collector, compound parabolic collector, dish collector, Fresnel reflector for power generation. Detail studies were carried out for all above mentioned collector considering its need, construction, working and applications. Comparative studies for the said collectors are performed and merits and demerits are discussed. The study concludes that awareness, government encouragement and research activities can result in satisfying increased energy demand.

Keywords: *Solar Energy, Concentrated collector, Power generation*;

Introduction

At present the energy consumed in India depends mainly on five main energy sources like coal, petroleum, natural gas, water and nuclear energy.[1] Sustainable energy sources are most often regarded as including all non-conventional energy sources such as solar power, wind power, biofuels, wave energy, tidal energy and geothermal energy.[2]

Fuel	MW	% of Total
Total Thermal	214,004	69.3%
Coal	187,803	60.8%
Gas	25,282	8.2%
Oil	919	0.29%
Hydro (Renewable)	43,133	14.9%
Nuclear	5,780	1.9%
RES** (MNRE)	45,917	14.9%
Total	308,834	

Table 1: Installed capacity of India [23]

India has a vast potential of renewable energy resources, and it has the largest programs in the world for deploying renewable energy products and systems. India is vigorously working on wind, solar, biomass, hydro, geothermal and biogas as alternate sources of energy. [3]

	Energy (MU)		Surplus(+)/deficts(-)	Percentage
	Requirement	Availability		
2009-10	8,30,594	7,46,644	-83,950	-10.1
2010-11	8,61,591	7,88,355	-73,236	-8.5
2011-12	9,37,199	8,57,886	-79,313	-8.5
2012-13	9,95,557	9,08,652	-86,905	-8.7
2013-14	10,02,257	9,59,829	-42,428	-4.2
2014-15	10,68,923	10,30,785	-38,138	-3.6

Table 2: Relation between demand and supply of energy in India [23]

Wind energy is the most utilized renewable source in India, but due to its high installation and running cost it is difficult to use it for prolonged time. Hence as a promising source solar energy is most preferable. [4]

From the other Renewable energy sources available,solar energy is the cleanest, widely available, eco-friendly source of energy. Collection of Solar energy is depend upon collector (i.e.; used for collection of solar radiations). The collectors are divided according their range of Temperatures i.e.; Low temperature (Flat plate), Medium Temperature (Parabolic Cylinder), High Temperature (Concentrated) Solar Collectors are: Parabolic Trough Collector, Solar Power Tower, Fresnel Collector, Compound Parabolic Collector and Dish Collector.

Parabolic Trough Collector (PTC)

Solar thermal power plants based on Parabolic Trough Collector (PTC) are the most popular solar technologies for power generation. Along with steam generation it is employed in power generation, industrial steam generation, and hot water production .The efficiency and cost of the parabolic trough collector designs is depend on structural stiffness, choice of materials, assembly tolerances, mirror cleanliness and wear [5]. With compare to conventional flat plate collectors, PTC has shown its more cost effectiveness.

Principle

It works on the principle of using long parabola shaped mirrors which reflects the concentrated sun radiations towards a receiver. This receiver then absorbs the incoming radiations to convert water to steam which is used to generate electricity. [6]

Construction and Working:

Parabolic troughs are devices like a flat, bend or curved at its end. The ends are curved in such a way that the incident solar rays concentrated at a single point source. The collector is made up of parabolic trough, which has the shape of a part of a parabola. [5]

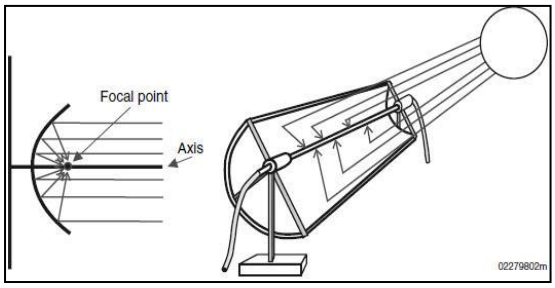


Fig. 3: Construction of Parabolic Trough Solar collector

Working

In parabolic trough collector long "Parabola curved shaped mirrors focus the rays of the sun into an absorber or receiver. Theabsorber or receiver is seated above the mirror in the center along the focal line and has a heat-absorbent medium running in it.The heat is transferred into the working fluid up to a temperature of about 400°C, which produce steam directly or indirectly to drive turbine.[8] In a closed system of Parabolic Troughs, the output can be used directly for rotating turbines and generating electricity; where as in an open system the output hot water can be used for any other beneficial task required.

Parabolic Trough Collector Based Plant In India[7]:

In India one of a Parabolic Trough Solar Collector plant was made in Supa, Maharashtra. This plant manufactured is of a high scale electricity generation , the assembly is made in supa and then distributed it to Gurgaon. It has a goal of making 1MW power generation in only 8 hours of day time.

Specifications of this plant are:

City: Supa
Region: Maharashtra
Land Area: 65 Acres
Type of Heat-Transfer Fluid: Water/Steam
Operating Temperature: 390ºC
Turbine Capacity: 1.8 MW
Power Cycle Pressure: 100 bar

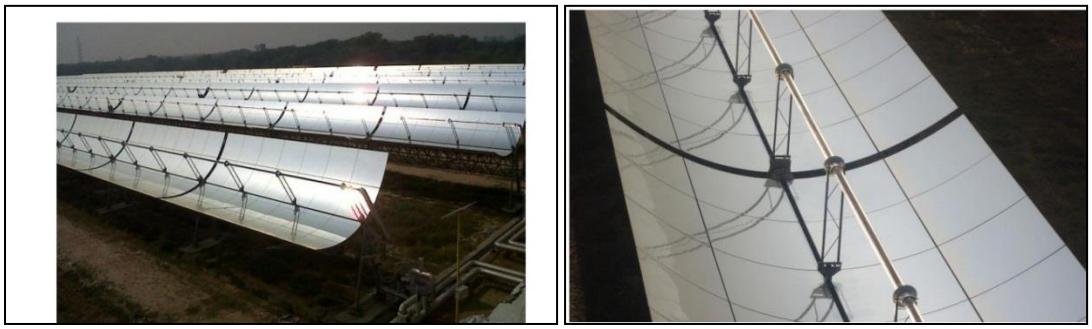


Fig4: Parabolic Trough Solar Field

Solar Power Tower

Solar power towers also known as Concentrated Solar Power (CSP) Towers which generate electric power from sunlight by focusing concentrated solar radiation on tower mounted heat exchangers. This system uses hundreds to thousands of sun-tracking mirrors which are called heliostats to reflect the incident sunlight onto the receiver. This plant is best suited for utility-scale applications in the 30 to 400 MW ranges [1].

Principle

Solar power tower generate electric power from sunlight by focusing concentrated solar radiation on a tower generate electric power from sunlight by focusing the concentrated solar radiation on a tower-mounted concentrated

Construction

In a solar tower power station, a set of mirrors reflects sunlight onto the top of tower. Here, the concentrated rays are converted into heat, giving rise to temperatures of up to 1000^{o}c. This energy is utilized to heat water and turn it into steam; where this steam is then used to drive a turbine. Solar tower power plants operate at higher temperatures than other kinds of solar-thermal power plants, like parabolic trough power plants.[11] Their high operating temperatures make the efficiency rating of these power plants very high – fewer collectors are needed per kilowatt-hour generated, thereby reducing the cost of power generation. It enables them to deliver renewably sourced electricity in line with varying demand.[9] Major parts of solar tower are Heliostat,Central Receiver,Heat transfer fluid, Steam Generator or turbines**.**

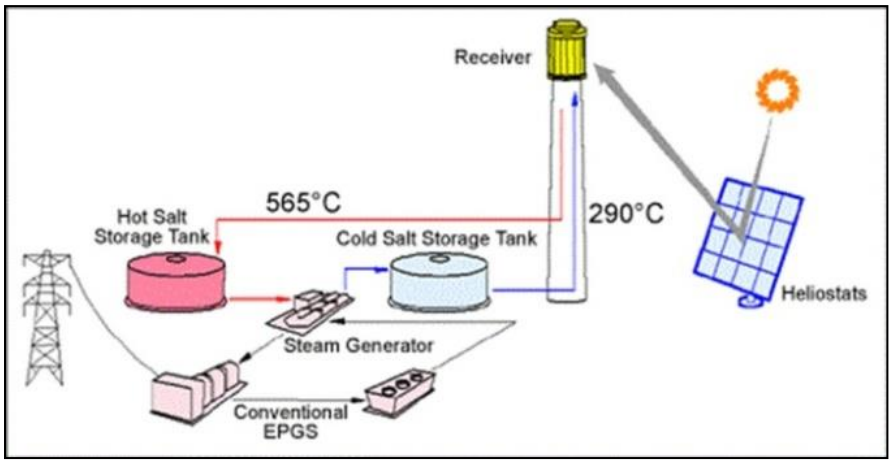


Fig 5:Working of Solar Power Tower [15]

Working

Central Towers are also called as solar tower power plants or 'Heliostat' power plants or power towers is a type of solar furnace using a tower to receive the focused light of sun.[10] It uses an array of flat, moveable mirrors which is called heliostats to focus the sun's rays upon a collector tower (the target). The high energy at this point of intense sunlight is transferred to a substance that can store the heat for later use. The newly heat transfer material that has been successfully used is liquid sodium. Sodium is a metal with a very high heat capacity, allowing that energy to be stored and drawn off throughout the evening. That energy can be used to boil water for use in steam turbines. [12] Water had traditionally been used as a heat transfer medium in earlier power tower versions (where the resultant steam was used to power a turbine).

Solar Tower in India

Scientists claim the endless sands of Rajasthan State could well earn the distinction of being the "biggest" solar power house producing 10,000 MW of electricity.[14]The Rajasthan Energy Development Agency (REDA) has initiated the spadework on an ambitious project.

Specifications of Plant:

City: Bikaner
Region: Rajasthan
Land Area: 12 acres
Aperture Area: 16,222 m²
No of Heliostats: 14,280
Tower Height: 46 m
Type of Heat-Transfer Fluid: Water/Steam
Operating Temperature: 420°C
Turbine Capacity: 2.5 MW
Power Cycle Pressure: 60.0 bar [15]

Fig 6: Solar power tower at Bikaner, Rajasthan, India

Fresnel Collector

The linear Fresnel technology receives it from the name from the Fresnel lenses, which was developed by the French physicist Augustin - Jean Fresnel for lighthouses in the 18th century. Linear Fresnel collector technology relies on array of linear mirror strips which concentrates light on to a fixed receiver mounted on a linear tower. [16]

Principle

The principle of this lens is the chopping of continuous surface of a standard lens into a set of surfaces with discontinuities between them. This allows a substantial minimization in thickness (and thus weight and volume) of the lens, at the expense of reducing the imaging quality of the lens. [16]

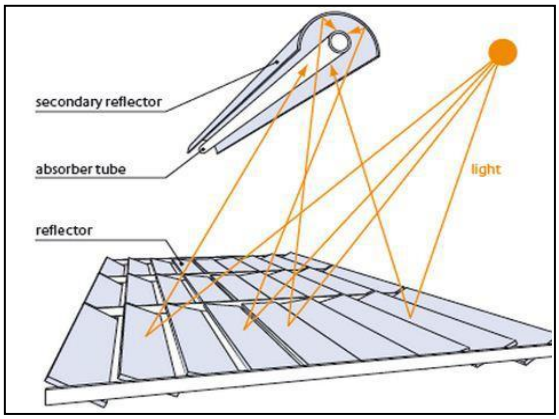


Fig 7: Construction of Fresnel Collector [17]

Construction

Primary reflector are the Fresnel reflector which are set of mirror situated in such a manner that the incident rays are concentrated to the secondary reflector as shown in fig 7.The secondary reflector is situated above the Fresnel reflector concentrating the rays to the absorber leading working medium heat in absorber and this water heated is further supplied to applicationthrough the balance system (i.e. pipes). [17]

Working

Using concentrating Fresnel collector, heat from the sun is concentrated on a black absorber located at the focus point of reflector in which the water is heated to a very high temperature to form. The receiver is seated above the mirror in the center along the focal line and has so as to capture the solar radiation and transfer the same to the thermal medium used in the system. The whole mirror arrangement is mounted on a hinged frame supported with a slotted lever for tilting the Fresnel reflector to a different angles so that the sun is always directed to the collector at different period of the day. The heat is transferred into the water, producing steam to drive turbine. [18]

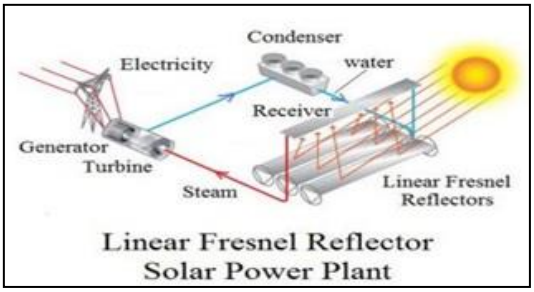


Fig 8: LFR solar power plant[22]

Fresnel Base Plant In India:

In İndia Fresnel Power plant is in construction in Dhursar,Jaisalmer,Rajastahan. It is Asia's largest Concentrated Solar Power (CSP) project 2 x 125 MW in Rajasthan, India. This 250 MW project will be the largest solar power installation in Asia and help India advance its country's goal of adding 20,000 MW of solar energy by 2022.[19]

Specifications of this plant are:

City: Jaisalmer
Region: Rajastahan
Land Area: 74.13 acres
Type of Heat-Transfer Fluid: Water/Steam
Operating Temperature: 390ºC
Turbine Capacity: 250 MW
Power Cycle Pressure:90 bars

Fig 9: Plant in Rajasthan[17]

Compound Parabolic Collector

Compound Parabolic Concentrator (CPC) is a non-imaging type of collector. It has a large acceptance angle and requires only intermittent tracking. The importance of geometry of CPC was discussed by Winston and it has been the subject of considerable attention. CPC are mostly used in two stages concentrating devices. Two stage concentration means that solar energy concentrated from another collector as PTC or solar dish is again focused by CPC to increase the Concentration Ratio up to 40,000. CPC is under commercial development stage

Construction:

The geometry of a CPC is shown in figure 1. It has two parabola sections AB and CD of parabola 1 and 2 respectively. AD is the aperture area with width w, while BC is the absorber area with width b. the axis are focused in such a way that C is the focus of parabola 1 and B is the focus of parabola 2. Also the height of the collector is so selected that tangents at A and D are parallel to the axis of the collector. The acceptance angle of the CPC is the angle AED

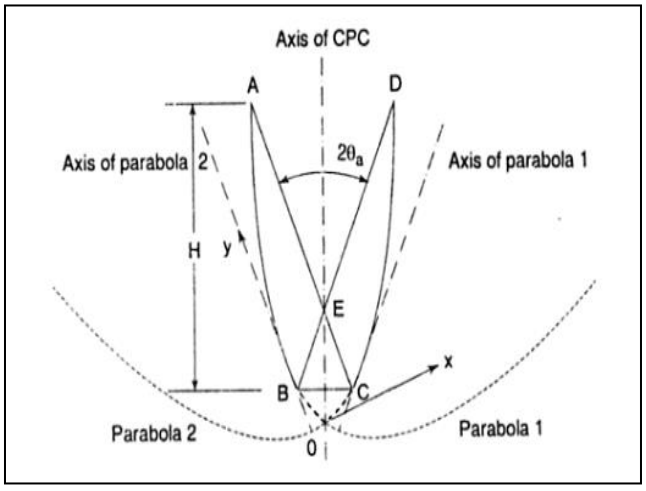


Fig 10: Construction of Compound Parabolic Concentrator [1]

CPC is generally used for medium pressure steam delivery, at around 130°C - 230ºC. These operating temperature are easily achieved by CPC as compared to FPC or PTC. CPC are used

in Solar Still Plant and Water Pasteurization, they make the process very economical. CPC with larger acceptance angle, not continuous tracking is required.

Working

When high temperature is required, it becomes necessary to concentrate solar radiation on to receiver. CPC is one of the solutions to achieve such temperature. Concentrator with reflector, focus sunlight on to the axis, where it is absorbed on the surface of the absorber and transfer to the fluid flowing through it. A concentric glass cover around the absorber helps in reducing convective and radioactive losses surrounding. Concentrator has to be rotated so that sun rays will be focused on to the absorber

Plant in India

This CPC system is designed and developed for the application of process steam generation in the Institute of Chemical Technology, Mumbai.

Specifications of this plant are:

City: Mumbai
Region: Maharashtra
Type of Heat-Transfer Fluid: Water
Operating Temperature: 122ºC
Acceptance angle: 6°
Aperture area 28.8 m^2
Concentration ratio= 6.3
Absorber 1.5'' 2 (pipe with matt black paint with 2 glass tube covers)

Fig 11: Compound Parabolic collector in India [20]

Dish Collector

Dish concentrator is one of the important types of solar energy concentrator Systems. They need to be relatively precise and are expensive to fabricate and to transport. Dish systems consist of a Parabolic shaped dish concentrator that reflects solar radiation on to a receiver mounted at the focal point as shown in fig. 12. These concentrators are mounted on active tracking system to follow the sun. The heat collected by the receiver is typically used by a heat engine mounted on the receiver that moves with the dish structure, such as Stirlingand Brayton cycle engines. The most effective parabolic shaped concentrator needs to focus the sunlight on the receiver and hence the shape of the parabola needs to be relatively precise.

The Concentrated beam radiation is absorbed into a receiver to heat a fluid or gas to approx. 750°C. This fluid or gas is then used to generate electricity. Dish technology produces relatively small amount of electricity compared to other CSP Technologies – typically in range of 10 to 25 kW which results in high capital costs. Stirling dish technologies are capable of achieving the highest efficiency of all types of CSP systems.

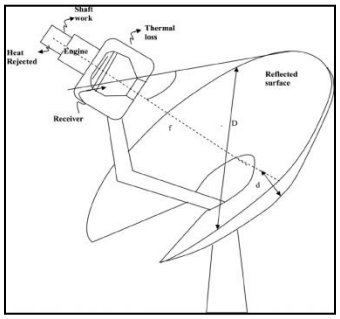


Fig.12 Schematic diagram of dish collector [21]

The solar steam cooking system installed at Shirdi has 40 parabolic concentrators / dishes (called Scheffler dishes after its inventor) placed on the terrace of Sai Prasad Building. The total system has an area of 1168 m2 comprising of 40 concentrators with 16 m2 capacities each. The system was commissioned during 2009 by Gadhia Solar Energy System Pvt. Ltd. Prior to the implementation of the CST system the establishment was using LPG as a fuel for its end use consumption. The system is integrated with its existing process.

Fig.13 Dish collector plant (PC shirdi sansthan, Maharashtra)

Conclusion:

Present study reveals that concentrated solar power plays important role in power generation sector. Being eco friendly source of energy, solar power can help to fulfill energy gap of India. The concentrated collector such as PTC, CPC, Solar Tower, Fresnel reflector and Dish collector have capacity to generated required power with no pollution. Though solar power has limitation of larger land requirement and variation in the solar radiation, it is still economical as compare to other power generating sources also it concludes the awareness, government encouragement and research activities which can result in satisfying increased energy demand.

References

1) S P Sukhatme, J.K Nayak, “Solar Energy-Principles of Thermal energy and storage”, 3rd Edition, TATA McGraw Hill 2010.
2) Renjish Kumar V K, Dr. Vimala M, “ENERGY CONSUMPTION IN INDIA-RECENT TRENDS”, Asia Pacific Journal of Research Vol: I. Issue XXXVI, February 2016 ISSN: 2320-5504, E-ISSN-2347-4793.

3) Paul, Shyamal&Rabindra N. Bhattacharya, "Causality between Energy Consumption and Economic Growth in India: A Note on Conflicting Results", Energy Economics, 2004s, Vol. 26, pp. 977-83.
4) Geodfrey Boyle, "Renewable energy - power for sustainable future", 3rd edition, Oxford university press, 2012.
5) Gang Xiao: "A closed parabolic trough solar collector", Quarterly Journal from PTC India Limited 2007.
6) Parikh Aradhya Anil, "Compound Parabolic Concentrator", Indian Institute of Technology, Kanpur-208016.
7) A.S.Pidaparthi, "India's first solar thermal parabolic trough pilot power plant'', SolarPACES 2013.
8) Garcia-Valladares, O.; Velazquez, N., "Numerical Simulation Of Parabolic Trough Solar Collector" Improvement Using Counter Flow Concentric Circular Heat Exchangers International Journal of Heat and Mass Transfer 2008.
9) G D Rai,"Non-conventional Energy Sources", Khanna publications.
10) George Kaplan, "Understanding Solar Concentrators", Nikkei business publications 1982.
11) B S Magal, "Solar Power Engineering", McGraw – Hill Book company pvt., ltd.
12) Dr. Reiner Buck, "Solar Tower Systems – An Example of Innovative Power Technology", Institute of Solar Research, DLR, DeutschesZentrum fur Luft-und Raumfahrt.
13) Peter Schossig, "Conclusion on thermal storages", Fraunhofer-Institute forsolar energy systems ISE.
14) ArunaKumarankandath and NayanjyotiGoswami, "THE STATE OF CONCENTRATED SOLAR POWER IN INDIA", 2015 Centre for Science and Environment.
15) U.S. Department of energy, "Concentrating Solar Power Projects", NREL, NATIONAL RENEWABLE ENERGY LABORATOR.
16) Matthias Gunther, "Linear Fresnel Technology"Advanced CSP Teaching Materials Chapter 6.
17) K. Gouthamraj, K. Jamuna Rani, G. Satyanarayana, May 2013 "Design and Analysis of Rooftop Linear Fresnel Reflector Solar Concentrator"International Journal of Engineering and Innovative Technology (IJEIT) Volume 2, Issue 11
18) Pankaj D. Menghani, R. R. Udawant, A. M. Funde, Sunil V. Dingare "Low Pressure Steam Generation by Solar Energy WithFresnel Lens: A Review"IOSR Journal of Mechanical and Civil Engineering.
19) Report AREVA site
20) Ajitkumar S. Gudekar,Dhanaji M. Kale2012, "Performance analysis of a novel and cost effective CPC system".Institute of Chemical Technology, Matunga, Mumbai 400 019, India
21) V. Siva Reddy , S. C. Kaushik , S. K. Tyagi, "Year round performance and economic evaluation of solar power plant for Indian tropical condition",· Jul 2012 · Journal of Renewable and Sustainable Energy
22) "Linear Fresnel Reflector Power Plant", U.S. Department of Energy, itcs.umich.edu
23) Report Power ministry India

Gamma Radiation Levels in the Environment and Alpha Activity Concentrations in The Soil Samples Of Northern Tumkur District, Karnataka, India

Jayasheelan A
Dept. of Physics, Maharani's Science College for Women,
Bangalore-560001, India
Corresponding author: *jayasheelanwillbe@gmail.com*

Abstract
Naturally Occurring Radioactive Materials (NORM) are present everywhere in all rock, soil, water, air etc. in variable amounts. Terrestrial radiations from these materials vary geographically. The presence of NORM in the environment produce radiation dose to the population both indoor and outdoor. The present study area is the Northern part of Tumkur, Karnataka, India, where 17 geographically different locations have been identified and studied. The gamma radiation exposures have been measured in outdoor using a highly sensitive GM type Environmental Radiation Monitor. It is observed from the present study that, the outdoor gamma absorbed dose varies widely from 60.9 to 269.7 nGyh^{-1} in Sira and Chirathahalli respectively with a geometric mean of 163.7 nGyh^{-1} in the entire study area. The average annual effective dose due to gamma radiations was 200.8 μSv. To understand the degree of concentration of radionuclides in the environment the gross alpha activities of soil samples have been measured. The soil samples belonging to the Pavagada taluk, Madugiri Taluk have elevated gross alpha activity. The gross alpha activity varied from 171.3 Bqkg^{-1} to 723.5 Bqkg^{-1} with geometric mean, which is the representative for the region under consideration, of 392.2 Bqkg^{-1}. The alpha activity and outdoor ambient gamma radiation level were moderately correlated with a correlation coefficient of 0.52.

Keywords: *Gamma radiation, Radiation dose, Alpha activity, Effective dose*.

Introduction

The exposure to radiation is unavoidable; some are exposed to radiation of smaller magnitude and some higher magnitude. All matter including minerals contains Naturally Occurring Radioactive Materials (NORM) [1]. Humans are exposed to environmental radiation through inhalation of dusts (contaminated with radiation) and gases, ingestion of dusts, soils, water, vegetation or meat and absorption of direct radiation from radioactive sources [2]. According to office of Environmental health Hazard Assessment various forms of ionizing radiation lead to alteration in the structure and functions of the cells or organs [3]. There has been no systematic measurement of natural background radiation levels made in the present study region. This study is aimed at an attempt to fill this lacuna. Seventeen locations have been identified to study the gamma radiation studies and gross alpha activity studies. The raidonuclides from earth's crust reach the surface of earth through rocks and sols. The background radiation depends on the amount of the radioactive materials in the environment. Naturally occurring radionuclides in earth's crust are strongly influenced by the local geological and geographical conditions [4]. Materials from the deposit of mineral sources may be brought to the surface soil through processes such as weathering of rocks and soil formation [5]. The common radionuclides contribute for natural background radiation from soil and rock, are ^{238}U, ^{232}Th and ^{40}K. The radioactivity

in soil is one of the important reasons for the natural background radiation. They are usually found in high concentrations in volcanic rocks (especially in granite), pegmatites and hydrothermal accumulations [6].

Materials and methods

The present area of study is Tumkur District, which is located in south India, with 13^0 20^1 latitude and 77^0 05^1 longitude. The human population in this area, according to the 2011 census is 2,681,449. The outdoor in situ gamma dose rate measurement was done by using digital environmental radiation dosimeter (Type SM 141D). The directly measured exposure rates have been converted to absorbed doses using the relation 1 μRh^{-1} = 8.76 $nGyh^{-1}$ [7]. For gross alpha studies, about 100 g of soil samples from each location, free from extraneous materials like plant debris, big pieces of stones and pebbles, were collected and finely powdered. This sample was taken in a silica dish and white ashed at 450 – 500 ^oC in a muffle furnace. About 0.05 g of this ashed, soil powder samples were spread over aluminium planchet(25 mm dia) evenly using sieves of 100 μm mesh size. The sampled planchet was weighed and the mass of the sample was determined. The sample was fixed over planchet by adding few drops of organic cellulose solution .The gross alpha from the planchet was measured using a pre calibrated (standard alpha source ^{241}Am) alpha counter for a period of 1000 s. The background of the alpha counter is determined by counting the empty planchet. The gross α activity was measured using the suitable formula [8].

Results and Discussion

The gamma radiation exposures measured were tabulated in table-1 and the map of Tumkur district is shown in Figure-1. It is observed that, the outdoor gamma absorbed dose varied from 60.9 (sira) to 269.7 $nGyh^{-1}$ (chirathahalli) with a geometric mean of 163.7 $nGyh^{-1}$. The average annual effective dose due to gamma radiations was 200.8 μSv. The outdoor lowest belong to Sira with 74.7 μSvy^{-1}. The underground geology shows the presence of gneiss and schist formation in this region. The highest outdoor annual effective doses 330.8 μSv was found in Chiratahalli, followed by Y.N.Hoskote, Ponnasamudra, Chandrabavi and Pavagada. These places are surrounded by granitic hills. The presence of granitic formations may be the reason for the elevated radiation dose in these areas. The gamma levels in all the regions were found to be within the normal range [7, 9].

The soil samples belonging to the Pavagada taluk, Madugiri Taluk have elevated gross alpha activity. The gross alpha activity varied from 171.3 $Bqkg^{-1}$ to 723.5 $Bqkg^{-1}$ with geometric mean of 392.2 $Bqkg^{-1}$. The results of measurements are summarized in Table-2. The table shows that, the soil samples belonging to the Pavagada taluk and Madugiri Taluk have elevated gross alpha activity due to the presence of high concentrations of volcanic rocks or granite. The alpha activity and outdoor ambient gamma radiation level were moderately correlated with a correlation coefficient of 0.52 which is shown in Figure-2

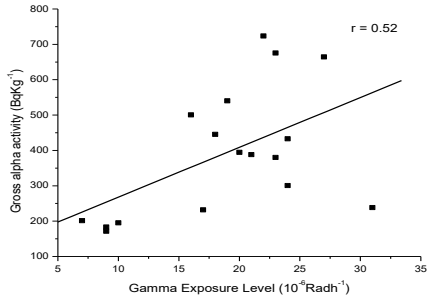


Figure-1: Map of Tumkur district showing the sampling locations

Sl.No	Location	γ Exposure Level (μRh^{-1})			γ Absorbed Dose (nGyh^{-1})	γ Effective Dose (μSvy^{-1})
		Number of Readings	Range	Mean		
1	Beldara	10	6-13	9.0	78.3	96.0
2	Koratagere	15	13-22	18.0	156.6	192.1
3	Dasarahalli	10	16-24	21.0	182.7	224.1
4	Madhugiri	20	15-30	19.0	165.3	202.7
5	Hosakere	10	22-36	27.0	234.9	288.1
6	Chandrabavi	10	18-30	23.0	200.1	245.4
7	Madakasira*	10	12-25	16.0	139.2	170.7
8	Pavagada	20	16-31	22.0	191.4	234.7
9	Ponnasamudra	10	16-33	23.0	200.1	245.4
10	Y.N.Hoskote	10	18-33	24.0	208.8	256.1
11	Obalapura	10	16-28	24.0	208.8	256.1
12	Nidagallu	10	18-22	20.0	174.0	213.4
13	Chirathahalli	10	25-37	31.0	269.7	330.8
14	Tavarekere	10	6-14	9.0	78.3	96.0
15	Sira	15	4-12	7.0	60.9	74.7
16	Bukkapatna	10	6-14	10.0	87.0	106.7
17	Huliyar	10	13-21	17.0	147.9	181.4
Min				7	60.9	74.7
Max				31	269.7	330.8
Mean				18.8	163.7	200.8
STDEV				6.81	59.27	72.69

Table-1: Ambient outdoor gamma radiation Level

Table-2: Gross α activities in Soil

Sl. No.	Location	Gross α activity ($Bqkg^{-1}$)
1	Beldara	183.4±40.2
2	Koratagere	445.3±63.7
3	Dasarahalli	388.2±54.2
4	Madhugiri	540.2±90.7
5	Hosakere	664.5±120.2
6	Chandrabavi	380.2±59.2
7	Madakasira	500.6±115.8
8	Pavagada	723.5±170.5
9	Ponnasamudra	675.3±134.2
10	Y.N.Hoskote	300.7±82.5
11	Obalapura	432.8±118.4
12	Nidagallu	394.6±135.6
13	Chirathahalli	238.5±58.9
14	Tavarekere	171.3±72.0
15	Sira	201.3±82.5
16	Bukkapatna	195.2±58.8
17	Huliyar	231.8±72.5
Min		147.5
Max		723.5
Mean		370.5
STDEV		162.8

Conclusion

In the present research, 17 locations of Northern part of Tumkur, Karnataka, India was studied for the determination of gross alpha activity of soil and ambient gamma radiation levels. It is observed from the present study that, the outdoor gamma absorbed dose varied from 60.9 to 269.7 $nGyh^{-1}$ in Sira and Chirathahalli respectively with a geometric mean of 163.7 $nGyh^{-1}$ in the whole study area. The average annual effective dose due to gamma radiations was 200.8 μSv. The gross alpha activity varied from 171.3 $Bqkg^{-1}$ to 723.5 $Bqkg^{-1}$ with a geometric mean of 392.2 $Bqkg^{-1}$. The correlation coefficient between alpha activity and outdoor ambient gamma radiation level was 0.52.

References

1. J.G. Koperski, and N.Tsurikov, Impact of Australian Radiation Protection and Nuclear Safety Legislation on Minerals' Industry in Australia – the TENORM Issue (1998). Australian Radiation Protection and Nuclear Safety Act 1998, No. 133. South-West Operations, Capel, Western Australia 6271; Mid-West Operations, Eneabba, Western Australia 6518.
2. International Atomic Energy Agency (IAEA), Guide Book of the Fallout of Radioactivity Monitoring in the Environment and Food Programme. Technical Report Series No.295, International Atomic Energy Agency,Vienna (1989).
3. Office of Environmental Health Hazard Assessment, Health Protective Considerations Regarding Measurement of Gross Particle Activity in Drinking Water (2003).
4. Miller K.M. and Shebell P. In situ gamma ray spectrometry. A tutorial for environmental scientists, USDOSE publication, EML-557 (New York: Environmental Measurement Laboratory) 1993.
5. Hazrati S, Baghi AN, Sadeghi H, Barak M, Zivari S, Rahimzadeh S, Investigation of natural effective gamma dose rates case study: Ardebil Province in Iran. Iranian J Environ Health Science & Eng, 9:1, 2012.
6. Banks D, Royset O, Strand T, Skarphagen H (1995). Radioelement (U, Th, Rn) Concentrations in Norwegian Bedrock Groundwaters. Environ Geol 25, 165-180.
7. Somashekarappa.H.M, Distribution of natural and artificial radionuclides in the environment of Kaiga, Ph.D thesis.Mangalore University 1993.
8. Nambi.K.S.V, Bapat.V.N, David.M, Sundram.V.K, Sunta.C.M, Soman.S.D, Country wide environmental radiation monitoring using thermoluminesence, J. of Rad. Prot. Dosim. 1987, pp 24- 27.
9. United Nations Scintific Committee on the Effects of Atomic Radiation, Sources and Effects of Ionizing Radiation, Report to the U.N. General Assembly with Scientific Annexes, New York 1993.

Decolorization of Methyl orange by immobilized *Klebsiella* sp. DA17

Sunil Radhakrishin Jagiasi[1] & Saraswati N. Patel[2]

[1]Department of Microbiology, R. K. Talreja College, Ulhasnagar-3. Maharashtra (India).

[2]Department of Microbiology, Smt. C. H. M College, Ulhasnagar-3. Maharashtra (India).

sunilrjagiasi@yahoo.com

ABSTRACT

The treatment of azo dye containing wastewater has been a major environmental concern and must be well treated before it is discharged into the environment. The physicochemical methods used to treat textile wastewater have some technical and economical limitations. On the contrary, microbial decolorization and degradation process does not have. This process does not use hazardous chemicals, produces less harmful sludge and totally environmental friendly.The present study emphasizes on the effect of immobilization and some specified culture conditions on decolorization of Methyl orange by diazobacteria Klebsiella sp. DA17 isolated from textile dye effluent sludge.Biodecolorization of Methyl orange was monitored spectrophotometrically for decrease in absorbance of reddish orange color of dye. The dye degradation was confirmed by FTIR and HPLC. The bacteria were immobilized using nontoxic gel matrix (beads), by calcium alginate entrapment method. The effect of pH, temperature, dye concentration and inoculums density were studied using One Factor At a Time approach for the decolorization. The significant difference in decolorization at different pH, temperatures and inoculums density were not observed; the differences were well pronounced in the free cells. Immobilized cells showed more efficiency for higher dye concentration and in repeated fed batch decolorization. The increase in efficiency of dye decolorization was nearly 96% by immobilized cells in Fed Packed Bioreactor Column.

This study exemplified the treatment feasibility of immobilized cells over Free State of isolate as decolorizing agent, by offering many advantages like prevent cell washout, maintenance of high cell density and degradation of high concentration of dye.

***Key words**: Azo dye, Biodecolorization, Immobilization, Textile wastewater.*

1. INTRODUCTION

Water pollution control is at present one of the major thrust area of scientific research. Color removal in particular, has recently become an area of major scientific interest. The textile industry plays an important role in the world economy and in our daily life, but at the same time, it consumes large quantities of water and generates large amount of waste water. Azo dyes are major synthetic textile dyes that are commonly used and often preferred in the textile industry because they are more stable, easier to produce and have a wider variety of colors than natural dyes. However, discharge of these dyes into the environment poses a significant threat due to their recalcitrant nature. These dyes are also reported to be toxic, mutagenic and carcinogenic[1].Several physico-chemical methods have been used to eliminate the color from wastewater, but these are expensive, produce large amount of sludge, generation of byproducts leading to secondary pollution and requires

additional cost for regeneration of treatment system[2].

In recent years research attention has been focused on biological methods for the treatment of effluents, some of which are in the commercialization process. Biological processes provide a cheap, environmental friendly and efficient way for the treatment of dye wastewater. Decolorization by biological means may take place in two ways: either by biosorption or biodegradation[3].

The advantages of using microbes for remediation include their features like their natural occurrence, easyto manipulate, highly adaptable, cheap production, fast growth rate, easilyavailable to treat large volumes of wastewater due to rapid kinetics and high selectivity, provide desirable qualities of bacterial community for the bioremediation[4].

Biosorption is the passive uptake of toxicants by dead / inactive biological materials or by materials derived from biological sources. This process is metabolically independent and essentially takes place on the cell wall. The advantages offered over biodegradation method are cost, maintenance, temperature, pH, versatility, rate of uptake, degree of uptake, regeneration and reuse of material. In general the use of microorganism may not be good option for continuous treatment of pollutant.Microbial biosorbents are basically small particles, with low density, poor mechanical strength and little rigidity. They often suffer several drawbacks such as solid – liquid separation problems, possible biomass swelling, inability to regenerate / reuse and development of high pressure drop in the column mode [5].

Biodegradation is the complete degradation of the pollutant to the level of nontoxicity. This process is metabolically dependent for transportation inside the cell and degradation. Among different agents available from bacteria, fungi, algae, and yeast for biodegradation, the bacteria are more preferable due to faster growth rate, non-luxuriant nature and easy to handle and maintain. But bacterial degradation carry some limitations. The use of freely suspended microbial cells for dye removal is limited due to their inherent disadvantages such as small size, possible clogging and low mechanical strength[6]. Also the use of living organisms may not be an option for continuous treatment of highly toxic organic / inorganic contaminants. Once the toxicant concentration becomes too high or the process operated for a long time, the amount of toxicant accumulated will reach saturation. Beyond this organism's metabolism get interrupted and resulting in cell death[5].

It has been reported that the decolorization rate of azo dyes by living cells could be increased by using redox mediators as they speed up the reaction by transferring electrons from electron donors to the dye (electron acceptor). However continuous use of redox mediators increases the cost of process and sludge generation[7].

These above issues can be resolved by cell immobilization. Immobilization of microbial cell is a best way to exploit their ability to degrade textile dyes. It has many advantages over a free cell. It prevents cell washout, high cell density to be maintained in bioreactors, increase substrate uptake, strong toleranceto toxicity, lower operating costs, simple maintenance management, lower residual costs and catalytic stability of microbes is often improved by immobilization[6].

Methyl orangeis the solid dye with CAS No. 547 – 58 – 0 and structure Sodium 4-{[4- (di methyl amino) phenyl] diazenyl } benzene-1-sulfonate, Chemical formula - $C_{14}H_{14}N_3NaO_3S$, Molar mass - 327.33 gm /

mole, Density – 1.28 gm /cm^3, soluble in water. As per European Union classification (67 / 548 / EEC)Methyl orange comes under Dangerous Substances Directives (DSD) as toxic, The MedianLD_{50} is 60mg / kg when given orally to the rat.

The present study is directed to investigate the decolorization ability of free and immobilized cells of *Klebsiella* sp. DA17 on Methyl orange as an azo dye.

2. MATERIALS AND METHODS

2.1 Chemicals

The Methyl orange dye, Burks Nitrogen free media, decolorization media and other chemicals required for study were purchased from Hi Media Pvt. Ltd., Mumbai (Maharashtra).

The 1000 mg/L of dye was prepared in double distilled water and used as a stock. The solution of desired concentration was obtained by successive dilution.

2.2 Isolation, screening and identification of potent decolorizing *Diazobacteria*

The samples were collected from the dye effluent outlet located in Ulhasnagar and near vicinity (Maharashtra), India. The dye acclimatized[8] samples were enriched using Burk's Nitrogen Free medium for selective enrichment of diazobacteria. The potent decolorizing diazobacteria were screened for their utilization of dye as carbon and / or nitrogen source. Further isolates were also checked for their tolerance and luxuriant growth at higher concentration of selected dye[9]. After isolation and screening, the potent isolate was identified on the basis of morphology, cultural and biochemicals utilization with reference to Bergey's manual of systematic bacteriology[10]. Furtheridentification was carried out using 16s rRNA sequencing and comparing other bacteria with reference to ncbi BLAST and phylogenetic tree[11, 12, and 13].

2.3 Decolorization assay

Nutrient broth with 100 mg/lit of Methyl orange dye was inoculated with potent decolorizing bacterial isolate obtained in the study and incubated at room temperature (30ºC) upto 72 Hrs. under static conditions. The decolorized broth was centrifuged at 10,000 rpm for 10 min. and the clear supernatant was read spectrophotometrically at the $\lambda_{max}$of the selected dye.The %ge decolorization was calculated using formula-

%Decolorization = (OD at T_0 – OD at T_t / OD at T0) x 100

Where T_0 is OD at initial "0" hrs. andT_t is OD after " t " hrs.

2.4 Immobilization of cells

The entrapment of cells in alginate was carried out mixing 3% sodium alginate and 4% (v/v) bacterial isolate by continuous stirring. This sodium alginate / cell mixture was extruded drop by drop into a cold sterile 0.2 M $CaCl_2$ solution through syringe. For better hardness and stability, gel beads were suspended into a fresh $CaCl_2$ solution and kept in refrigerator overnight before use.

2.5 Study of different parameters

Immobilized isolate in the form of beads (4% w/v) were placed in a 100 ml nutrient broth medium containing 100 mg/lit of the dye. To evaluate the effects of environment factors on the efficiency of dye degradation with a One Factor At a Time Approach, the batch decolorization experiments were carried out for different pH (5, 6, 7, 8 and 9), temperature (0ºC, 10ºC, RT (30 ± 0.2ºC), 37ºC and 55ºC), dye concentration (100 – 500 mg/L), and inoculum density (1-5%) after keeping other pre-optimized factors constant. The above mentioned parameters were studied using free cells as well. The same medium was used for the potent decolorizing isolate. 4% (v/v) of inoculum was used in the study. The decolorization assay was carried out using spectrophotometric method as mentioned above.

2.6 Repeated Fed Batch decolorization

The Repeated Fed Batch process was set up for both free and immobilized cells. The study was carried out by regular addition of Methyl orange (100 mg /lit) at regular interval of 24 Hrs, in same dye containing nutrient broth medium (with various degrees of decolorization) without additional nutrients. The dye was added continuously until isolate do not lose decolorization ability. The decolorization of dye was monitored using spectrophotometric method.

2.7 Fed packed bioreactor column

A packed reactor was designed to demonstrate the applicability of this system at higher scales. It was developed using a glass column of 40 cm height and 3.0 cm internal diameter. The available void volume was 10 ml. The bioreactor was loaded with inoculum carrying alginate beads and loaded with Methyl orange dye samples of 100 mg / L. The dye sample 5 ± 0.5 ml per hour was collected from the exit of the column and analyzed spectrophotometrically[6].

2.8 Confirmation of dye degradation

The dye degradation analysis was also carried out by FTIR and HPLC where extracted biodegraded samples were compared with that of un-degraded (control) dye. This was carried out for detecting the appearance / formation of new functional groups with respect to new intermediates/compounds.For FTIR spectrogram, the samples were scanned in the range of 4500-500 cm^{-1} using Shimadzu model of FTIR instrument. HPLC analysis was carried out on a C18 column (Symmetry 4.6 x 250 mm) using the isocratic method with a 10 min. run time and 0.2 ml flow rate of methanol as a mobile phase and JASSCO HPLC system equipped with a variable wavelength detector[15, 16, 17, and 18].

3. RESULTS AND DISCUSSION

Entrapment is the most widely used technique for whole cell immobilization and alginate is a suitable matrix material because it is nontoxic towards the microorganisms[19]. Calcium alginate is widely used as entrapment carrier for immobilization of the enzymes and whole cells because of its biocompatibility, excellent physical properties, cheapness and simplicity[4].

3.1 Isolation, screening and identification of potent decolorizing diazobacteria

Textile dye effluent which was used as sample for isolation of dye decolorizing bacteria was acclimatized[8] with increasing concentration of Methyl orange for one month. The dye decolorizing diazobacteria were enriched, isolated and screened[9]for their dye utilization; details as mentioned in Materials and Methods.

The potent decolorizing diazobacteria was identified as *Klebsiella* sp. DA17 based on morphology, cultural and on biochemical utilization with reference to Bergey's manual of systematic bacteriology[10] and further confirmation by 16s rRNA sequencing followed by comparison with ncbi and phylogenetic tree[11, 12, and 13].

3.2 Study of different parameterson Methyl Orange decolorization by *Klebsiella* sp. DA17

3.2.i pH

Higher decolorization was observed at optimum pH 7.0 followed by rapid decrease at extremes of selected pH range. This may be related to rate limiting step of dye molecules transport across the cell membrane[3 and 14].

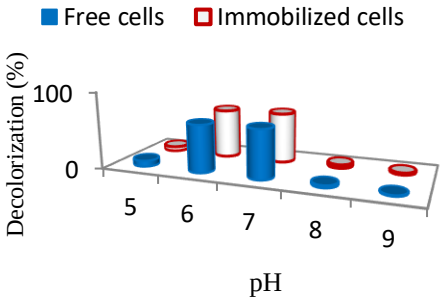


Fig. 1- Effect of pH on decolorization

Acidic Neutral Alkaline

Fig.2- Effect of pH on beads

As shown in fig.1, maximum decolorization of Methyl orange was observed at pH 7.0 which was 73.49% in Free State and 76.91% under immobilized conditions of the above isolate *Klebsiella* sp. DA17. pH of media as shown in figure 2, also affects the integrity of bead structure and shrink the bead structure.

3.2.ii Temperature

Temperature is very important factor for all processes associated with microbial vitality including the remediation activity.

In this study of effectof incubation temperature (fig.3),maximum decolorization of the dye was observed at 37°C and it was about 73.96%. Under immobilization conditions, the isolate

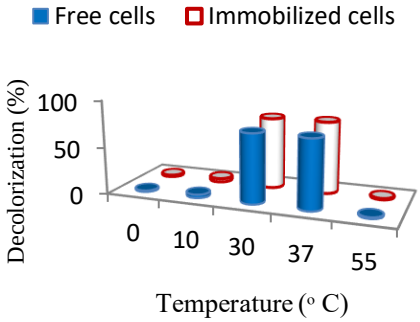


Fig.3 – Effect of temperature

Klebsiella sp. DA17 showed 76.48 % decolorization at RT. Hence it could be seen that there were insignificant difference in decolorization at RT and 37 ºC. But at

extreme temperatures the decolorization ability of the isolate was affected. At Low temperature, the growth of bacteria was restricted and dye degradation rate decreased.Increase in temperature, though increased the rate of enzyme catalyzed reaction, led to protein instability and the denaturation of the enzyme azoreductase[3 and 14].

3.2.iii Dye Concentration

The fig. 4 demonstrates the decolorization activity of the isolate *Klebsiella* sp. DA17 at different dye concentrations varying from 100 mg/lit to 500 mg/lit. The maximum decolorization observed was

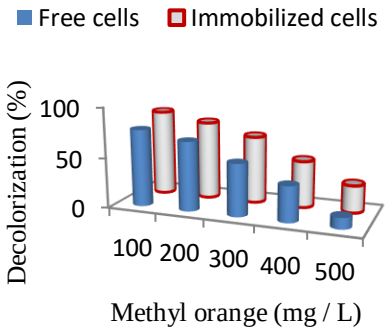


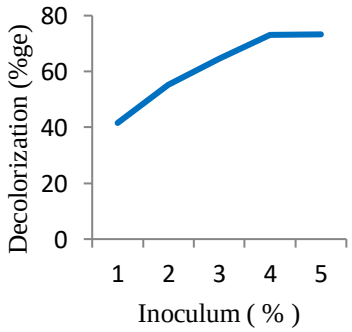
Fig. 4 – Effect of dye concentration

76.99% for Free cells and 85.56% for immobilized cells of*Klebsiella* sp. DA17 at 100 mg /lit of Methyl orange. Further increase in dye concentration resulted in reduction in decolorization rate, due to dye toxicity and unavailability of dye receptors on the cell surface[14].

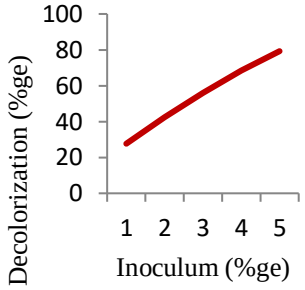
Immobilized cells were more efficient at high concentration of dye comparatively and confirming the shielding effect of beads towards cells for toxicity of dye.

3.2.iv Inoculum density

The fig. 5, shows effect of inoculum density on decolorization. The 4% of inoculum density at 0.4 OD (600 nm) was observed optimum for the present system. At 4% inoculums density, *Klebsiella* sp. DA17showed maximum decolorization for methyl orange (73.18%) in Free State (fig. 5a). The continuous increase in decolorization was observed with increase in inoculum in the form of beads for immobilized cells (fig.5b).



(a) Decolorization by free cells



(b) Decolorization by immobilized cells

Fig. 5 – Effect of inoculums density

The higher inoculum density results, decrease in decolorization due to formation of cell heaps or aggregates at high concentration of inoculum density in Free State, which makes them unavailable for the dye molecules. The issue can be resolved with immobilization, as this can maintain high density of cells in the form of beads as a special enclosure.

3.3 Fed Batch Repeated decolorization

In fed batch conditions (fig.6), at regular interval of 24 Hrs. the isolate was fed with the fixed amount of dye without adding any new / extra nutrients. This is to check the efficiency of isolate to cope up with the nutrient stressed conditions for its ability to dye decolorization.*Klebsiella*sp. DA17 had shown efficient decolorizationunder Free State upto 13 cycles for Methyl orange with reduction in decolorization from 91.08% to 0.73%. For immobilization condition, increase in decolorization efficiency of isolate was seen for the same turns of cycle with reduction from 91.42% to 0.81% in decolorization.

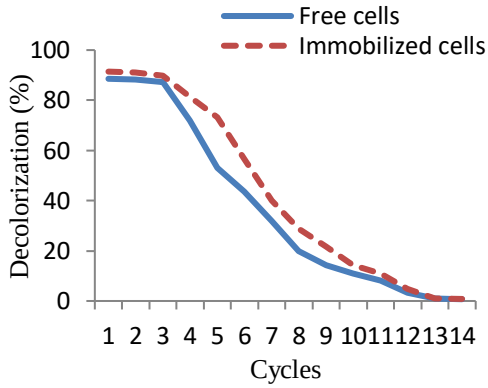


Fig. 6 – Fed Batch dye decolorization

3.4 Bioreactor column

Decolorization study with immobilized beads of isolate *Klebsiella* sp. DA17 was carried out using glass column. The beads were packed in column as shown in fig.7 (a and b), and Methyl orange dye solution (100 mg/lit) was passed through column. The nearly 96% decolorization was observed when dye solution passed through beads packed column. In an hour, 5 ± 0.5 ml decolorized solution was collected. Decolorization of dye can be faster by using glass column which were packed with immobilized beads of isolate than the same prepared immobilized beads used in flask study. The application of a Fed Packed

Bioreactor column improves its scope for use at larger scale for treating textile effluents [4, 6].

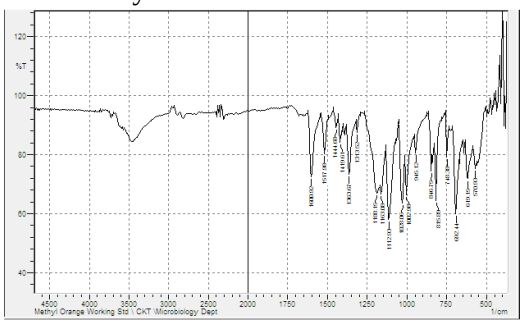
(a) Before decolorization

(b) After decolorization

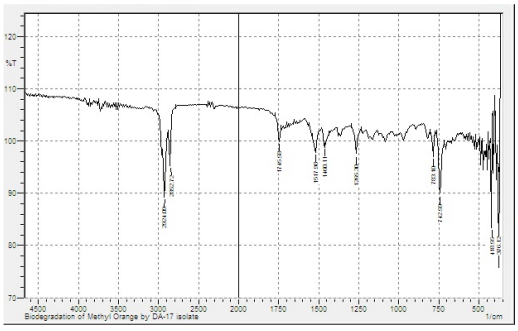
Fig. 7 – Fed Packed Bioreactor column

3.5 FTIR and HPLC

Biodegraded metabolites of Methyl orange were extracted from the culture supernatant with an equal volume of chloroform. The extract was dehydrated over anhydrous Na_2SO_4 and evaporated to dryness in rotary vacuum evaporator. The crystals obtained were dissolved in small volume ofHPLC grade methanol.



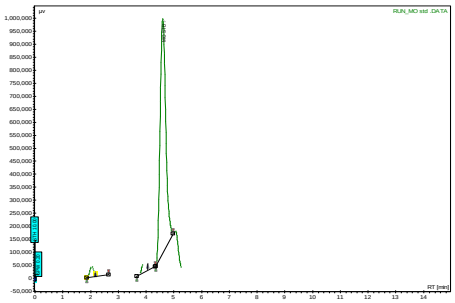
(a) Control Methyl orange



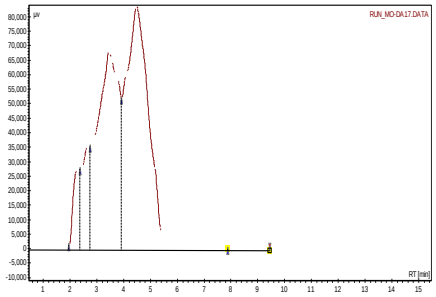
(b) Biodegraded Methyl orange

Fig. 8 – FTIR spectrum of dye

The biodegraded Methyl orange was characterized by FTIR. The extracted sample was mixed with KBr pellet and scanned in the range of 4000–500 / cm. The KBr pellet was used as blank.FTIR analysis was done to confirm the dye degradation. The results of FT-IR analysis of the dye Methyl orange and sample obtained after decolorization showed various peaks. The FTIR spectra of Methyl Orange control dye(fig. 8a) display peaks at 1600.92/cm, 1363.67/cm, 1112.93/cm, 1028.06/cm, 1002.98/cm, 815.69/cm, 692.44/cm, 619.15/cm and 570.93/cm. All these peaks were absent in biodegraded Methyl orange dye by the isolate as shown in fig.8b. The absence of sharp peaks at 1028.06/cm and1112.93/cm indicates the cleavage of $–SO_3Na$ group from the Methyl orange dye molecule. The absence of sharp peak at 1600.92/cm and 1363.67/cm suggest cleavage of –N=N- bond, -N $(CH_3)_2$ group. The peak characteristic of azo bond at 1600.92 of Methyl orange was absent in the decolorized sample, confirmed the degradation of Methyl Orange to intermediate products which are followed to oxidation for giving simpler compounds.



a. Control Methyl orange



b. Biodegraded Methyl orange

Fig. 9 – HPLC analysis of dye

In HPLC chromatogram, control Methyl Orange dye (fig.9a) showed major peak at 4.59 min. whereas formation of peaks at 3.45 min., 4.48 min. in biodegraded Methyl orange (fig.9b) by isolate *Klebsiella* sp. DA17confirmed the formation of metabolites / products [15, 16, 17and 18].

4. CONCLUSION

Bioremediation of textile effluent using immobilized bacterial cells is an effective method for treating textile effluent and can be a good substitute for conventional remediation processes. This will be useful for the treatment of not only textile effluent but also industrial effluents of any kind. Studies on physicochemical parameters optimization using One Factor At a Time Approach proved that immobilization increased the efficiency of decolorization under the optimal conditions. Fed Packed Bioreactor Column increased the

reusability of the cells. FTIR and HPLC confirmed the biodegradation of Methyl orange dye. The biodegraded dye toxicity is under study with Plant Growth Promoting Rhizobacteria and *Moonga radiata seeds.*

REFERENCES

1. Anna Christina R. Ngo, Mark Kevin P. Devanadera, and Gina R. Dedeles (2016).Decolorization of selected synthetic textile dyes by yeasts from leaves and fruit peels. Journal of Health & Pollution. Vol. 6 (10).
2. PalrajRanganathan,V. Kasiviswanathan, and R. Sayeekannan (2016). Proficient decolorization of methylene blue by returnable *Bacillus coagulans* immobilized beads: kinetics, isotherms and thermodynamic studies. Int. j. pharm. Biosci., 7(3): (b), 1121 – 1134.
3. Chimezie Jason Ogugbue and Thomas Sawidis (2011). Bioremediation and detoxification of syntheticwastewater containing Triarylmethane dyes by *Aeromonas hydrophila* isolated from industrial effluent. Biotechnology Research International.
4. PatilPratibha S. (2016). Decolorization, degradation and kinetic study of textile dye Navy blue HE2R using immobilized bacterial consortium PMB11. Journal of Environmental Science and Pollution Research.2(3), 99-102.
5. NatarajanSaravanan, Tiruvenkadam Kannadasan, Chiya Ahmed Basha and VeerasamyManivasagan (2013). Biosorption of textile dye using immobilized bacterial (*Pseudomonas aeruginosa*) and fungal (*Phanerochatechrysosporium*) cells. American Journal of Environmental Science.9 (4): 377- 387.
6. U. Sneha, R. Poornima and S. Sridhar (2015). Studies on decolorization of malachite green using immobilized *Pseudomonas putida.* Journal of Chemical and Pharmaceutical Research. 7(12):589-596.
7. SharmaSubed Chandra Dev , Sun Qian LiJiangwei , Wang Yuwen , Suanon Fidele , Yang Jinyan , and Yu Chang-Ping (2016). Decolorization of azo dye Methyl red by suspended and co immobilized bacterial cells with mediators anthraquinone-2,6 - disulfonate and Fe_3O_4 nanoparticles, International Biodeterioration and Biodegradation 112, 88 – 97.
8. Thorat P.R., & Sayyad M. (2010). Microbial decolorization and degradation of crystal violet by aerobic bacteria. The Bioscan. 5, 591- 594.
9. Alalewi Aamar& Jiang Cuiling (2012), Bacterial influence on textile wastewater decolorization, Journal of environmental protection,3, 889-901.
10. Bergey D.H., and Holt J.G.(2000). Bergeys Manual of Determinative Bacteriology, 9th Edition, Publisher Philadelphia Lippincott, William and Wilkins.
11. Saitou N. and Nei M.,(1987). Theneighbour – joining method, A new method for reconstructing phylogenetic trees, Molecular Biology and Evolution. 4, 406 – 425.
12. Felsenstein J.(1985, Confidence limits on phylogenies, An approach using the bootstrap, Evolution. 39, 783-791.
13. Tamura K.,, Peterson D., Peterson N., Stecher G., Nei M. , and Kumar S. Mega-5, (2011). Molecular evolutionary genetics analysis using maximum likelihood, evolutionary distance and maximum parsimony methods, Molecular Biology and Evolution (In Press)
14. Sratale R.G., Saratale G.D.,Chang J.S., GovindwarS.P.(2011). Bacterial

decolorization and degradation of azo dyes: A review. Journal of the Taiwan Institute of chemical Engineers. 42, 138-157.

15. Moutaonakkil A., Zeroual Y., Dzayri F.Z., Talbi M., Lee K., Blaghen M. (2003).Bacterial decolorization of the azo dye Methyl red by *Enterobacteragglomerans*. Annals of Microbiology. 53,161-169.
16. Telke Amar A., Kadam Avinash A., JagtapSujit S., Jadhav Jyoti P., and Govindwar Sanjay P. (2010). Biochemical characterization and potential for textile dye degradation of Blue Laccase from *Aspergillus ochraceus* NCIM-1146. Biotechnology and Bioprocess Engineering. 15: 696 - 703.
17. Shah Maulin P., Patel Kavita A., Nair Sunu S., &Darji A.M.(2013). Microbial decolorization of Methyl orange dye by *Pseudomonas* spp. ETL-M. International Journal of Environmental Bioremediation and Biodegradation. 1,54-59.
18. Tripathi A. and Srivastava S.K. (2011). Ecofriendly treatment of azo dyes: Biodecolorization using Bacterial strains. Int. J. of Biosciences, Biochemistry &Bioinformatics Vol.1.
19. K. Suganya and K. Revathi (2016). Decolorization of Reactive dyes by immobilized bacterial cells from textile effluents. Int. J. Curr. Microbiol. App. Sci. 5(1): 528-532.

Food Commensals: Vast Pool of Antibiotic Resistance and Mode of its Dissemination

Omkar A. Naik[1], Ravindranath Shashidhar[2], Devashish Rath[3], Jayant R. Bandekar[2] & Archana Rath[1*]

[1]Department of Biotechnology,
University of Mumbai, Vidyanagari, Santacruz (East), Mumbai-400098, INDIA.
[2]Food Technology Division, Bhabha Atomic Research Centre, Trombay, Mumbai-400085, INDIA.
[3]Molecular Biology Division, Bhabha Atomic Research Centre, Trombay, Mumbai-400085, INDIA.
[*]E-mail: arath09@gmail.com

Abstract

Antibiotic resistance (AR) has emerged as a major health concern to an extent that this topic was debated for the first time in recently conducted United Nations General Assembly, 2016. It is speculated that by 2050, AR will be the biggest killer surpassing cancer. Though antibiotic resistant (ART) pathogens are a major threat, we have ignored the significance of food-borne commensal micro-flora as vector for spreading AR in the community. Commensals outnumber pathogens by vast margin and may harbour large ART gene pool thus contributing in evolution of AR in pathogens by lateral gene transfer. Factors like uncontrolled use of antibiotics as growth promoters, disease prophylaxis, metaphylaxis in animal husbandry and aquaculture, besides overuse and misuse by humans may lead to emergence of ART microorganisms. Mumbai; a overcrowded coastal city with high demand for seafood is subjected to various anthropogenic activities like sewage, industrial waste, agricultural runoff and aquaculture that increase the prevalence of AR determinants in microbial communities. In retail fish samples studied, we found high ART microbial diversity. Majority of them were commensals like E. coli, Providencia alkalifaciens, Staphylococcus arlettae, Macrococcus caseolyticus, Proteus vulgaris, Bacillus cereus etc. These organisms had multiple antibiotic resistant (MAR) index as high as 0.5. Most of these microorganisms harboured R-plasmids which carried ART traits on them. This facilitates rapid mobility of AR within food microbes. All this highlight the grave problem we are facing in terms of food quality consumed and safety standards implemented in maintaining it. Hence there should be coordinated efforts of both research and government food safety organizations to prevent AR spread via food chain and monitoring food quality.

Keywords: *Antibiotic resistance, antibiotic resistant genes, food commensals, marine fishes, R-plasmids*

Introduction:

In the past decade there has been a phenomenal rise in the emergence of antibiotic resistant (ART) pathogens. These resistant pathogens untreatable by a wide class of antibiotics are a real concern for human health and wellbeing. The food-borne infections world-wide constitutes a major public health burden and represents a significant cost to society in many countries.

The impact of food-borne illnesses in India is poorly understood because of weak surveillance. Though most of the research has been done with the ART pathogens, the magnitude of the ART gene pool in food-borne commensal microbes (Wang et al. 2006) has not been studied in detail. Commensals outnumber pathogenic organisms by a vast margin in food micro biota and hence may be act as a potential reservoir of ART traits easily transmissible to pathogenic microorganisms. It is widely reported that the ART components may get transferred from non-pathogenic microorganisms to pathogens through HGT events (Andremont 2003). A constant influx of ART commensals in human gastrointestinal

tract through food, coupled with HGT events between commensal and pathogenic microorganisms may influence the antibiotic resistance of the human gut micro-biota.

There are numerous reasons for the occurrence of ART organisms, like unprecedented and uncontrolled use of antibiotics by humans. These antimicrobial agents are also used for growth promotion, disease prophylaxis, metaphylaxis and treatment in animal husbandry and aquaculture (Gyles 2008; Pattanayak 2010; Jiang et al. 2012). Such extensive use of antibiotics in animal food can indirectly lead to antibiotic resistance in humans thus untreatable by most of the currently used clinical antibiotics. Analyzing the prevalence of multiple drug resistant food-borne commensals; considering their pivotal role in horizontal gene transfer (HGT) of antibiotic resistant traits is necessary for creating awareness regarding antibiotic use and effective control of pathogens before they enter the food chain. Further Mumbai is a densely populated coastal city with its coastal belt coming under immense anthropogenic impact like agricultural, industrial and municipal sewage runoff which could contribute to rise in AR among microbial populations from marine fishes. In this present study, we isolated and characterized multidrug resistant (MDR) food borne commensals from commonly consumed retail fish and their plasmid profile was analyzed. Also plasmids were screened for ART genes by PCR to confirm plasmid mediated AR.

Materials and Methods:

Eight MDR commensals were isolated from commonly consumed different marine fishes in and around Mumbai. These ART organisms were selected from colonies initially grown on five different antibiotics viz. bacitracin, ciprofloxacin, doxycycline, erythromycin and trimethoprim. Further they were screened by 16S rDNA sequencing. Commensals belonging to different families like *E. coli*, *Providencia alkalifaciens*, *Stphylococcus arlettae*, *S. epidermidis*, *Macrococcus caseolyticus*, *Proteus vulgaris*, *Bacillus cereus* and *B. safensis* were identified.

Antibiotic susceptibility testing

Susceptibility testing was done by the standard disk diffusion method as described by Bauer *et al*. (1966) on Mueller-Hinton agar and incubated at 37^{o}C for18-24h. Reference strain used was *E. coli* ATCC 25922. Following antibiotic discs (µg/disc) (Himedia Laboratories, Mumbai, India) were used; bacitracin (10units), ciprofloxacin (5), chloramphenicol (30), cefotaxime (30), doxycycline (30), erythromycin (15), gentamicin (50), kanamycin (5), neomycin (30), penicillin G (10 units), rifampicin (30), streptomycin (25) and trimethoprim (10). Results were interpreted according to EUCAST breakpoint tables.

Plasmid isolation

Plasmid DNA from identified isolates was extracted by QIAprep Spin Miniprep kit (Qiagen, GmbH, Germany). All centrifugation steps were performed at 13000 rpm. Plasmids were resolved by agarose gel electrophoresis on 0.8% agarose with a 1 kb molecular weight marker for the complete plasmid profile.

PCR amplification of ART genes

Extracted plasmid DNA was used as template for profiling ART genes by PCR. The primer sequences and annealing temperatures utilized is given in Table 1. Reaction mix was setup in 10µl volume. 2x PCR Taq mixture (Himedia Laboratories, Mumbai, India) was used. Cycling conditions were as follows; initial denaturation at 94^{0} C for 8 min followed by 35 cycles of denaturation at 94^{0} C for 20 sec, primer annealing for 30 sec, extension at 72^{0} C for 40 sec, and final extension at 72^{0} C for 5 min. PCR products were resolved on 1.5% agarose gel by electrophoresis

.

Table 1 Details of primers used for PCR

Target gene	Primer	Sequence (5'-3')	Conferring resistance against	PCR product size (bp)	Annealing temperature (^{o}C)
aadA	*aadA* F	ACCGTAAGGCTTGATGAAACA	Streptomycin, Kanamycin	624	57
	aadA R	TTCCAAAAGGTCGTTGATCAAA			
bla$_{CTX-M}$	*blaCTX-M* F	CGATGGGACGATGTCACTG	Cefotaxime, Penicillins	500	59
	blaCTX-M R	CGGCTTTCTGCCTTAGGTT			
bla$_{TEM}$	*bla$_{TEM}$* F	GCACGAGTGGGTTACATCGA	Cephalosporins, Penicillins	310	60
		GGTCCTCCGATCGTTGTCAG			
dfrA1	*dfrA1* F	TGGTAGCTATATCGAAGAATGG AGT	Trimethoprim	425	60
	dfrA1 R	TATGTTAGAGGCGAAGTCTTGGG TA			
tetA	*tetA* F	GCTACATCCTGCTTGCCTTC	Doxycycline	205	67
	tetA R	CATAGATCGCCGTGAAGAGG			

Results:

Table 2 Antibiogram and MAR index of MDR commensals from retail fish samples

Isolate	Food commensal	Resistance pattern	MAR index
1.	*Escherichia coli*	Bac, Cef, Dox, Ery, Kan, Neo, Pen, Rif, Trm, Cip	0.77
2.	*Providencia alkalifaciens*	Bac, Ery, Neo, Pen, Rif, Trm, Cip	0.54
3.	*Proteus vulgaris*	Bac, Dox, Ery, Pen, Rif	0.38
4.	*Staphylococcus arlettae*	Bac, Ery, Pen, Trm	0.31
5.	*Staphylococcus epidermidis*	Ery, Neo, Pen, Trm	0.31
6.	*Macrococcus caseolyticus*	Ery, Neo, Trm, Cip	0.31
7.	*Bacillus cereus*	Bac, Ery, Kan, Neo, Pen, Rif	0.46
8.	*Bacillus safensis*	Neo, Cip	0.15

Table 2 represents ART profile of isolated commensals. Most of the organisms were found to be resistant to bacitracin, erythromycin, neomycin and penicillin. All these are clinically important antibiotics. Complete absence of resistance was seen against few clinically significant antibiotics like

chloramphenicol, gentamycin and streptomycin while only one isolate showed resistance to cefotaxime. Five and four out of 8 isolates showed resistance against trimethoprim and ciprofloxacin respectively. Few isolates showed co-resistance phenotype for bacitracin-erythromycin-neomycin-penicillin or erythromycin-neomycin-penicillin. Greater than 0.2 multiple antibiotic resistance (MAR) index suggests increased load of ART microbial contamination where antibiotics are used (Osundiya et al. 2013).

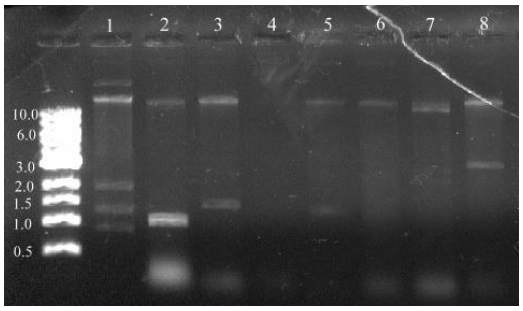


Fig. 1 Plasmid profile of MDR food commensals isolated from retail fish samples.
Lane 1- *E. coli*, Lane 2- *P. alkalifaciens*, Lane 3- *P. vulgaris*, Lane 4- *S. arlettae*, Lane 5- *S. epidermidis*, Lane 6- *M. caseolyticus*, Lane 7- *B. cereus*, Lane 8- *B. safensis*

The plasmid profile of commensal organisms is shown in Fig. 1. All the strains except for *S. arlettae* harboured similar size plasmid of greater than 10kb. However *E. coli* had 2 high molecular weight plasmids of above 10 kb and 3 lower size plasmids in the range of 0.75 to 2 kb. *P. alkalifaciens*, *P. vulgaris*, *S. epidermidis* and *B. safensis* also harboured two plasmids in the range of 1kb to 15kb.

a. b.

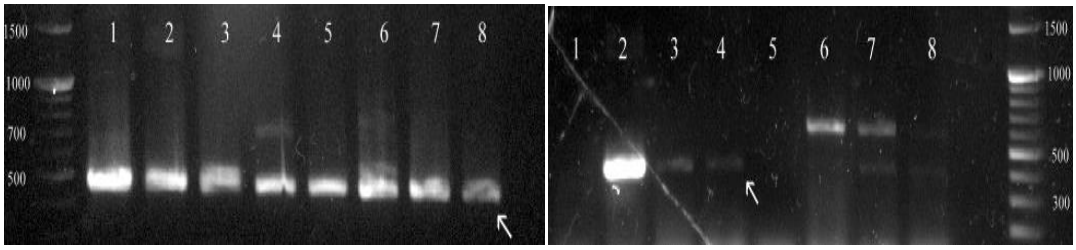


Fig. 2 PCR gel pictures for representative amplified genes; a. bla$_{CTX-M}$ and b. dfrA1 of the 8 isolates from retail fish samples. Lane 1- *E. coli*, Lane 2- *P. alkalifaciens*, Lane 3- *P. vulgaris*, Lane 4- *S. arlettae*, Lane 5- *S. epidermidis*, Lane 6- *M. caseolyticus*, Lane 7- *B. cereus*, Lane 8- *B. safensis*

Table 3 ART gene amplification of plasmids by PCR

Isolate	Species	No. of plasmids	ART gene profile					Corresponding AR phenotype
			aadA	*bla$_{CTX-M}$*	*dfrA1*	*tetA*	*bla$_{TEM}$*	
1.	*E. coli*	5	-	**+$^{@}$**	-	+	+	Cef, Dox, Pen
2.	*P. alkalifaciens*	2	+	+	+	+	+	Pen, Trm
3.	*P. vulgaris*	2	+	+	+	+	+	Dox, Pen
4.	*S. arlettae*	1	+	+	+	+	+	Pen, Trm
5.	*S. epidermidis*	2	+	+	-	+	+	Pen
6.	*M. caseolyticus*	1	-	+	-	+	+	-
7.	*B. cereus*	1	-	+	-	+	+	Pen
8.	*B. safensis*	2	+	+	-	+	+	-

$^{@}$ Gene amplification corresponding with phenotypic expression for AR is represented in bold

Genotypic profile generated by PCR corresponded with observed resistant phenotype in most cases as represented in Table 3. The $bla_{CTX-M,}$ bla_{TEM} and *tetA* were the most prevalent genes identified in this study followed by *aadA*. Resistance to trimethoprim was mediated by *dfrA1* as observed in 3 isolates. *P. vulgaris*, though harboured *dfrA1* showed susceptibility to trimethoprim. *aadA* gene conferring resistance to streptomycin and kanamycin was seen in 5 isolates. However all these isolates were phenotypically susceptible to both aminoglycosides. Though β-lactamase encoding genes; bla_{CTX-M} and bla_{TEM} were present in all isolates, except for *E. coli*, all other isolates were susceptible to cefotaxime while 2 isolates were susceptible to penicillin. Isolates like *E. coli* and *P. vulgaris* resistant to doxycycline harboured *tetA* gene on their plasmids. Three isolates possessed *aadA* and dfrA1 gene together on their plasmids.

Discussion:

Co-resistance to different class of antibiotics highlights the fact that unlike other reports (Houang and Greenwood 1977) cross resistance leading to MAR need not be necessarily associated with antibiotics belonging to same class. Resistance against cefotaxime in *E. coli* is matter of concern considering their significance in treating serious enteric infections (Pitout and Church 2004) and knowing the fact that *E. coli* is known to transfer AR traits to pathogens at a high rate (Nsofor and Ukwandu 2016). Doxycycline resistance in commensals is due to extensive use of tetracycline in aquaculture and animal farming (Jiang et al. 2012). Trimethoprim resistances observed in couple of species even in absence of its usage in aquaculture suggest cross-resistance or inter ecosystem spread. Ban on use of chloramphenicol and streptomycin in aquaculture explains complete susceptibility to these antibiotics observed in these isolates.The similar co-resistance patterns among isolates is probably due to similar high molecular weight R-plasmids carrying these resistant traits (Chitnis et al. 2000).

The prevalence of R-plasmids confirms mostly plasmid origin of observed MAR in the isolated commensals from fish. R-plasmid associated antibiotic resistances have been reported elsewhere also (Joshi et al. 2003; Rajini et al. 2003). Multiple plasmids including R-plasmid with high MAR index in *E. coli* confirms its role as an agent for transferring ART traits to other harmful pathogens in human gut. The inter- and intra-genus transfer of ART traits using MDR *E. coli* in aqueous setting has been reported (Grabow and Prozesky 1973). This is a serious concern since highly MDR *E. coli* with multiple plasmid bands have been isolated from marine fish samples in present study. Other reports have also documented multiple ART traits bearing plasmids in *E. coli* (Vigil et al. 2009). Consumption of such commensals harbouring MDR plasmids via food chain is detrimental to human health as it might cause lateral transfer of ART traits to gut bacteria leading to evolution of new ART pathogens. R-plasmid prevalence in *P. alkalifaciens* and *B. safensis* has not been widely reported elsewhere while there are rare findings about prevalence of MDR plasmids in *M. caseolyticus*, *P. vulgaris*, *S. epidermidis* and *B. cereus* (Tsubakishita et al. 2010; Abo-Amer and Shobrak 2015; Bender et al. 2015; Lobova et al. 2015).

The high prevalence of *tetA* gene among fish commensals confirms the extensive usage of tetracyclines in aquaculture. There are reports of *tetA* prevalence in *Vibrio* species from aquatic shrimps (Han et al. 2015). *CTX-M* gene is most dominant form of extended spectrum β-lactamase (ESBL) of animal source, though more recently they are also prevalent in humans. High distribution of this gene specifically in *Enterobacteriaceae* isolates in present study confirms other

findings about worldwide distribution of *CTX-M* from *Enterobacteriaceae* members found in clinical specimens (Karczmarczyk et al. 2011). Another ESBL encoding gene bla_{TEM} was prevalent in all isolates is an indication of long history of exposure to the β-lactam class of antibiotics. These were amongst the first antibiotics used and since then have been extensively applied in human, animal and aquaculture. This has led to increased resistance to this class of antibiotics (Shaikh et al. 2015). Few susceptible isolates to antibiotics showing positive amplification for corresponding ART traits might be due to defects in those genes or there reduced expression required\ to confer resistance. Co-existence of *aadA* and *dfrA1* suggests their presence as part of gene cassettes on *Class I* integrons harboured by R-plasmids. *Class I* integrons isolated from *Enterobacteriaceae* family are reported to carry *aadA*, *dfrA1* and *sul1* genes together as gene cassettes (Sung and Oh 2014).

Overall the present study confirms high possibility of lateral dissemination of ART traits across the microbial community mediated by highly mobile R-plasmids and integrons harbouring these traits.

Conclusion:

Our study suggests that the commensal organisms isolated from food samples (retail fish) act as vast reservoirs of multiple antibiotic resistant traits. Further. genes for these MAR are encoded by high molecular weight R-plasmids. Possibility of these R-plasmids harbouring *Class I* integrons carrying ART gene cassettes coupled with their high mobility makes them a potent weapon in lateral dissemination of ART traits across the gut micro-flora via food chain leading to rise of new ART pathogens. Mumbai, being a tourist destination, is an easy target for inter-country spread of AR mediated by HGT events through foreign travelers. More studies have to be performed like transformation and conjugation to study inter and intra generic spread of AR among the microbial community.

Acknowledgements: The present study was supported by the financial grant from Department of Atomic Energy-Board of Research in Nuclear Sciences (DAE-BRNS), Sanction no. 2012/37B/50/BRNS. The authors would like to acknowledge technical help from Ms. Amruta Dhawale.

Conflict of interest: No potential conflict of interest to declare.

References:

1. Abo-Amer AE, Shobrak MY. 2015. Isolation and Molecular Characterization of Multidrug-Resistant Salmonella, Shigella and Proteus from Domestic Birds. *Thai J Vet Med*. 45(1):23-34.
2. Andremont A. 2003. Commensal flora may play key role in spreading antibiotic resistance. *ASM News*. 69:601–607.
3. Bauer AW, Kirby WMM, Sherris JG, Turk A. 1966. Antimicrobial susceptibility testing by standardized single disc method. *Am J Clin Pathol*. 45:493-496.
4. Bender J et al. 2015. Linezolid resistance in clinical isolates of Staphylococcus epidermidis from German hospitals and characterization of two cfr-carrying plasmids. *J Antimicrob Chemother*. 70:1630–1638.
5. Chitnis V, Chitnis D, Patil S, Ravikant. 2000. Hospital effluent- A source of multiple drug resistant bacteria. *Curr Sci*. 79(7):989-991.
6. European Committee on Antimicrobial Susceptibility Testing (EUCAST), Breakpoint tables for interpretation of MICs and zone diameters, version 5.0. h
7. ttp://www.eucast.org/fileadmin/src/media/PDFs/EUCAST_files/Breakpoint_tables/v_5.0_Breakpoint_Table_01.pdf, 2015.
8. Grabow WOK, Prozesky OW. 1973. Drug resistance of coliform bacteria in hospital and city sewage. *Antimicrob Agents Chemother*. 3(2):175-180.

9. Gyles CL. 2008. Antimicrobial resistance in selected bacteria from poultry. *Anim Health Res Rev*. 9(2):149–158.
10. Han JE, MohneyLL,Tang KFJ, Pantoja CR, Lightner DV. 2015. Plasmid mediated tetracycline resistance of Vibrio parahaemolyticusassociated with acute hepatopancreatic necrosis disease (AHPND) in shrimps. *Aquaculture Reports*. 2:17–21.
11. Houang ET, Greenwood D. 1977. Aminoglycoside cross-resistance patterns of gentamicin-resistant bacteria. *J Clin Path*. 30:738-744.
12. Jiang HX, Tang D, Liu YH, Zhang XH, Zeng ZL, Xu L, Hawkey PM. 2012. Prevalence and characteristics of β-lactamase and plasmid-mediated quinolone resistance genes in Escherichia coli isolated from farmed fish in China. *J Antimicrob Chemother*. 67(10):2350-2353.
13. Joshi S, Litake GM, Ghole VS. 2003. Plasmid born extended spectrum β-lactamase in a clinical isolate of Acinetobacter baumannii. *J Med Microbiol*. 52:1125-1127.
14. Karczmarczyk M, Abbott Y, Walsh C, Leonard N, Fanning S. 2011. Characterization of Multidrug-Resistant Escherichia coli Isolates from Animals Presenting at a University Veterinary Hospital. *Appl Environ Microbiol*. 77(20):7104–7112.
15. Lobova TI, Yemelyanova E, Andreeva IS, Puchkova LI, Repin VY. 2015. Antimicrobial Resistance and Plasmid Profile of Bacterial Strains Isolated from the Urbanized Eltsovka-1 River (Russia). *Microb Drug Resist*. 21(4):477-490.
16. Nsofor CA, Ukwandu NCD. 2016. Transfer of Resistance Plasmids between Escherichia coli Isolates from Domestic Livestock. *EC Microbiology*. 3(1):402-408.
17. Osundiya OO, Oladele RO, Oduyebo OO. 2013. Multiple Antibiotic Resistance (MAR) Indices of Pseudomonas and Klebsiella Species Isolates in Lagos University Teaching Hospital. *Afr J Cln Exper Microbiol*. 14(3):164-168.
18. Pattanayak S. 2010. Development of resistance in bacteria against anti-microbial agents: Reasons, Threats and ongoing Encounter. *EAMR*. 1:7-19.
19. Pitout JDD, Church DL. 2004. Emerging gram-negative enteric infections. *Clin Lab Med*. 24:605–626.
20. Rajini, Rani DB, Mahadevan A. 1992. Plasmid mediated metal and antibiotic resistance in marine Pseudomonas. *Biometals*. 5(2):73-80.
21. Shaikh S, Fatima J, Shakil S, Rizvi SM, Kamal MA. 2015. Antibiotic resistance and extended spectrum beta-lactamases: Types, epidemiology and treatment. *Saudi J BiolSci*. 22:90–101.
22. Sung JY, Oh JE. 2014. Distribution and Characterization of Integrons in Enterobacteriaceae Isolates from Chickens in Korea. *J Microbiol Biotechnol*. 24:1008–1013.
23. Vigil KJ et al. 2009. Multidrug-resistant Escherichia coli bacteremia in cancer patients. *Am J Infect Control*. 37(9):741-745.
24. Wang HH, Manuzon M, Lehman M, Wan K, Luo H, Wittum TE, Yousef A, Bakaletz LO. 2006. Food commensal microbes as potentially important avenue in transmitting antibiotic resistance genes. *FEMS Microbiol Lett*. 254:226–231.
25. Tsubakishita S, Kuwahara-Arai K, Baba T, Hiramatsu K. 2010. Staphylococcal Cassette Chromosome mec-Like Element in Macrococcus caseolyticus. *Antimicrob Agents Chemother*. 54(4):1469–1475.

Leaching Characteristics of Trace and Toxic Metals from Soil-Fly Ash Admixtures at Environmental Conditions

Sandeep P., Sukanta Maity, D. K. Chaudhary, C. B. Dusane, S. K. Sahu* and G. G. Pandit

Environmental Monitoring & Assessment Section,
Health Safety & Environment Group, Bhabha Atomic Research Centre, Trombay, Mumbai-400085
*Corresponding author: Tel. +912225592375; fax: +91225505151
*E-mail address: sksahu@barc.gov.in (S.K. Sahu)

Abstract

Coal has always been a very important energy source for India. Research has shown that coal fly ashes can be effective in stabilizing soils. However, because fly ash contains toxic trace elements, the use of fly ash in various applications can present a potential risk to the environment. Hence it is important to study the leaching behavior of trace and toxic metals from soil-FA admixtures. In the present study, leaching behavior of toxic metals (viz. Se, Cr and V) was carried out by varying the percentage mass fraction of FA and soil. Accordingly, FA weight percentage was varied from 20% to 80% by maintaining sum of soil and FA weight to 12.5g.

Leaching study for soil-FA mixture was carried out by varying the leachant pH from 5 to 9. The results indicate that, as the FA weight percentage increases the leachability of metals also found to be increased. The leachability for Se was found in the range of 50.4 - 460.2 ng/g. Among these metals V has the highest leachability followed by Se and Cr. The present study result indicates that Se leachable concentration can contaminate the ground water quality.

1. Introduction

Coal is the most abundant and widely spread fossil energy resource in the world (Benito et al., 2001). With growing energy demand, many industrialized and developing countries will continue to rely on coal for power generation in the decades to come. Coal has always been a very important energy source for India (Singh et al. 2012). About 70% of the total power generated in India contributed by the thermal power plants. Any energy source brings with it some technological advantages and disadvantages, as well as some environmental benefits and problems. Coal combustion by coal-fired power plants, cement plants, and steel plants produces large quantities of coal fly ashes (FA) worldwide. Indian lignites are typically low-grade coals which have very low calorific value and high mineral matter content. It has been reported in various studies that extreme, high ash yields can reach that range from 23% to 64% (Karayigit et al., 2000; Esenlik et al., 2006), which produce huge quantities of coal fly ash to be disposed. In India approximately, 170 million tonnes of FA per annum was produced in 2012 and is

expected to increase in the range of 300–400 million tonnes per annum by 2017. Although coal fly ash is partly used in concrete and cement manufacturing, more than half percent of the production is disposed of in landfills (WWCCPN, 2011).

Recent studies (Tastan et al., 2012; Cetin et al., 2010) have shown that FAs can be useful in soils stabilization to improve soil strength, durability, and stiffness. Accordingly, in situ soil stabilization with fly ash has become a practical and economical solution for soil stabilization. It has been reported that trace

element concentrations in FA are sometimes 4–10 times higher than their original concentrations in coal samples. The reuse of FAs for roadway construction and for other different applications has spurred interest in understanding its environmental impact with focus on metal release to ground water when FA comes in contact with water (Jegadeesan et al., 2008; Choi et al., 2002; Galbreath et al., 2004; Świetlik et al., 2012; Baba et al., 2010; Cetin et al., 2012a, b; Cetin et al., 2014). Lau and Wong (2001) found that different elements have different leaching behaviors because of differences in elemental properties and pH of the solution, which strongly influence leaching behavior (Świetlik et al., 2012). Hence, studying the pH-dependent leaching behavior and mechanisms controlling leaching of major and trace elements from soil-fly ash mixture is important for assessing the environment impacts associated with using fly ash in soil stabilization.

For better understanding the possible environmental impacts, we investigated the leaching of selected trace metals from FA generated at two power plants. The objective of this study is to investigate leaching behavior of soil-fly ash mixtures at different FA weight percentages and at pH conditions. The study focused on the leaching behavior of selenium (Se), chromium (Cr) and vanadium (V).

2. Materials and Methods

2.1 Sampling

FA samples used for the leaching experiments were collected from dust hoppers of a thermal power plant (TPP) in India. In the present study, multiple numbers of samples were collected from the electrostatic precipitators and were mixed to get one representative sample. Samples were stored in a clean polyethylene bags until chemical analyses and leaching studies were carried out. Soil samples were collected from different location around the TPP. All the soil samples collected at TPP were also mixed to get a representative soil sample. The corresponding representative FA and soil samples of study locations were mixed by varying the FA weight percentages from 20%, 40%, 60% and 80% keeping sum of soil and FA weigh to 12.5g.

2.2 Estimation of total metal concentration in FA

It is a crucial step prior to leaching experiments. To achieve this purpose, microwave assisted acid digestion method was used. About1 g of FA was weighed in replicate into Teflon beakers containing 10 ml HNO_3 and 2 ml HF. After microwave digestion, the resulting solutions were transferred into Teflon beakers and heated on a hot plate to remove excess acid. The remaining solutions were filtered into the 25 ml volumetric flask by giving multiple washing to the sample beakers using 0.25 % HNO_3. For Se analysis, FA samples were acid digested at a relatively lower temperature to avoid volatilization. Resulting sample solutions were analyzed for various metals of interest using (ICP-AES, Jobin–Yvon Horib, and model ULTIMA 2) and Hydride Generation Atomic AbsorptionSpectroscopy (HG-AAS).

2.3 Leaching study

In the present work, all the leaching studies were carried out using Grant shaking water bath (model OLS200), which has both the orbital and linear motion facility. Operating temperature and orbital linear shaking speed are in the range of 5–80^{0}C and 20–200 rpm respectively. In the present study all the batch leaching experiments were carried out for 24 hat 150 rpm shaking speed (Deepak et al. 2012). Concentrations of trace metals in FA leachate solutions were determined by various analytical techniques as mentioned above. During metal analysis, instruments were calibrated for each metalusing a set of three to five high-quality standards supplied by VHG Labs manufactures, USA. The calibration

curvewas checked frequently by injecting a known standard andthe data was subsequently corrected for any observed minute deviation.

2.4 Leaching study

The pH dependent leaching tests were performed at varying leachate solution pH values from 5 to 9 on Soil-FA mixed samples. Deionized water was added to the flask containing Soil-FA mixture (12.5 g) in combination with HNO_3 or NaOH to obtain the desired endpoint pH of the Soil-FA-water system. After leaching for 24 h, the leachate solutions were centrifuged at 6000 rpm for 15 min and separated from the solid residue by filtering through a 0.45 µm filter paper. The leachate solutions were poured into acid cleaned beaker and digested for 8 h on a hot plate by adding 1–2 ml of concentrated HNO_3. Excess solution was reduced to near dryness and left out solution was filtered into the 25 ml volumetric flask by giving multiple washing to the sample beaker to assure complete transfer of leached out elements (Bably and Kajal, 2008). Processed leachate solutions were analyzed for various trace and toxic metals of interest.

3. Results and Discussion

The total concentration of Cr, Se and V associated with FA is presented in Figure 1. Among these metals Cr observed to have the highest concentration followed by V and Se. The metals concentration observed in the present study are found in the concentration range reported in the literature.

The leaching study results for V, Cr and Se are presented in Figure 2a, 2b and 2c respectively. It is observed that as the FA weight percentage increases from 20% to 80% the leaching concentration of V, Cr and Se are also increases.

Among these metals, V was observed to have the highest leachability followed by Se and Cr. At pH 5 of leachate solution with 20% of FA, the leaching concentration of V, Cr and Se was found to be 170.4 ng/g, 50.4 ng/g and 35.0 ng/g respectively. As the FA weight percentage increased to 80% (at pH 5), the leaching concentration of V, Se and Cr was increased to 3230.6 ng/g, 460 ng/g and 256.4 ng/g respectively. The leachable concentration was increased to about 19 times for V, 9 times for Se and to 7 times for Cras the FA weight percentage increased from 20% to 80%.

The highest leachability of V could be due to the occurrence of V both in clay minerals and in the easily volatilized organic matter in coal (Finkelman, 1995) which on combustion results in high surface association in FA. In the case of selenium also the surface association might be the reason for observed high leachability. Irrespective of its mode of occurrence inthe coal matrix, Se might react with Ca and form stable compounds (Shah et al., 2008) condensing on the surface of ash particles causing it to have higher solubility compared to other metals (Cornelis et al., 2008). The low leaching behavior of Cr could be due to the fact that Cr generally present as Cr^{+3} in fly ash (Spearsa et al., 2004; Goodarzi et al., 2008), and is mostly associated with the aluminosilicate phase (glass) causing it to difficult to release from FA matrix.

Although, V has the highest leachability but in terms of percentage leachability Se was observed to have the highest value followed by V and Cr. The percentage leachability of Se was observed in the range from 1.7% to 15.9%. Other study reports (Iwashita et al., 2005; Nugteren et al., 2001) indicates that with water, 10–50% of Se has been found to be leachable from a large number of fly ash samples worldwide. In the case of V, the leaching percentage was observed in the range of 0.15% to 2.84% which is within the range (0.1% - 4%) reported by Moreno et al., 2005. Cr found to have very low percentage

leachability with values observed in the range of 0.03% to 0.26%.

Figure 2 also shows the variation in leachability of V, Se and Cr with respect to leachate solution pH. From Figure 2 it can be observed that as pH increases from 5 to 9, the Se leachability also observed to be increased. This could be due to the presence of Al and Fe-oxyhydroxides in large amounts in fly ash that has a strong affinity to sorb selenates (Belvisoet al., 2015; Izquierdo et al., 2012; Iwashita et al., 2005; Otero-Rey et al., 2005). This adsorption decreases with the increase of pH. The change in concentration of Se as a function of pH can be explained by the species in the leachate and pH-dependent surface charge of soil and fly ash. Negatively charged oxyanionic Se (e.g., SeO_3^{2-} or SeO_4^{2-}) precludes adsorption onto the negatively charged surface of the fly ash and soil contributing to high Se concentrations at alkaline pH.

In the case of V and Cr also, the leachability increased as the leachate solution pH increases. For e.g., the V leachability at 40% of FA weight increased from 421.0- 646.6 ng/g, similarly Cr leachability increased from 62.6- 113.0 ng/g. It was observed that as the FA weight percentage increases the concentration ratio of V and Cr at pH 5 to that observed at pH 9 was increased gradually.

4. Conclusion

In the present study, V was observed to have the highest leachability as compared to Se and Cr. As the FA weight percentage increases the leachability was also found to be increased for all the metals of interest. In terms of percentage leachability Se was found to have highest leachability (15.9%) followed by V and Cr. The leachate pH was also found to have significant effect on the metal's leachability. All the metal's leachability was found to be increased as the pH of leachate increases. Among Se, Cr and V, the leachable concentration of Se fromsoil-FA mixture can moderately contaminate the ground water-quality.

List of figures

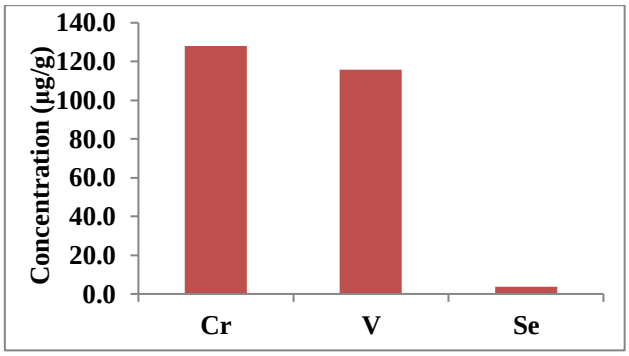


Figure 1

Figure 1: Concentration of Cr, V and Se in FA

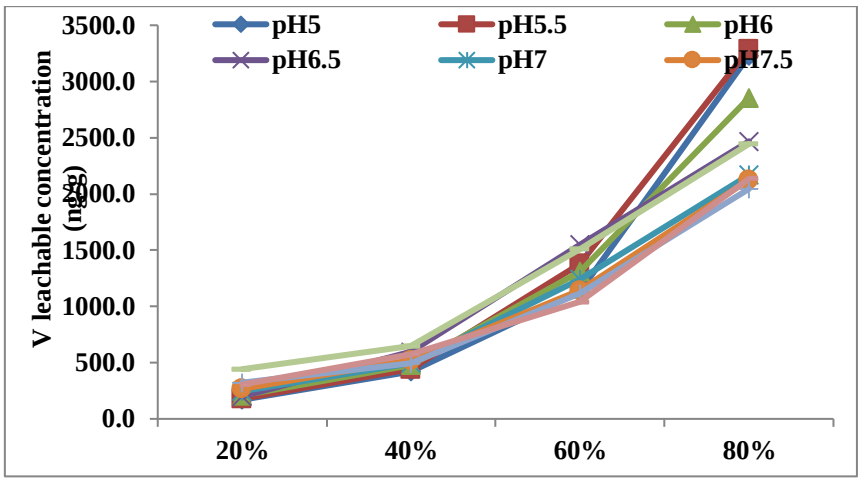


Figure 2a: Variation of leaching behavior of Vanadium with variation in FA quantities

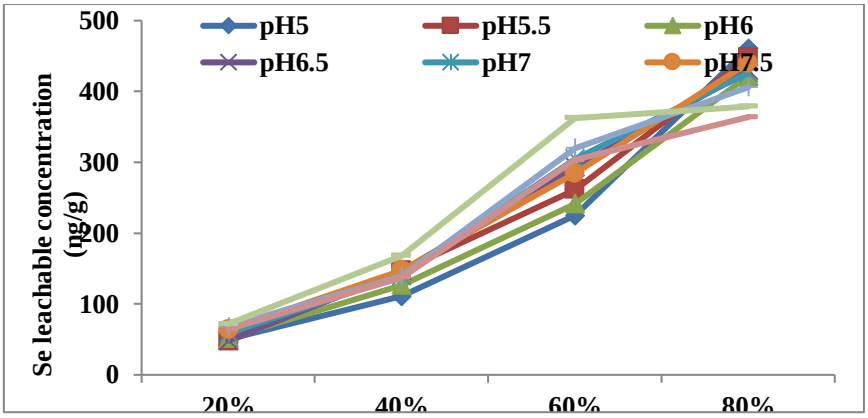


Figure 2b: Variation of leaching behavior of selenium with variation in FA quantities

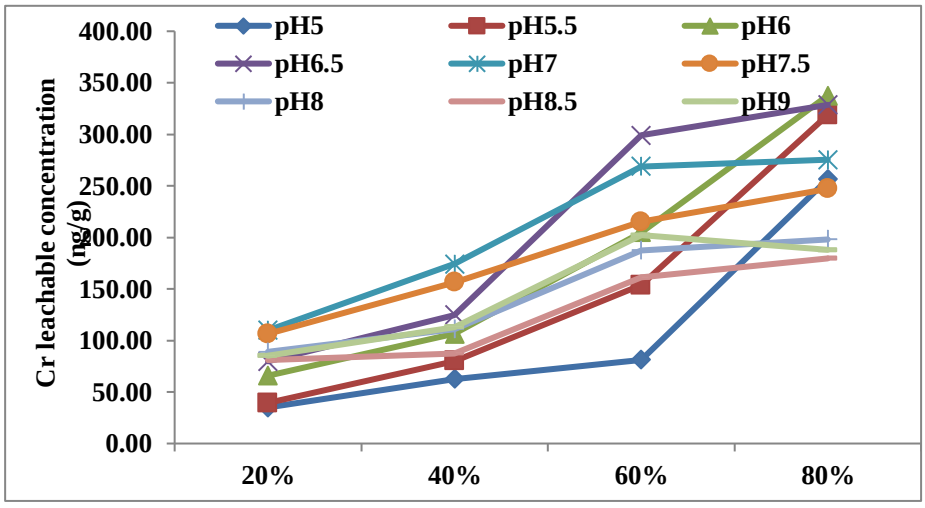


Figure 2c: Variation of leaching behavior of chromium with variation in FA quantities

References

1. Benito, Y., Ruiz, M., Cosmen, P., Merino, J.L., 2001. Study of leachates obtained from the disposal of fly ash from PFBC and AFBC processes. Chemical Engineering Journal. 84, 167.
2. Singh, R.K., Gupta, N.C., Guha, B.K., 2012. The leaching characteristics of trace elements coal fly ash and an ash disposal system of thermal power plants. Energy Source, Part A-Recovery, Utilization, Environmental Effects. 34, 602–608
3. Karayigit, A.I., Gayerb, R.A., Querol, X., Onacak, T., 2000. Contents of major and trace elementsin feed coals from Turkish coal-fired power plants, International Journal of Coal Geology. 44, 169–184.
4. Esenlik, S., Karayigit, A.I., Bulut, Y., Querol, X., Alastuey, A., Font, O., 2006. Element behavior during combustion in coal-fired Orhaneli power plant, Bursa-Turkey, Geological Acta. 4, 439–449.
5. WWCCPN, 2011. World-Wide Coal Combustion Products Network. http://www.wwccpn.org/2011 Last access: 2011.
6. Cetin, B., Aydilek, A.H., Guney, Y., 2010. Stabilization of recycled base materials with high carbon fly ash. Resources, Conservation and Recycling. 54–11, 878–892.
7. Jegadeesan, G., Al-Abed, S.R., Pinto, P., 2008. Influence of trace metal distribution on its leachability from coal fly ash, Fuel. 87, 1887–1893.
8. Choi, S.K., Lee, S., Song, Y.K., Moon, H.S., 2002. Leaching characteristics of selected Korean fly ashes and its implications for the ground water composition near the ash mound, Fuel 81, 1080–1090.
9. Galbreath, K.C., Zygarlicke, C.J., 2004. Formation and chemical speciation of arsenic-, chromium-, and nickel-bearing coal combustion $PM_{2.5}$, Fuel Processing Technology. 85, 701–726.
10. Świetlik, R., Trojanowska, M., Jóźwiak, M.A., 2012. Evaluation of the distribution of heavymetals and their chemical forms in ESP-fractions of fly ash, Fuel Processing Technology. 95, 109–118.
11. Baba, A., Gurdal, G., Sengunalp, F., 2010. Leaching characteristics of fly ash from fluidized bed combustion thermal power plant: case study: Çan (Çanakkale-Turkey), Fuel Processing Technology. 91, 1073–1080.
12. Cetin, B., Aydilek, A.H., Guney, Y., 2012a. Leaching of trace metals from high carbon fly ash stabilized highway base layers. Resources, Conservation and Recycling. 58, 8–17.
13. Cetin, B., Aydilek, A.H., Li, L., 2012b. Experimental and numerical analysis of metalleaching from fly ash-amended highway bases. Waste Management. 32, 965–978.
14. Cetin, B., Aydilek, A.H., Li, L., 2014. Trace metal leaching from embankment soilsamended with high-carbon fly ash. J. Geotech. Journal of Geotechnical and Geo-environmental Engineering. 140(1), 1–13.
15. Lau, S.S.S., Wong, W.C., 2001. Toxicity evaluation of weathered coal fly ash: amended manure compost. Water Air and Soil Pollution. 128, 243-254.
16. Deepak, K., Lokeshappa, B., Kandarp, S., Anil, K.D., 2012. Mobilization of metals from Indian coal fly ash under dynamic conditions. World Environment. 2(1),1–5.
17. Bably. P., Kajalm K.M.m 2008. Heavy metals leaching in India fly ash. Journal of Environmental Science and Engineering. 50(2),127–132
18. Finkelman, R.B., 1995. Modes of occurrence of environmentally-sensitive trace elements in coal. In: Swaine, D.J., Goodarzi, F. (Eds.), Environmental Aspects of Trace Elements in Coal. Springer.

19. Shah, P., S. V., Prince, K., Nelson, P.F., 2008. Speciation of As, Cr, Se and Hg under coal fired power station conditions. Fuel 87, 1859–1869.
20. Cornelis, G., Johnson, C.A., Van Gerven, T., Vandecasteele, C., 2008. Leaching mechanisms of oxyanionic metalloid and metal species in alkaline solid wastes: a review. Applied Geochemistry. 23, 955–976.
21. Spearsa, D.A., Martinez-Tarrazona, M.R., 2004. Trace elements in combustion residues from a UK power station. Fuel. 83, 2265–2270.
22. Goodarzi, F., Huggins, F.E., Sanei, H., 2008. Assessment of elements, speciation of As, Cr, Ni and emitted Hg for Canadian power plant burning bituminous coal. International Journal of Coal Geology. 74, 1–12.
23. Iwashita, A., Sakaguchi, Y., Nakajima, T., Takanashi, H., Ohki, A., Kambara, S., 2005. Leaching characteristics of boron and selenium for various coal fly ashes. Fuel 84, 479–485.
24. Nugteren, H.W., Janssen-Jurkovícová, M., Scarlett, B., 2001. Improvement of environmental quality of coal fly ash by applying forced leaching. Fuel. 80, 873–877.
25. Moreno, N.,Querol, X., Andrés, J.M., Stanton, K., Towler, M., Nugteren, H., Janssen-Jurkovicová, M., Jones, R., 2005. Physico-chemical characteristics of European pulverized coal combustionfly ashes. Fuel. 84, 1351–1363.
26. Belviso, C., Cavalcante, F., Di Gennaro, S., Palma, A., Ragone, P., Fiore, S., 2015. Mobility of trace elements in fly ash and in zeolitised coal fly ash. Fuel. 144, 369–379
27. Izquierdo, M., Querol, X., 2012. Leaching behaviour of elements from coal combustion fly ash: an overview. International Journal of Coal Geology. 94, 54–66.
28. Iwashita, A., Sakaguchi, Y., Nakajima, T., Takanashi, H., Ohki, A., Kambar, S., 2005. Leaching characteristics of boron and selenium for various coal fly ashes. Fuel. 84, 479–85.
29. Otero-Rey, J.R., Mato-Fernandez, M.J., Moreda-Pineiro, J., Alonso-Rodriuez, E., Muniategui-Lorenzo, S., Lopez-Mahia, P., Prada-Rodriguez, D., 2005. Influence of several experimental parameters on As and Se leaching from coal fly ash samples. Analytical Chemical Acta. 531, 299–305.

Correlation studies between Chlorophytes and physicochemical parameters of river Gadhi, Panvel, Maharashtra

Minakshi Gurav*, Madhuri Pejaver, Nitin Wasnik***

*D.G. Ruparel College of Arts, Science and Commerce, Mumbai, 400016

** B.N. Bandodkar College of Science, Thane, 400 601

nitin.wasnik@ruparel.edu

Abstract

Majority studies have shown use of Cyanobacteria to indicate organic pollution in water. There are few reports indicating presence of Chlorophytes in eutrophicated waters. The present paper deals with correlation of some water quality monitoring parameters and chlorophytes in River Gadhi. Two sites were selected for study, one having moderate or no organic pollution and the other site having high organic pollution. They were monitored for 16 months for their hydrology and plankton density and diversity. The relationship between water quality parameters and chlorophytes was analysed using SPSS (two tailed). Moderately polluted site has only few genera showing positive correlation with silicates and chlorides, however, the highly polluted site had many genera showing moderate to strong positive correlation with BOD. Other chlorophytes, except few, did not show much significant relation with water parameters on either sites. The study is best suited to use the chlorophytes as BOD indicators.

Key word: *Pearson correlation, bioindicator, Ankistrodesmus, Chlorella, kirchnerinella*

Introduction

Algae form the major group of organisms in fresh as well as marine water. They play a role as carbon sink, primary producer and resource for many other things useful to human welfare. They are also important indicator for pollution since the physicochemical parameters always reflect the status of water body but does not really reveal how it is going to affect on the organisms. In an effort to characterise more precisely the cumulative impact of human activities on ecosystems, it is important to shift environmental monitoring from sole reliance on chemical indicators towards the increased use of biological conditions (McCormick & Cairns 1994). Algae are the best organisms as bio-indicator since they are very sensitive and have short life span with fast rate of reproduction. Kolkwitz and Marsson (1908) were the pioneers who classified algal species based on their tolerance to various kinds of pollution.Palmer (1969) has developed an index indicating organic pollution based on the occurrence of the organisms in polluted water.Patrick (1971) and Dixit *et al.* (1992) focused on diatom as a flora for evaluating water quality. Gurav and Pejaver (2013) have studied rotifers for its use as water quality indicator. The work by Kalesh & Nair (2005) and Ryback *et al.* (2012) studies accumulation of heavy metals in chlorophytes. Dora *et al.* (2015) explores the potential of algal community as bio-indicator for the River Damodar based on biological indices.Planktonic diversities and densities with respect to its relation to nutritional status of the water was studied by Patil *et al.* (2013).Gurav and Pejaver (2010) also studied the relation between densities and diversities of phytoplankton and nutrient loading in the river Gadhi. The literature review shows fragmented work in the field of potential of Chlorophytes as bio-indicator. The present work attempts to explore the relation between several physicochemical parameters of water and green algaewhich will help in strengthening the use of algae as bio-indicator.

The water body selected for the study is River Gadhi running on the outskirts of Panvel town (longitude 18°58' N and latitude 73° 12' E), Maharashtra, India. The river originates from a small reservoir that gets filled by the rain water running down the hills during rainy season. It runs over a distance of 16 km receiving the drainage and sewers on its way and finally meets Panvel creek. Though it is not perennial, the water remains available at many sites throughout the year. The sources of this water besides rain waterare either the small underground springs or the sewage that runs into the main stream.

Materials and Methods

Two sites were selected on the river, one of which was upstream, approximately 12 km away from the creek. This site has minimum disturbance. It is used for washing clothes, bathing etc. Cattle are found wallowing. Fishing is also done by hand pick method or using traditional gears at very low scale. However, it doesnot receive direct sewage from any source. The other site selected is 10 km downstream the reservoir and 6 km away from the creek. It receives the drainage of New Panvel and the small villages located nearby. The study was conducted for a period of 16 months where the surface water sample was collected monthly once. The samples were collected from either sites in the morning hours in plastic carboy and immediately brought to the laboratory for theanalysis of its physicochemical parameters. The pH, temperature and light penetration were checked on the spot. The DO was fixed using Winkler's reagents. For algae, 500 ml surface water sample was collected in dark colour bottle and immediately fixed with Lugol's iodine. The algae were then concentrated by settling method. Qualitative analysis was done using keys (Ward and Whipple, 1918 and Bellinger, 1992,) and quantitative analysis was performed by using Lackey's drop method.

The Chlorophytes were identified upto genus level. The correlation between different genera with important water parameters which are related with pollution status of the water was found using SPSS software. Two tailed test was performed at the level of significance <0.05.

Results and discussion

Phosphates, nitrates and hardness did not show any significant correlation with the green algae though they are important limiting factors for the growth of algae. The negative correlation of Chlorophyceae with nitrates, turbidity and phosphates was shown by Sharma *et al.*(2016) which is not reflected in the present study. The study of Sharma *et al.*(2016) also showed the strong positive correlation between hardness and Chlorophytes. However, in the present study no green alga has been seen to be correlated with hardness. Agale *et al.* (2013) found lack of correlation between total hardness and Chloropytes which is in accordance with the current findings.

Chlorides and *Kirchneriella* are shown to be positively related at non-polluted site where average chloride concentration was 11.97 mg/lbut did not show any correlation at polluted site where average chlorides were 162.50 mg/l. Ferroni *et al.* (2007) showed that *Kirchneriella* spp. has ability to tolerate salt stress, however he also added that the cells are not completely protected against chronic salt stress. It can be inferred that slight increase in concentration favours the growth of *Kirchneriella* but chronic exposure cannot be tolerated by this genera.

Dissolved oxygen is one of the vital constituent for the aquatic system. The source of oxygen is either atmospheric oxygen or the photosynthetic oxygen produced by water organisms itself. However, the decomposition process uses this oxygen leading to the depletion of the same. The present study does not show any relation of green alga with dissolved oxygen. *Chlamydomonas* showed moderately positive correlation (0.59) with

Table 1: Pearson correlation between algae and physicochemical parameters at Non Polluted site

Name of the genus	*TS*	*CHLO*	*DO*	*T HARD*	*SIL*	*PHOS*	*NIT*	*BOD*
Chlamydomonas	-0.37	0.22	-0.13	0.45	0.44	0.09	-0.20	0.30
Chlorella	-0.36	0.18	-0.09	0.29	0.75	-0.04	-0.22	0.16
Coelastrum	-0.20	0.34	-0.08	0.39	0.33	0.17	-0.28	0.23
Crucigenia	-0.11	0.19	-0.07	0.36	-0.13	0.23	-0.15	0.21
Gloeocystis	-0.40	0.12	-0.10	0.26	0.70	-0.11	-0.14	0.21
Golenkina	-0.18	0.20	-0.08	0.39	0.01	0.21	-0.19	0.23
Kirchneriella	0.42	0.66	0.12	-0.16	0.10	0.08	-0.27	0.08
Monoraphidium	-0.14	0.20	-0.09	0.38	-0.11	0.23	-0.14	0.24
Pediastrum	-0.13	0.24	-0.08	0.38	-0.11	0.23	-0.16	0.24
Scenedesmus	-0.17	0.22	-0.08	0.40	0.06	0.21	-0.19	0.22
Sphareocystis	-0.07	0.30	-0.08	0.36	-0.17	0.25	-0.17	0.26

dissolved oxygen to the polluted site where average concentration of DO was 10.30 mg/l. Though *Chlamydomonas* was even found at non-polluted site it did not show any correlation with dissolved oxygen where average DO was 7.68 mg/l.The high average DO at polluted site is actually due to hyperoxic conditions noted at this site during summer season, the reason of which could be due to eutrophication. Further observation also showed that *Chlamydomonas* was seen only in two months at polluted site, once when the DO was very high (29.69 mg/l) and the other time when DO was very low (2.02 mg/l). Eppley and Mocias (1963) showed that anaerobic conditions favoured the growth of *Chlamydomonas mundana.* Our finding is not in accordance with the findings of Eppley and Mocias (1963).

At non-polluted site the silicate ranged between 1-26 mg/l whereas at polluted site the range was between 1-35 mg/l. The average values of silicates was almost same at either sites (8.4 mg/l at non-polluted site and 9.8 mg/l at polluted sites. The concentration was comparatively higher in summer than rest of the year at both sites. Besides having much similarities, the *Chlorella* has shown positive correlation with silicates at non-polluted site but on the contrary at polluted site *Chlorella* has no significant relation. Instead, a slight negative correlation is seen at polluted site. The work of Mooij*et al.* (2016) showed that in absence of silicates, a green algae community is dominated. It can be inferred from this that the relation between C*hlorella* and silicate could be an incidence and has not do deal with the presence of *Chlorella*. *Gloeocystis* also has shown relation with silicates only at non-polluted site. However, the relation between silicates and *Gloeocystis* is not persistent.

Level of significance <0.05

Table 2: Pearson correlation between algae and physicochemical parameters at Polluted site

Name of the genus	*TS*	*CHLO*	*DO*	*T HARD*	*SIL*	*PHOS*	*NIT*	*BOD*
Ankistrodesmus	-0.16	-0.12	0.28	-0.08	-0.22	0.23	-0.07	0.61
Chlamydomonas	0.10	-0.12	0.59	-0.04	-0.23	0.38	-0.17	0.43
Cholorococcum	-0.16	-0.20	-0.12	-0.24	-0.18	-0.28	-0.17	-0.22
Chlorella	0.15	0.25	0.06	0.35	-0.36	0.37	-0.01	0.55
Coelastrum	0.55	0.46	-0.18	0.36	0.21	-0.03	0.52	0.15
Cosmarium	-0.13	-0.08	0.29	-0.04	-0.33	0.28	-0.02	0.57
Crucigenia	-0.10	-0.05	0.37	-0.01	-0.28	0.31	-0.02	0.63
Golenkina	-0.02	-0.03	-0.15	0.05	-0.08	0.23	-0.10	0.05
Kirchrinella	-0.12	-0.07	0.21	-0.01	-0.21	0.34	-0.09	0.63
Richteriella	-0.12	-0.07	0.34	-0.16	-0.08	-0.04	-0.18	0.20
Pediastrum	-0.10	-0.10	0.04	-0.08	-0.35	0.04	-0.05	0.34
Scenedesmus	0.33	0.34	0.27	0.25	-0.08	-0.14	0.18	0.29
Sphareocystis	-0.11	-0.13	-0.24	-0.14	-0.27	-0.24	-0.14	-0.18
Tetraedron	-0.13	-0.08	0.16	0.00	-0.22	0.45	-0.02	0.60
Tetraspora	-0.19	-0.18	0.01	-0.09	-0.15	0.35	-0.19	0.34

Level of significance <0.05

Non-polluted site has very less BOD ranging from 1.77 to 12.31 mg/l whereas polluted site has very high BOD ranging between 0.93 to 41.41 mg/l. The genera those were restricted to polluted site and showed significant correlation include *Ankistrodesmus, Coelastrum, Cosmarium, Richteriella, Tetradron and Tetraspora*. *Chlorella* though common at both sites showed significant positive correlation only at polluted site with BOD. The relation was insignificant at non-polluted site since the BOD load was not seen at this site. Thongpinyochai and Ritchie (2014) has found *Chlorella* as predominant species in pond water. Tiwari and Chauhan (2006) and Kshirsagar *et al*. (2012) also have mentioned the presence of *Chlorella* in a highly polluted pond.Among several genera described as pollution tolerant by Palmer (1969), Chlorella is one.

Crucigenia is another genus found at polluted site showing strong positive relation with BOD. It was also present at non-polluted site showing weak relation. Ferdous *et al.* (2012) has found the abundance of *Crucigenia* at site where BOD was comparatively low. There are no sufficient evidences in literature indicating the relation between BOD and *Crucigenia* neither the relation with pollution.

Kirchneriella showed strong positive correlation with BOD at polluted site but almost no relation at unpolluted site. *Tetraedron* showed strong positive relation with BOD and was seen only at polluted site. Basavraj *et al.* (2013) found the presence of *Tetraedron* spp. at polluted site. There are no sufficient evidences showing relation between *Tetraedron* and BOD as well as K*irchneriella* and BOD.

Conclusion

The present study is analysis of correlation between various algal species and water parameters present at polluted site and non-polluted sites. The species which were found at non-polluted site with certain correlation did not show the same trend at polluted site and *vice versa.*However, the from the present study and from the study carried out by other researchers, it could be inferred that *Chlorella* spp. and BOD are positively correlated.

There is tremendous potential in algae to be used as a pollution indicator since they represent how the changing water parameters affect biological system. Various indices exists showing correlation between organic pollution and the presence of various species of algae. However, when individual hydrological parameter is compared with the algal species present in the water, persistent correlation is not seen. The present work was carried out to find out the consistency in the correlation between algal species and hydrological parameter considering polluted and non-polluted site. However, no consistent and strong relation is seen. To develop an equation stating correlation between any hydrological parameter and algal species, there is a need of diverse data and testing the relation using statistical tools.

Acknowledgement

The authors are thankful to the management, VPM Thane and C.K.T. College, Panvel for providing infrastructure for conducting the work. Thanks are also to the Principal, D.G. Ruparel College and Head, Department of Zoology, D.G. Ruparel College.

References

1. Agale, M. C., Patil J. V., and Patel, N.G. (2013). Study of seasonal variations of Phytoplankton and their correlation with physicochemical parameters of Budaki Medium Irrigation Tank, Shirpur. Dist.Dhule (M.S.) India. *European Journal of Zoological Research*, 2 (3), pp. 8-16.
2. Andrzej Rybak, BeataMessyasz , BogusławaTeska. (2012). Freshwater Ulva (Chlorophyta) as a bioaccumulator of selected heavy metals (Cd, Ni and Pb) and alkaline earth metals (Ca and Mg). *Chemosphere,* 89(9), pp. 1066-1076. doi: doi: 10.1016/j.chemosphere.2012.05.071
3. Basavaraja D., Narayana J., Puttaiah E.T. and Prakash K. (2013) Phytoplankton species diversity indices in Anjanapura reservoir, Western Ghat region, India. *Journal of Environmental Biology*, 34, pp. 805-810.
4. Bellinger, E. E. (1992) A key to common algae. Freshwater, esturine and some coastal species. The Institute of Water and Environmental Management, London. pp. 139.
5. Eppley, R. W. and Macias, F. M. (1963). Role of the alga Chlamydomonasmundana in anaerobic waste stabilization lagoons. *Limnol. andOceanog*., 8, pp. 411-416.
6. Ferdous Z., Akter S., Hasan M., Ara R. and Shahajahan R. (2012) phytoplankton diversity and abundance in relation to pollution levels in the Hazaribagh tannery effluent sewage water of the river Buriganga. *Bangladesh J. Zool*. 40(1), pp. 121-128.
7. Ferroni L., Baldisserotto C., Pantalaeoni L., Billi P., Fasulo M.P. and Pancaldi S. (2007). High salinity alters chloroplast morpho-physiology in a freshwater *Kirchneriella* species (Selenastraceae) from Ethiopian Lake Awasa. *American Journal of Botany*, 94(12), pp.1972–1983.
8. Gurav M. N. and Pejaver M.K. (2013). Survey of rotifers to evaluate the water quality of the river Gadhi and its

reservoir. *Eco. Env. & Cons.*, 19 (2), pp. 417-423.

9. Gurav M.N. and Pejaver M.K. (2010). Effect of urbanization on nutrient loading and phytoplankton densities in River Gadhi and Deharang reservoir, Panvel, Maharashtra. In the proceedings of *Lake 2010: Wetland, Biodiversity and Climate Change*

10. Kalesh N.S. and Nair S.M. (2005).The accumulation levels of heavy metals (Ni, Cr, Sr, & Ag) in marine algae from southwest coast of India. 87(2), pp. 135-146. DOI: http://dx.doi.org/10.1080/02772240400029744

11. Kshirsagar D., Ahire M.L. and Gunale V. R. (2012) Phytoplankton Diversity Related to Pollution from Mula River at Pune City Ayodhya. *Terrestrial and Aquatic Environmental Toxicology,* 6 (2), pp. 136-142.

12. McCormick PV, Cairns J. (1994). Jr Algae as indicators of environmental change. *Journal of Applied Phycology*, 6, pp. 509–526.

13. Mooij P.R., Jongh L., Loosdrecht M., Robbert K. (2015). Influence of silicate on enrichment of highly productive microalgae from a mixed culture. *Journal of Applied Phycology*, 28 (3), pp. 1453-1457. doi: 10.1007/s10811-015 -0678-2

14. Palmer CM. (1969) A composite rating of algae tolerating organic pollution. *Journal of Phycology,* 5(1), pp. 78–82.

15. Palmer, C M (1969). A composite rating of algae tolerating organic pollution. *Phyco*. l5, pp. 78-82

16. Sharma R.C., Singh N. and Chauhan A. (2016). The influence of physico-chemical parameters on phytoplankton distribution in a head water stream of Garhwal Himalayas: A case study. *Egyptian Journal of Aquatic Research*, 42, pp. 11–21.

17. Thongpinyochai S. and Ritchie R.J. (2014). Using Chlorella vulgaris to Decrease the Environmental Effect of Garbage Dump Leachates. *J Bioremed Biodegradation,* 5(5), pp. 239-245. http://dx.doi.org/10.4172/2155-6199.1000239

18. Ward H.B. and Whipple G. C. (1918*). Fresh-water biology.* John Wiley & sons.

Effective Microorganisms Based Fermentation for Antioxidant-Rich Health Drink from Medicinal Plants

Mohanan M*, Phadke M, Tambe D.
Department of Microbiology,
SIES College of Arts, Science and Commerce. Sion (W)
Maharashtra, India

Abstract

In the present work, production of a health drink through fermentation of medicinal plants- Asparagus racemosus (Shatavari) and Phyllanthus emblica (Amla) and along with Citrus sinensis (Orange) juice was carried out by using Effective Microorganisms (EM). EM is a combination of useful regenerative microorganisms predominantly containing lactic acid bacteria and yeasts. The fermentation of the health drink was carried out for 7 days under static conditions in two batches for each plant. Antioxidant and alcohol levels were measured during the fermentation period. The drink was then filtered using a commercial filter. The produced health drink showed high antioxidant levels and low alcohol content which can be useful for preventing chronic diseases, cancer by maintaining healthy gut biome and good overall health.

Key words*: Fermentation, Ayurveda, Effective Microorganisms, Antioxidants, Phytochemicals*

1. Introduction

The ancient science of Ayurveda involves various plants, their extracts and decoctions. One of the most effective ways of making an ayurvedic herbal preparation is fermentation. Fermentation is a metabolic process in which an organism converts a carbohydrate, such as starch or a sugar, into an alcohol or an acid. The present study employs the use of effective microorganisms (EM) for fermentation of medicinal plants. EM contains selected species of microorganisms including predominant populations of lactic acid bacteria and yeasts, and smaller numbers of photosynthetic bacteria, actinomycetes and other types of organisms. All of these are mutually compatible with one another and can coexist in liquid culture. EM has found application in the many areas especially agriculture, production of health drink, waste water treatment, preparation waste biomass material for bioconversion into fuels such as bio-diesel and other etc.

Fermentation of the plants brings out desirable changes in their properties. One of these is changes is the production of antioxidants. Studies have shown that antioxidants help slow ageing and prevents several diseases like cardiovascular diseases, cataract, brain dysfunction, oxidative stress, birth defects and also help enhance the immune system (Ames B.et al, 1993). Alcohol is the other product of fermentation which in moderate or low concentration can be beneficial to the body.

Increasing pollution and stress subjects out body to various oxidative damage which are brought about by free radicals. These free radicals adversely alter lipids, proteins, and DNA and trigger a number of human diseases. Hence application of external source of antioxidants can assist to cope with this oxidative stress (Lobo V. et al 2010). Consumption of fermented health drink helps regain the antioxidant balance in our body which will in turn help to counteract the effects of free radicals, thereby preventing ailments like cardiovascular diseases, carcinogenesis and ageing.

2. Materials and Methods

2.1 Preparation of effective microorganisms (EM stock):

125gm of banana, papaya and pumpkin were collected and chopped into small pieces and transferred into air tight container and mixed with 500ml boiled water, subsequently 125gm of jaggery and one egg were added. The container was closed tightly and incubated for 7 days. The fermented solution was then collected and used as EM stock solution.

2.2 Isolation of effective microorganisms:

The EM stock was isolated onto Nutrient agar and Tomato Juice Agar plates to study the morphological characteristics.

2.3 Detection of pathogens in EM stock: EM stock was tested for presence of pathogens using media like TCBS (Thiosulfate Citrate Bile salts Sucrose) agar, XLD (Xylose Lysine Deoxycholate) agar and SS (Salmonella Shigella) agar plates.

2.4 Activation of EM stock solution:

20ml of EM stock solution and 20gm of jaggery were mixed with 400ml of boiled water in a 500ml conical flask. For the period of activation, the container was placed in shade at room temperature. This solution was then kept for a period of 3 weeks for activation. It was verified by a pH of 3.5 or lower.

2.5 Fermentation of health drink:

The health drink was prepared in two batches. The first batch consisted of 250ml orange juice, 5ml EM stock solution and 5gm of dried leaves of Shatavari. The second batch was made using the same ingredients with 5ml Amla juice. The fermentation was carried out at room temperature for 7 days. The fermented product was then filtered and centrifuged at 500 rpm for 15 minutes and the supernatant was used to estimate the total anti- oxidation level and alcohol content.

2.6 Anti-oxidant activity assay by-phosphomolybdenum method:

Ascorbic acid standard was pipetted out containing concentration varying from 4-20 µg into a series of test tubes and made up to 2ml with H_2O. The test tubes were added with 2ml of phosphomolybdenum complex reagent containing 6M H_2SO_4, 28mM sodium phosphate, 4mM ammonium molybdate and incubated in boiling water bath at 95^oC for 90 min. After the samples cool at room temperature, the absorbance of the aqueous solution of each is measured at 695nm against blank. The standard graph plotted was used to obtain the unknown values of the antioxidant content in the health drink.

2.7 Distillation and Estimation of ethanol by potassium dichromate method:

To 30ml fermented juice, few drops of phenol red indicator was added and pH was adjusted between 7.0 and 8.0. To this 2ml of 25%$ZnSo_4$ solution was added and then 2ml of 1N NaOH was added for proper mixing. The mixture was adjusted to definite volume using distilled water and used for distillation using a Leighbig distillation apparatus.

Alcohol standard was pipette out containing 1-5mg/ml into series of conical flasks. 10 ml $K_2Cr_2O_7$ was added and incubated at Room temperature for 30minutes. Then 100ml distilled water and 4ml KI solution was added. The I_2 liberated was titrated against 0.1N $Na_2S_2O_3$ using starch as indicator. End point is blue to colourless. Similarly, readings for blank samples are obtained.

2.8 Filtration:

At the end of fermentation, the prepared health drink was filtered using a commercially available bacteria-proof filter (Eureka Forbes Aquaguard Personal Purifier Bottle) to separate out the fermenting organisms. Filtration efficiency was estimated by obtaining viable count of the filtrate on Nutrient Agar Plates.

3. Results

3.1 Preparation of EM

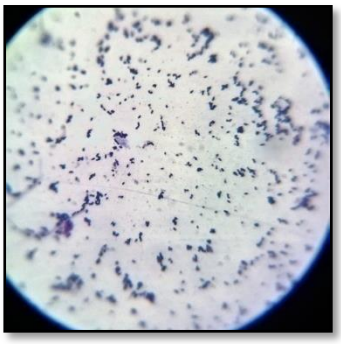
Banana, papaya and pumpkin were fermented along with jaggery for a week till a white layer appears on top. This is activated and used for health drink preparation.

3.2 Isolation of Effective Microorganisms

The EM showed different types of colonies on isolation on Nutrient agar and Tomato juice agar. Gram staining showed presence of Gram positive oval cells (Fig.3.2a) and Gram positive coccobacilli (Fig.3.2b).

Fig. 3.2a Gram positive oval cells

Fig.3.2b. Gram positive coccobacilli



3.3 Detection of pathogens in EM stock: The EM did not show presence of any pathogenic organisms on isolation onto pathogen detection agar plates like XLD, TCBS and SS.

3.4 Activation of EM stock solution: The EM stock was activated for 3 weeks or longer till the pH drops to 3.5 or lower.

3.5 Anti-oxidant activity assay by-phosphomolybdenum method:

The antioxidant activity of both batches of the health drink was analyzed at the end of fermentation period. Batch 1 containing shatavari showed 616µg/ml (Fiig.3.5a) and batch 2 containing Amla juice showed 384µg/ml (Fig 3.5b) of antioxidant concentration after fermentation.

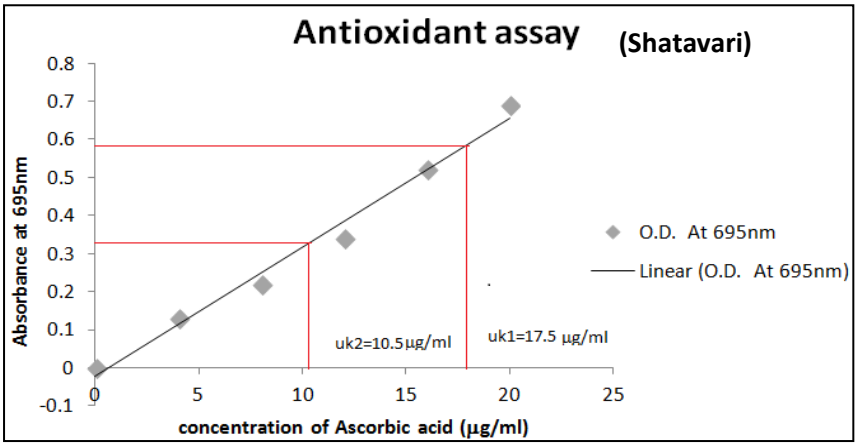


Fig.3.5a Antioxidant activity of health drink containing Shatavari

Uk2=2.5µg/ml

(Amla)

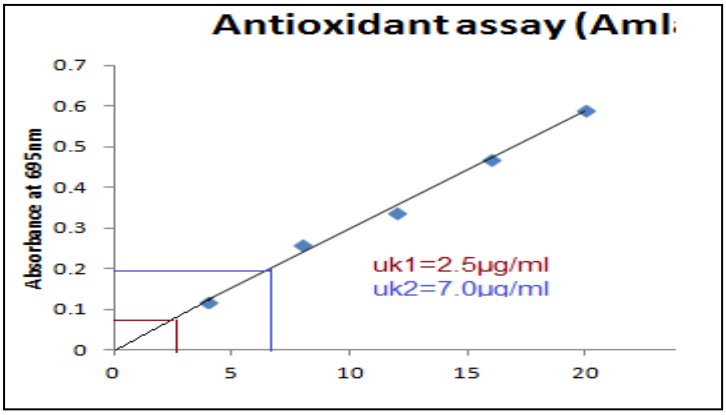
Uk1=7.0µg/ml

Fig. 3.5b. Antioxidant activity of health drink containing Amla juice

Conc. Of Ascorbic acid (µg/ml)

3.6 Estimation of ethanol by potassium dichromate method:

The ethanol level was estimated to be as low as 0.58% for Batch1 (Shatavari) and 0.06% for Batch2 containing Amla at the end of fermentation. (Fig. 3.6a and 3.6b)



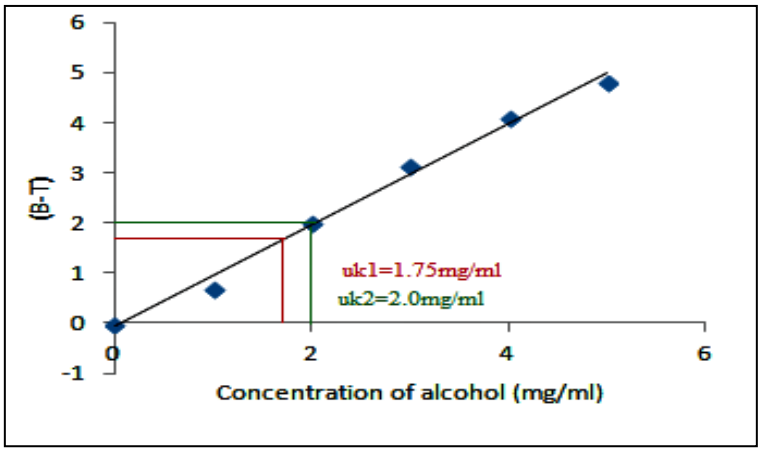


Fig.3.6a. alcohol content in health drink containing Shatavari

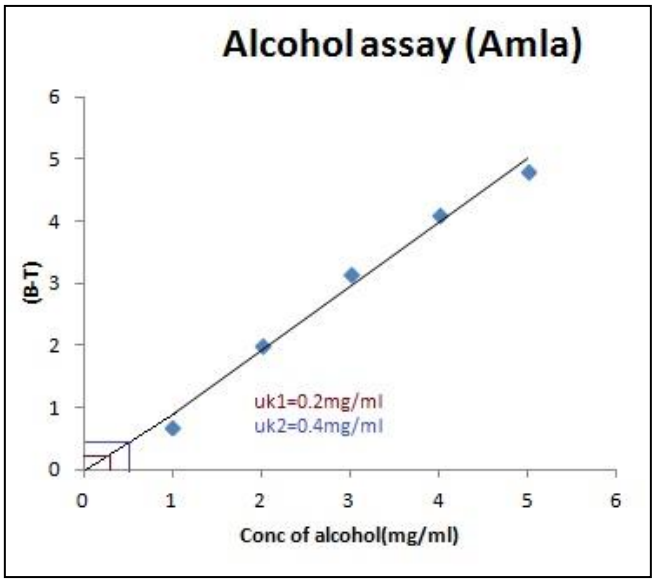


Fig.3.6b. alcohol content in health drink containing amla

4. DISCUSSION

Food fermentation is one of the earliest technologies developed by humans. Although yeasts are the principle organisms involved, filamentous fungi, lactic acid bacteria, acetic acid bacteria and other bacterial groups all play a role in the production of alcoholic fruit products (Guleria A. et al 2012). Effective microorganisms are consortia of lactic acid bacteria and yeast that work together to ferment the health drink bringing about desirable changes in it. A study conducted on health drink preparation using EM has demonstrated high antioxidant, antibacterial, tyrosinase inhibition activities, and biofilm inhibition activity of pathogenic bacteria (Li Z.et al, 2010). Another study based on an EM fermented cocktail derived from unpolished rice, papaya and sea weeds reports its ability to modulate the oxidative damages against kidney and liver of rats in vivo (Aruoma O.et al, 2002).

Cells in humans and other organisms are constantly exposed to a variety of oxidizing agents, some of which are necessary for life. Overproduction of oxidants can cause an imbalance, leading to oxidative stress, especially in chronic bacterial, viral, and parasitic infections (Liu R. et al, 1995). Oxidative stress can cause oxidative damage to large biomolecules such as proteins, DNA, and lipids, resulting in an increased risk for cancer and cardiovascular disease (Ames B.et al, 1991).The produced health drink showed high concentration of antioxidants i.e. 700µg/ml after 7 days of fermentation. Studies have shown that antioxidants help slow ageing and prevents several diseases like cardiovascular diseases, cataract, brain dysfunction, oxidative stress, birth defects and also help enhance the immune system (Ames B.et al, 1993). Experimental as well as epidemiological data indicate that a variety of nutritional factors can act as antioxidants and inhibit the process of cancer development and reduce cancer risk.

The alcohol content in the health drink was very low which is safe for consumption. Light to moderate alcohol use by older adults is associated with lower mortality, fewer cardiovascular events, and less dementia and diabetes (Reid M.et al,2002; Baum C.et al,1985). The idea that moderate to low alcohol use is beneficial in the context of preventive medicine is not new. Certain Ayurvedic preparations called *Arishtas* are herbalized wines which have very low concentrations of alcohol.

Prolonged fermentation of the health drink may lead to rancidity and make it unfit for consumption. Therefore, filtration was performed to separate out the microbial cells, thereby stopping further fermentation of the health drink.

5. CONCLUSION

In the present world of stress and pollution, a fermented health drink rich in antioxidants, containing all natural ingredients is one of the best ways to maintain health and vitality.

6. REFERENCES

1. **Ames B.N., Gold L.S**. 1991. "Endogenous mutagens and the causes of aging and cancer". Mutation Research/Fundamental and Molecular Mechanisms of Mutagenesis **250**:3–16.
2. **Ames B.N., Shigenaga M.K., Gold L.S**. 1993. "DNA lesions, inducible DNA repair, and cell division: the three key factors in mutagenesis and carcinogenesis". Environmental Health Perspectives. **101(5):**35–44.
3. **Aruoma O.I., Deiana M., Rosa A., Casu V., Piga R., Peccagnini S., Dessì Massunta, Ke B., Liang Y-F, Higa T**. 2002. "Assessment of the ability of the antioxidant cocktail-derived from fermentation of plants with effective microorganisms (EM-X) to modulate oxidative damage in the kidney and liver of rats in vivo: studies upon the profile of poly- and mono-unsaturated fatty acids". Toxicology Letters. **135**:209–217.

4. **Baum-Baicker C**. 1985. "The health benefits of moderate alcohol consumption: A review of the literature". Drug and Alcohol Dependence **15**:207–227.
5. **Devasagayam T., Tilak J., Boloor K., Sane K., Ghaskadbi S., Lele R**.2004. "Free Radicals and Antioxidants in Human Health: Current Status and Future Prospects". The Journal of the Association of Physicians of India.**52**:795-804
6. **Dragsted L.O., Strube M., Larsen J.C**.1993. "Cancer-protective factors in fruits and vegetables: biochemical and biological background". Pharmacology and Toxicology.**72**:116–135.
7. **Guleria A**. 2012. "Production of Grape wine by the use of yeast, *Saccharomycese cerevisiae"*. GRA Global Journal For Research Analysis. **3:**1–5.
8. **Hertog M., Feskens E., Kromhout D., Hertog M., Hollman P., Hertog M., Katan M**. 1993. "Dietary antioxidant flavonoids and risk of coronary heart disease: the Zutphen Elderly Study". The Lancet. **342**:1007–1011.
9. **Kannahi M., Dhivya U**. 2014. "Production of health drink using effective microorganisms and medicinal plant extracts". Journal of Chemical and Pharmaceutical Research.**6(6):**496-500
10. **Li Z., Lee J., Cho M.H**. 2010. "Antioxidant, antibacterial, tyrosinase inhibitory, and biofilm inhibitory activities of fermented rice bran broth with effective microorganisms". Biotechnology and Bioprocess Engineering. **15**:139–144.
11. **Liu C.H., Hsu W.H., Lee F.L., Liao C.C**.1996. "The isolation and identification of microbes from a fermented tea beverage, Haipao, and their interactions during Haipao fermentation". Food Microbiology.**13**:407-415.
12. **Liu R.H., Hotchkiss J.H**.1995. "Potential genotoxicity of chronically elevated nitric oxide: a review". Mutation Research/Reviews in Genetic Toxicology.**339**:73–89
13. **Lobo V., Patil A., Phatak A., Chandra N.** 2010. "Free radicals, antioxidants and functional foods: Impact on human health". Pharmacognosy Reviews **4:**118.
14. **Reid M.C., Boutros N.N., O'connor P.G., Cadariu A., Concato J**. 2002. "The health-related effects of alcohol use in older persons: A systematic review". Substance Abuse. **23**:149–164.
15. **Waladkhani A.R., Clemens M.R**.1998. "Effect of dietary phytochemicals on cancer development". International Journal of Molecular Medicine**.17**:47–53.

Assay of Allelopathic Potential of Peel and Seed Extracts of *Punica Granatum* on Seed Germination of *Vigna Mungo*: An Alternative Strategy for Chemical Herbicides

Divya Singh and Dr Babita Rana

Department of Botany, G.N.Khalsa College, Matunga , Mumbai-19

Abstract-

Preliminary photochemical analysis of ethanolic extract of peel and seed of Punica granatum was evaluated by standard methods. It was noted that ethanolic peel and seed extract of Punica granatum showed the presence of all photochemical constituents except tannins, glycosides and anthocyanins. Further, aqueous extracts of peel and seeds of Punica granatum were tested for their herbicidal effect by evaluating the percentage seed germination and seedling growth of Vigna mungo and Vigna radiata exposed to different doses of the extracts. From among the plant parts tested, the extract of seed showed maximum percentage reduction (100%) in seed germination and this was dose dependant. The maximum percentage reduction in germination (83%) was recorded for tests with the peel extract. Besides impacting germination, the extracts also effected the growth of the shoot and root in terms of reduction in their lengths. The seed extract appeared to be the best in reducing the growth of the root and shoot other than the peel extract. The allelopathic effect of Punica granatum could be contributed to one or more photochemical analyzed in peel and seed extract. The results indicate the usefulness of seed and peel extract of Punica granatum as alternative strategy in weed management in agro-systems.

Introduction:

Allelopathy is a natural ecological phenomenon known and used in agriculture since ancient times. Allelopathy indicates all of the effects that directly or indirectly result from biochemical substances transferred from one plant to another (Molisch 1937). Allelopathy is defined as any direct or indirect harmful or beneficial effect by one plant (including microorganisms) on another through production of chemical compounds that escape into the environment (Rice, 1984). It involves secondary metabolites produced by plants microorganisms, viruses and fungi that influence the growth and development of agricultural and biological systems. Allelochemicals, which are non nutritive substances mainly produced as plant secondary metabolites are the active media of allelopathy. It can stimulate or inhibit plant germination and growth, and permit the development of crops with low phytotoxic residue amounts in water and soil, and are suitable substitute for synthetic herbicides. Allelopathy may therefore offer an attractive environmentally friendly alternative to pesticides in agriculture pest management. Plants have been used as a valuable source of natural products to maintain health. *P.granatum* is one of the important and oldest edible fruits of tropical and subtropical regions. The importance of *P.granatum* is seeds and peel from containing high levels of phenolic compounds such as ellagic, flavanoids, gallic acid, coumarin, caffeic, acid...,etc. which poses antioxidant activity. Several scientists evaluated the inhibitory effect could be due to the presence of some of the secondary metabolites like glycosides, flavanoids, tannins present in the ethanolic seed/peel extract of *P.granatum.* As weeds are extensively present in agricultural systems which reduce yields of many basic crops, *P.granatum* should be endowed with the

property of inhibiting the colonization of other species and therefore is a good source of allelochemicals. It is against this observation that this was undertaken to evaluate the allelopathic property of *P.granatum.* In several bioassays, seed germination and seedling development are measured after the exposure to alleged allelochemicals since plants are considered to be the most susceptible at the seed and seedling development stage and can therefore be used as an effective parameter for demonstrating allelopathy. In this study, the black gram, *Vigna mungo* was used to evaluate the allelopathy of dried samples of the seed and peel of *P.granatum.*

Materials and methods-

Collection of plant material

Plant samples were collected from the local market at Matunga, Mumbai and were brought in the Department of Botany, Guru Nanak Khalsa College, Matunga, Mumbai.

Preparation of extracts

The plants were washed thoroughly in running tap water to clear off the adhering soil matter. The peel and seeds were then separated, cut into small pieces, weighed and dried separately. Aqueous extracts of these plants parts were prepared using distilled water. One gram of plant material was ground in 10 ml of distilled water and left for 12 hrs at room temperature. It was then filtered using a double layered muslin cloth and the filtrate centrifuged at 5000 rpm for 5 minutes. The supernatant was made up to a final volume of 100 ml and this represented the stock solution. The various extracts were diluted with distilled water appropriately to obtain 25, 50, 75 and 100 % concentration of test extracts.

Selection of test seeds and experimental protocol

In the search for potential herbicides derived from plants, the purpose is to demonstrate allelopathic activity and to determine the activity range of the resultant allelochemical herbicide with respect to necessary dose and target. In such experiments, sensitive plant species such as lettuce or tomato are normally selected. We have selected, the black gram, *Vigna mungo* as it is one of the most widely used pulse crop in India, very rich in phosphoric acid, and the size of the seeds make it convenient for various types of experimental work.

Seeds of *V. mungo* were obtained from the local market at Matunga, Mumbai. The seeds were surface sterilized with 70% alcohol for 2 minutes and rinsed with distilled water several times. Ten seeds for each treatment were spread in a petridish lined with double layered filter paper and 10 ml of test solution (25%, 50%, 75%, 100% of aqueous extracts of seed and peel) was gently added to the petridish and allowed to be soaked by the filter paper. Thereafter, the seeds were moistened with water whenever necessary till the end of the study period. Ten ml of distilled water was used for the control sample. The petridishes were incubated at room temperature for 7 days in a germination rack illuminated with fluorescent light during day time till the end of the 4^{th} day after treatment. The protrusion of radical through seed coat was taken as the criterion for germination. On the 7^{th} day after treatment, allelopathic parameters such as germination percentage root and shoots lengths were recorded.

Result and Discussion–

Phytochemical screening of pomegranate peel and seed-

Chemical tests	**Peel Extract**		**Seed Extract**	
	Ethanol	**Aqueous**	**Ethanol**	**Aqueous**
I. Test for Triterpenoids & Steroids				
Liebermann Burchard Test	-	-	+	_
II. Test for Glycosides				
Keller Killiani Test	-	+	+	-
Bromine water	-	+	+	-
III. Test for Saponins				
Foam test	-	-	+	+
IV. Test for Alkaloids				
Hager's Test	-	-	+	_
V. Test for Flavanoids				
Ferric Chloride test	+	+	_	_
Alkaline reagent test	+	+	_	_
Lead Acetate Solution test	+	+	_	_
VI. Test for Tannins				
Gelatin Test	+	_	+	_
VII. Test for Proteins				
Biuret test	_	_	_	_
VIII. Test for Free amino acids				
Ninhydrin Test	_	_	_	_
IX. Test for Carbohydrates				
Benedict's Test	+	+	+	+

(Table 1): Bioassay of aqueous extract of Peel and Seed of *P.granatum* on seed germination of *V.mungo*.

Concentrations (%)	**Peel Extract**	**Seed Extract**
Control	100.0	100.00
25	16.66 (84)	100.00 (0)
50	3.33 (97)	33.3 (67)
75	0 (100)	13.3 (87)
100	0 (100)	13.3 (87)

The number in parenthesis indicates the percentage deviation from the control

(Table 2)- Bioassay of aqueous extract (peel and seed) of *P. granatum* on the root and shoot length of *V. mungo.*

Concentrations (%)	Peel extract		Seed extract	
	Root length (cm)	Shoot length (cm)	Root length (cm)	Shoot length (cm)
Control	2.81	4.12	3.70	3.44
25	2.53 (9%)	3.12 (24%)	2.87 (22%)	3.12 (9%)
50	1.51 (46%)	3.21 (22%)	2.72 (26%)	3.12 (9%)
75	1.11 (60%)	2.54 (38%)	2.68 (27%)	2.52 (26%)
100	0.81 (71%)	1.78 (56%)	1.54 (58%)	1.82 (52%)

The number in parenthesis indicates the percentage deviation from the control

Germination percentage-

The aqueous extract of all parts of *P.granatum* tested generally inhibited germination of the seeds of *V.mungo* as evident based on a comparison with the control (Table.1). The percentage inhibition was also dose dependant. Extracts of the peel showed 48% inhibitory potential whereas seed showed 100% inhibition. A similar hierarchy in the inhibitory property of the extracts of various plant parts was reported by A. Sethuram *et al.*, (2013) who tested the extracts of *Typha angustifolia.*Utilizing aqueous extracts have always found favour among agricultural farmers rather than using organic solvents. In the context, the results obtained here with the aqueous extracts of *P.granatum* have greater acceptance. However, in allelopathic studies while using seed germination as a test parameter, other bioassay conditions such as test species, light conditions, osmotic potential and interactions between these factors strongly influence the result as pointed out by Haugland and Brandsaeter (1996). Factors such as seed size, seed dormancy and the length of the after-ripening period to which the seed has been subjected can influence the concentration of allelopathic compound necessary to produce an effect on seed germination (P'erez, 1990). Therefore higher percentage of inhibition of seed germination using the aqueous extracts of *P.granatum* can be achieved by increasing the concentration of the test extract.

Root and Shoot growth –

Aqueous extracts of the peel and seed of *P.granatum* at 100% concentration showed the maximum reduction (71% and 58%) in the growth of the roots while the extracts of the seed were significantly lesser. Similar results were observed for the shoot length with the extracts of the peel and seed. Some recent studies indicate the reduction of root and shoot length to be due to phytotoxic/allelopathic effect of plants such as *Typha angustifolia* (A. Sethuraman *et al.,* 2013), *Tectona* (Rincy *et al., 2012)* and *Parthenium hysterophorus (*Batish *et al., 2002;* Singh *et al., 2003)*.

Conclusion-

The present investigation demonstrated the allelopathic effects of *P.granatum* by studying the percentage germination of seeds of *V. mungo* and assessing the growth of the roots and shoots exposure to different aqueous

concentrations of the extracts of peel and seed. Although all these plant parts had allelopathic effect, the peel appeared to be the most potent part of the plant with allelopathic properties. It is now construed that a mixture of allelochemicals would have a greater effect than a single compound. Furthermore, some experiments have indicated that mixtures of some allelochemicals such as flavanoids and organic compounds such as carbohydrates, amino acids can possess allelopathic activity even though concentrations of individual compounds are significantly below their inhibitory level.

References-

1. Batish, D.R, Singh, H.P, Pandher, J.K, Arora, V, and Kohli, R.K, 2002. 'Phytotoxic effect of Parthenium residues on the growth of radish and chickpea and selected soil properties ', *Weed boil. Manage*. 2:73-78.
2. Femina, D, Lakshmipriya, P, Subha, S and Manonmani, R, 2012. 'Allelopathic effect of weed (*Tridax procumbens* L) extract on seed germination and seedling growth of some leguminous plants'. *International Res. Journal of pharmacy*, 3(6) 90-96.
3. Neelamegam. R, 2011. 'Allelopathic effect of *Ixora coccinea*. On seed germination and early seedling growth of paddy (*Oryza sativa*)' *Journal OF Phytology*, 3 (6):51-55.
4. Rincy Evangeline, V.,John Jothi Prakash, E.,selvin Samuel, A., and Jayaku, m, 2012,' Allelopathic potential of *Tectona grandis* on the germination and seedling growth of *Vigna mungo*, Pak. J. Weed Sci. Res.18(1):65-70.
5. A. Sethuraman and K. P. Sanjayan, 2013.' Bio-herbicidal effects of *Typha angustifolia* extracts on seed germination and seedling growth of *Vigna mungo*.
6. Radwan S. Farang and Sekina, S. Emam. 'Herbicidal and Fungicidal Effects of Pomegranate Peels and Leave Crude Juices'. International Journal of Research and Innovations in Earth Science Volume 3, Issue 1, ISSN (Online):2394-1375.
7. G. Prasada Babu, Vinita Hooda, K.Audiseshamma and Ch. Paramageetham. 'Allelopathic effects of some weeds on germination and growth of *Vigna mungo'. International Journal of Current Microbiology and Applied Sciences ISSN: 2319-7706* Volume 3 Number 4 (2014) pp.122-128.

Growth Response of *AzollaMicrophylla* to Salinity and UV-B

Abhishek Chris [1,2]* and Farooze Ahmad Lone [1]

1. Department of Biological Sciences
Sam Higginbottom Institute of Agriculture, Technology and Sciences Allahabad, India
2. Department of Botany, Wilson College, Mumbai, India
* Email: achris1@rediffmail.com
Contact No-08652194555

Abstract

A study was conducted under controlled laboratory conditions to investigate the individual and combined impact of salinity (20 and 40 mMNaCl) and ultraviolet-B radiation (15 and 60 min exposure) on growth behavior of paddy field biofertilizerAzollamicrophylla. Both the stresses declined the dry weight and protein contents. The values of photosynthetic pigments chlorophyll and carotenoids in fronds were also decreased with increased and rising concentrations of NaCl and UV-B. Root length and root number in fronds were found to be in dose dependent manner and they were highly reduced at highest combined dose i.e. $NaCl_{40mM}$+UV-B $_{60min}$ exposure.

Key words*: Azollamicrophylla, salinity, ultraviolet-B radiation*

Introduction

Azolla is the smallest aquatic fern harbouring nitrogen fixing cyanobacteria, *Anabaena azollae* in its dorsal leaf lobe cavities. Because of nitrogen fixing potential, the fern have long been applied to paddy fields as nitrogenous biofertlizers to reduce the cost and ill effects caused by chemical nitrogen fertilizers. Both *Azolla* and rice share similar growth conditions and hence, *Azolla* becomes an integral component of rice ecosystem (Sood, et al., 2012).

In the natural environment, plants including *Azolla* experience different kinds of stresses like pesticide, heavy metals, drought, UV-B and salinity etc. Salinity is a serious handicap for cultivation and production of agricultural crops. Approximately 7% of world's total land area is affected by salt as a similar percentage of its arable land (Ghassemi et al., 1995). The area is still increasing as a result of irrigation or land clearing (FAOSTAT).It is estimated that in next 25 years, there will be a loss of 30% in the farmable land, and by the year 2050, this will increase to 50% (Zhu, 2001).During the last few decades considerable interest has been generated over the reduction of stratospheric ozone due to anthropogenic pollutants (Molina and Rowlands, 1974). The decrease in ozone layer could lead to significant increases in the ultraviolet-B (UV-B) radiation reaching the surface of the Earth (Blumthalerand Amback,1990). According to an estimate the level of stratospheric ozone is predicted to remain unchanged for the next 20-25 years (Environment Health Criteria, 1994).

There is no doubt that an *Azolla-Anabaena* association is important from an agronomic point of view due to its ability to fix atmospheric nitrogen. However, there is still a gap in our knowledge on the effect of salinity and UV-B singly or in combination on the growth behavior of agronomically important *Azollamicrophylla*.

Materials and Methods

Plant material

*Azollamicrophylla*one of the dominant strains of the locality was collected from paddy fields of Allahabad. Plants were washed and cleaned of contaminating organisms. The plants were surface sterilized with a solution of mercuric chloride (0.1% for 30 min) and were dipped immediately into a large volume of sterile distilled water. Plants were then transferred into dishes containing combined-N free 2/5

strength sterile Hoagland's medium (Allen,1968) and 0.04 mM ferrous ion as Fe-EDTA, pH 5.6.The cultures were grown at 26 ^{0}C under a 16:8 (light: dark) photoperiod with light from a combination of incandescent and cool white light fluorescent lamps at a photon fluence rate of 95 µmol $m^{-2}s^{-1}$. Fronds were routinely transferred into fresh medium twice a week to maintain plants in a sterile state. Log phase fronds were used for the experiment.

NaCl , UV-B Treatment and protein estimation

Salt treatment was provided to *Azollamicrophylla* by incubating the plants in Hoagland's nutrient solution containing NaCl at concentration of 20 and 40 mM. For UV-B treatment *Azolla* fronds were taken in Petri dishes containing Hoagland's medium and exposed to UV-B ($0.4Wm^{-2}$) along with white light (50µmol $m^{-2}s^{-1}$ photon flux density).The UV-B irradiation was provided by UV-B tube (Philips,TL 40 W/12, Holland) with its main output at 312 nm. Plants grown without the addition of NaCl and UV-B treatment served as control.

Protein of the plants was measured following the method of Bradford (1976) using bovine serum albumin as standard.

Chlorophyll estimation

Chlorophylls was extracted from fronds with 80% acetone and estimated spectrophotometrically according to the method of Litchenthaler and Welburn (1983).

Determination of average root length and root number

All the plants from the dish were removed, blotted on the filter paper and then the total root number was counted. Root length was measured by transferring the plants on a graph paper and marking their upper and lower limits. Average root length was calculated as total length of the roots (mm) divided by number of roots.

Statistical Analysis

The different parameters were statistically analyzed using Students**'t'** test

Results and Discussion

Dry weight (DW) of *Azollamicrophylla* was studied at various exposure times of UV-B and doses of NaCl (data not shown). Only two selected doses of UV-B ($UV\text{-}B_{15}$ and $UV\text{-}B_{60}$; 15 and 60 min exposure, respectively) and NaCl ($NaCl_{20}$mM and $NaCl_{40}$mM respectively) were applied to demonstrate the effect of these stresses singly as well as in combinations of growth (dry weight). UV-B and NaCl reduced the DW of *Azolla* significantly with increasing UV-B exposure time and NaCl concentration. The inhibitory effect became more severe when UV-B was combined with NaCl, as growth was decreased by 18-46 % under UV-B and NaCl combinations (Table 1). Some earlier studies showed that UV-B and NaCl stresses individually reduced the biomass of plants (Rai et al. 2001; Chris and Alexander, 2010). Such changes in plants may be associated with the changes in the cell division, cell elongation because of damaging effects of these stresses on nucleic acids and due to reduction in photosynthetic rate and enzymes activities (Chris and Alexander, 2010; Puteh and Mondal, 2013).

Table 1 shows a general inhibition of protein due to the stresses used in the current study. Approximately 10 and 17% protein content was noticed after 15 and 60 min of UV-B exposure, respectively. However in the case of salt, the protein content was 14 and 22% following 20 and 40 mM treatment. The intensified decrease in protein content was noticed following the combined treatment of UV-B and NaCl. Both the doses of NaCl along with 15 min UV-B exposure decreased the protein content by 20 and 28%.Similarly, a combination of UV-B 60 min and both the doses of NaCl brought a decrease of 25 and 37% decrease in protein content. Reduction in protein could be due to phytotoxic effect of UV-B as well as NaCl and is in conformity with findings of Chris (2013) and Jaya Kumar

et al. (2002). They observed reduction in protein in *Azollamicrophylla* plants under UV-B and salt stress. Protein inhibition in *Azolla* fronds could be due to the osmotic injury or specific ion toxicity due to entry of salt. Excess salt decreases leaf water potential leading to reduced water and nutrient uptake by the plants (Chris 2013). Protein inhibition in *Azolla* could be correlated with the reduced photosynthetic activity, nitrogen metabolism and DNA damage under UV-B stress (Chris and Alexander, 2010; Jaya Kumar et al. 2002).

The effect of NaCl and UV-B on chlorophyll and carotenoids contents are shown in Table 1.Both the individual doses of UV-B and salt Decreased both the pigments significantly and when both the stresses were combined together, more severe effect was observed, as it was decreased by 14 to 35% in chlorophyll and 7 to 15% in carotenoids with the tested UV-B and NaCl combinations. Chlorophyll and carotenoids of NaCl and UV-B treated *Azolla* plants decreased significantly over the control (Table I). Our results are consistent with Chris (2013) and Chris et al. (2006) who found that NaCl stress and UV-B radiation affects photosynthetic pigments and several other physiological processes including photosynthesis in cyanobacteria and *Azolla*.The reduction in chlorophyll and carotenoids content under salt stress might be due to salt accumulation by plants. It seems that presence of NaCl in the growth medium adversely affected chlorophyll/carotenoids content and alteration in chl a/b ratio in *Azolla* plants. This could lead to reduced photosynthetic efficiency of *A. microphylla* plants exposed to salinity.Also, UV-B exposure resulted in a marked decrease in photosynthetic pigment contents and altered thylakoid integrity, suggesting the photosynthetic machinery as the primary target of UV-B stress. Therefore, enhanced UV-B radiation causes damage to Chl- a and b due to the inhibition in Chl biosynthesis (El Mansy and Salisbury, 1971).

Following $NaCl_{20}$ and $NaCl_{40}$ treatments, the average root length (ARL) was decreased by 12 and 16%, respectively. UV-B alone also reduced the ARL by 5% and 9% at 15 and 60 min treatments and simultaneous exposure caused the further reduction in ARL. On the other hand, *Azolla* fronds were showed a decreased by 14 and 20% due to UV-B_{15}+ $NaCl_{20}$ and UV-B_{15}+ $NaCl_{40}$.Similarly when fronds were exposed to UV-B_{60}+ $NaCl_{20}$ and UV-B_{60}+ $NaCl_{40}$ ARL was decreased by 18 and 23% respectively (Table 1). Similar trend in result was obtained when root number was analyzed after giving individual and combined doses of NaCl and UV-B. A noticeable decrease in root number and average root length at higher and combined concentrations probably resulted in the reduction of water and mineral nutrient uptake capacity and consequently led to growth reduction and death of *Azolla* plants.Concentration of NaCl in the external medium and ratio of Ca+/Na+ plays a crucial role in the growth and development of roots (Ibrahim and Mustafa, 2007; Rai et al. 2001).

Conclusion

In the present study it was found that *Azollamicrophylla* are at severe risk when exposed to UV-B and salt. It has been reported by several research groups that UV-B and salt individually are highly effective in causing damage to living organisms in their respective ecosystems. Thus these stresses might adversely affect the ecologically important *Azolla*which in turn may affect the productivity of crops since it is used as biofertilizer in paddy fields.

Acknowledgement

Authors are thankful to Prof. M. S. Mishra Head, Department of Biological Sciences, SHIATS University, Allahabad, India for providing lab facility. We are also grateful to

Prof S Kavarana, Head, Department of Botany, Wilson College for encouragement.

References

1. Allen, M. M., 1968.Simple conditions for growth of unicellular blue-green algae on plates. J.Phycol. 4,1-4.
2. Blumthaler, M.,Amback, W., 1990. Indication of increasing solar UV-B radiation flux in alpine region. Science. 248,206-208
3. Bradford, M. M., 1976. A rapid and sensitive method for quantitation of microgramquantities of protein using dye binding. Anal. Biochem. 77,248-254.
4. Chris, A., Zeeshan, M., Abraham, G., Prasad, S.M., 2006. Proline accumulation in *Cylindrospermum* sp. Env. Exp. Bot. 57,154-159.
5. Chris, A., Alexander, K., 2010. Supplemental ultraviolet-B radiation induced biochemical responses of *Azollamicrophylla*. Biochem. Cell. Arch. 10, (supp 1), 5-10
6. Chris, A., 2013. Biochemical response of paddy field biofertilizer*Azollamicrophylla* exposed to NaClstress.Int. J. Biotech.Biosci.3 (1),13-21
7. El-Mansy, H. I., Salisbury, F. B., 1971. Biochemical responses of *Xanthium* leaves to ultraviolet radiation. Radiat. Bot. 11,325-328
8. Environment Health Criteria (1994).Ultraviolet radiations, world health organization report number 160.
9. FAOSTAT, Statistics database http://apps.fao.org/cgi.bin/nph.db.pl.
10. Ghassemi, F., Jakeman, A. J., Nix, H.A., 1995. Salinization of land and water resource; Human cause extent, management and case studies. UNSW Press, Sydney, Australia and CAB International Wallingford, UK.
11. Ibrahim, M. M., Mostafa, E. M., 2007. UV-B Effect on Constituents of *Azollacaroliniana*. Z. Natureforch. 62,246-252.
12. Jaya Kumar, M., Linga Kumar, K., Kulandaivelu, G., 2002. Effect of enhanced UV-B radiation on growth and photosynthetic activities in aquatic fern *Azollamicrophylla*Knulf. Photosyn.40,85–90
13. Lichtenthaler, H.,Welburn, A. R., 1983. Determination of total carotenoids and chlorophyll-a and b of leaf extracts in different solvents. Biochem. Soc. Trans. 11,591-592.
14. Molina, M. J., Rowland, F. S., 1974. Stratospheric sink for chlorofluoromethanes: Chlorine atom based destruction of ozone. Nature. 249,810-812.
15. Puteh, A. B.,Mondal, M. M. A., 2013. Salinity effect on dry mass partitioning in different plants parts and ion uptake in leaves of rice mutants. J. Env. Sci. Nat.Res. 6 (1), 239- 245.
16. Rai, V., Tiwari, S. P., Rai, A. K., 2001.Effect of NaCl on nitrogen fixation of unadapted and NaCl- adapted *Azollapinnata-Anabaena azollae.* Aqua. Bot. 71,109-117
17. Sood, A., Kalra, C., Pabbi, S.,Uniyal, P. L., 2012. Differential responses of hydrogen peroxide, lipid peroxidation and antioxidant enzymes in *Azollamicrophylla* exposed to paraquate and nitric oxide. Biologica.67, 1119-1128.
18. Zhu, J. K., 2001. Plant salt tolerance. Trend. Plant. Sci.6,66-71.

Table 1: Effect of NaCl and UV-B on Dry weight, Protein,
Total chlorophyll, Carotenoids, Average root length, and Root number of *Azollamicrophylla*. Mean+SE, values in parenthesis are percent decrease with reference to respective control. All treatments are significantly different (0.05) from control (Student's t-test).

Treatment	Dry Weight (mg)	Protein (mg/gm f.w)	Chlorophyll (mg/gm f.w)	Carotenoids (mg/gm f.w)	AverageRoot length (cm)	Root Number
Control	0.610±0.5	0.234±0.4	0.193±0.4	0.048±0.3	0.45±0.3	15±0.5
$NaCl_{20}$	0.540±0.4 (-10)	0.210±0.3 (-14)	0.175±0.3 (-9)	0.045±0.2 (-6)	0.40±0.3 (-12)	13±0.4 (-11)
$NaCl_{40}$	0.440±0.3 (-27)	0.182±0.2 (-22)	0.150±0.2 (-22)	0.042±0.2 (-12)	0.38±0.2 (-16)	12±0.4 (-16)
UV-B_{15}	0.540±0.4 (-11)	0.210±0.3 (-10)	0.177±0.3 (-8)	0.047±0.3 (-2)	0.43±0.3 (-5)	14±0.5 (-6)
UV-B_{60}	0.460±0.3 (-24)	0.194±0.2 (-17)	0.165±0.2 (-14)	0.043±0.2 (-10)	0.41±0.3 (-9)	13±0. (-13)
$NaCl_{20}$+ UV-B_{15}	0.500±0.4 (-18)	0.180±0.2 (-20)	0.160±0.2 (-14)	0.044±0.2 (-7)	0.39±0.2 (-14)	12±0.4 (-16)
$NaCl_{20}$+ UV-B_{60}	0.42±0.3 (-30)	0.170±0.2 (-25)	0.150±0.1 (-20)	0.041±0.1 (-13)	0.37±0.2 (-18)	11±0.3 (-22)
$NaCl_{40}$+ UV-B_{15}	0.390±0.2 (-35)	0.160±0.1 (-28)	0.140±0.1 (-27)	0.042±0.1 (-12)	0.36±0.2 (-20)	12±0.3 (-20)
$NaCl_{40}$+ UV-B_{60}	0320±0.1 (-46)	0.140±0.0 (-37)	0.120±0.0 (-35)	0.040±0.1 (-15)	0.35±0.2 (-23)	09±0.2 (-36)

Readings have been taken 72 hours after treatment

Biosorptionof Heavy Metal by Using Selected Strain Isolated From Mangrove Soil (Kharghar), Navi Mumbai

Jadhav Ankita[1]*, Gavit Hemangi[2], Koliyar Jyoti[3]

1,3 Department of Environmental Science, SIES (Nerul) college of Arts, Scienceand Commerce, Sector 5, nerul,NaviMumbai. 2 Department of Biotechnology, Bhauraopatil College (Vashi), NaviMumbaI.

*jadhavankita473@gmail.com

Abstract

The pollution of environment with toxic heavy metals is serious problem throughout the world today, due to the toxic effect of heavy metals, and its accumulation in food chain leads to ecological and health problems. Bioremediation is better option in the treatment of heavy metal pollution. Bioremediation employs microorganisms capable of degrading toxic contaminants or have ability to accumulate it in their cells. This concentrated end product can afterwards be directed for a controlled way for recovery of metal. The present study deals with biosorption of heavy metal (Cr) by using heavy metal resistant bacteria isolated from mangrove soil, from different isolate 2 isolates were selected both showing resistance to the concentration of 0.25 mg/ml (Cr).These two isolates wereAcinetobacter twoffii, Myroides spp. Using Acinetobacter twoffiibio sorption of heavy metal wasdone.

Key Words*; Biosorption, Heavy Metal, Bioremediation*

Introduction

The rapid development of industrial and modern technologies has resulted in introducing diverse toxic substances, including heavy metals into the environment. Heavy metals are used in various industries, including mining, electronics, electroplating, and metallurgy. Many technological processes generate waste containing heavy metals(1) these metals are toxic to higher organisms because they are non –degradable and are persistent in environment. There are various conventional technologies used to remove heavy metal from environment such as, chemical precipitation, lime coagulation, solvent extraction, membrane filtration, reverse osmosis all these technique has its own merits and limitation in application.(2)

To overcome limitations arises due to these technologies an eco-friendly approach has emerged which include microbial biomass as potential agent to remove heavy metal pollution. The process which use microbial biomass as adsorbent material is called as biosorption. Biosorption can be defined as the ability of biological material to accumulate heavy metals from wastewater through metabolically mediated or physic-chemical pathways of uptake.(2)

Living as well as dead biological materials have been soughtto remove metal ions. It was found that various functional groups present on their cell wall offer certain forces of attractions for the metal ions and provide a high efficiency for their removal.

The present study aims at isolation of chromium resistant bacteria and check its biosorption efficiency.

Materials and Method

Site description and sample collection:

The site selected for the study was Kharghar, NaviMumbai. Soil was collected from 4 cm depth using a sterile spatula and transferred to pre-sterilized plastic bag and stored at 4ºC.

Isolation of Microorganisms:

1 gram of soil sample was suspended in 0.8% sterile saline and serially diluted. Spread plate technique was used to isolate the colonies on sterile Luria Bertani agar plates, which was prepared as per the composition given in Sambrook& Russell. The plated were incubated at room temperature for 24 hours.

Identification of heavy metal tolerance:

An effort was made to study the effect of varying concentration of heavy metal on the growth of soil isolates.Various concentrations of $K_2Cr_2O_7$ used were 0.25 mg/ml, 0.5 mg/ml, 0.75 mg/ml, 1.0 mg/ml, 1.25 mg/ml. 1ml of bacterial suspension was spread on sterile Luria Bertani media supplemented with the above concentrations of the heavy metal. The plates were incubated at room temperature for 24 hours. The isolates capable of growing under these conditions were selected for further **studies.**

Identification of bacteria:

The Grams nature of 2 selected isolates was confirmed by Grams staining technique. These 2 isolates were identified using Biomerieux Vitek®2 compact system which is an automated microbial identification system.

Biosorption study:

Isolate 1 was used for biosorption study. Culture was inoculated in 100ml of sterile LB medium supplemented with 0.25 mg/ml concentration of $K_2Cr_2O_7$ and incubated at room temperature in shaking condition at 120rpm for 24 hours.Culture was inoculated in 100ml of sterile LB medium and kept as Control A to check the bacterial growth. 100ml of sterile LB medium supplemented with 0.25 mg/ml concentration of $K_2Cr_2O_7$ without bacterial inoculation was kept as Control B to check the initial concentration of $K_2Cr_2O_7$ in medium. After incubation the supernatant was collected from test flask by centrifugation.

A 0.25 % w/v solution of diphenyl carbazide was prepared in 50% acetone. 15 ml each of the sample solution, containing various concentration of Cr were prepared. To this 2ml of 3M H_2SO_4 was added followed by 1ml of diphenyl carbazide and the total volume was made up to 100ml by distilled water. Standard dilutions were prepared of $K_2Cr_2O_7$ ranging from 0.05 to 0.35 mg/ml. Absorbance of these were taken at 540 nm on UV-Visible Spectrophotometer. Graph of the absorbance versus concentration of standard solution of $K_2Cr_2O_7$ was plotted. Absorbance of test and control B was extrapolated on the graph.

Result and Discussion

Screening and selection of $K_2Cr_2O_7$ tolerant bacteria:

An attempt was made to study the isolation and identification of heavy metal resistant bacteria from mangrove soil collected from Kharghar, Navi Mumbai. Serially diluted sample was spread on sterile LB media supplemented with various concentrations of $K_2Cr_2O_7$ and incubated. Several isolated colonies were observed after 24 hours. Among these two colonies were selected for further studies. They were named as Isolate 1 and Isolate 2. Macroscopic and microscopic analysis of these colonies was carried out. Observations are as follows:

Colony characteristics	Isolate 1	Isolate2
Size	Small	Small
Shape	Circular	Circular
Margin	Entire	Entire
Color	White	Yellow
Surface	Smooth	Smooth
Elevation	Flat	Convex
Grams nature	Grams negative	Grams negative
Morphology	Short rods	Short rods

Heavy metal tolerance:

Heavy metal tolerance study was done using above mentioned protocol. A MIC value of the isolates for potassium dichromate was found to be 0.25 mg/L.

Isolates / Metal concentration	0.25 mg/ml	0.5mg/ml	0.75mg/ml	1mg/ml	1.25mg/ml
Isolate 1	+ ve	- ve	- ve	- ve	- ve
Isolate 2	+ ve	- ve	- ve	- ve	- ve

Identification of the isolates:

Both the isolates were identified using Biomerieux Vitek®2 compact system. Isolate 1 was identified to be *Acinetobacter twoffii* and isolate 2 was identified to be *Myroides spp.*

Biosorption study:

Isolate 1 *i.e. Acinetobacter twoffii* was used for biosorption study. UV-Visible Spectrophotometer was used to study the bisorption of heavy metal by Isolate 1. Graph of the standard concentrations was plotted and readings of the test and control B were extrapolated on the standard graph. Absorbance of the test corresponded to 0.170 mg/ml concentration of $K_2Cr_2O_7$. Absorbance of the control B corresponded to 0.236 mg/ml concentration of $K_2Cr_2O_7$. Decrease in absorbance was observed in the test flask containing $K_2Cr_2O_7$ and inoculated with *Acinetobacter twoffii*. This observation indicates that *Acinetobacter twoffii* can effectively remove $K_2Cr_2O_7$ from sample. The percent biosorptionwas calculated as-

$$\%\text{Biosorption} = \frac{(\text{Initial concentration of } K_2Cr_2O_7 - \text{Final concentration of } K_2Cr_2O_7)}{\text{Initial concentration of } K_2Cr_2O_7} \times 100$$

$$= \frac{(0.236 - 0.170)}{0.236} \times 100 = 27.966\ \%$$

Conclusion:

Mangroves are coastal wetlands forest, generally found near the intertidal regions of estuaries between creeks, lagoon, marshes etc. mangroves provide a unique ecological site to different microbes because of richness in carbon and other nutrients. (3) Mangrove soil harbor large number of unique bacteria as well a prevalent to stressconditions such as salt stress but microorganisms growing under such stress condition could have likely to tolerate high concentration of heavy metal. Hence there is possibility that mangrove soil must harbor heavy metal resistant bacteria that can be used for bioremediation. In the present study *Acinetobacter twoffi*i was used for biosoption study. The present study shows that the *Acinetobacter twoffii* was able to effectively bioadsorb 0.25 mg/ml of Cr.

Future Prospects

Adsorption isotherms will be determined by using dried biomass of *Acinetobacter twoffii*. The effect of PH, Temperature on biosorption will be determined.

References:

1. Magdalena Zabochnicka-Swiatek, MalgorzataKrzywonos (2014),**"Potential of Biosorption and Bioaccumulation Processes for Heavy Metal Removal"** Pol. J. Environ. Stud. Vol. 23, no. 2.
2. Salman H. Abbas1, Ibrahim M. Ismail, et.al (Oct 2014)**"Biosorptionof Heavy Metal: A Review"** Journal of Chemical Science and Technology, Vol. 3.
3. Bhat M.R.ShewadeLeena (2013),**"Isolation and Characterization of Microorganisms From Mangrove Soil of CBD Belapur Creek, Navi Mumbai, MS India"**International Journal of Environmental Science Vol. 3, no.6.
4. Laura-DorinaDinu et.al (2011),**"Isolation of Heavy Metal Resistant Bacterial Strain From the Battery Manufactured Polluted Environment"** Romanian Biotechnology Letters, Vol. 16, No 6.
5. Mohammad Oves et.al (2013),**"Bisorption of Heavy Metal *by Bacillus thuringinsis*Strain OSM29 Originating From Industrial Effluent Contaminated North Indian Soil"**Saudi Journal of Biological ScienceVol.20.

Isolation &Characterization of BiosurfactantProducing Bacteria from Oil Contaminated Soil

Ashwini Jadhav*[1],Pooja Desai[2]

1,2SIES(Nerul) College of Arts,Commerce and Science

*ashwinij944@gmail.com

ABSTRACT:

Biosurfactant are diverse group of surface active agents produced by many micro-organisms.They produce amphiphilic compounds contain hydrophobic and hydrophilic moiety and they have ability to reduce interfacial tension between two or more different fluid phases.Biosurfactant has unique properties like non-toxic, easily biodegradable,eco-friendly and high stability,wide variety of industrial application makes them highly useful group of chemical compounds. The objective of this study is to isolate and characterize the biosurfactant producing bacteria from oil contaminated soil.Thenisolation,screening of bacteria is done by oil spreading technique,emulsification assay,foaming activity, hanging drop method, drop collapse method.Ahead physical characterization is done by the gram staining method.Presence and absence of bacteria is checked by the biochemical tests-Catalase test,Citrate test,Urease test,Methyl red test,Indole test,Gelatin test,Starch hydrolysis test. Through this isolation of bacteria from oil contaminated soil we can study it's characteristics by the physical & biochemical methods.After analysis we can use the isolated bacteria for further environmental friendly applications such as Bioremediation, Industrial biotechnology.

Keywords*-Biosurfactant, Amphiphilic compound, Hydrophobic, Hydrophilic, Biodegradable,Eco-friendly.*

Introduction–

Biosurfactant are active compounds that are synthesized by micro-organism & they are able to reduce interfacial tension between two liquids with low toxicity & high specificity. Surfactants are organic compounds that contain both hydrophilic and hydrophobic moieties. Thus, surfactant contain both water insoluble i.e. water repellent group as well as water soluble i.e. water loving group[1].The natural surfactants are amphiphilic compounds produced on living surface, recognized as the natural source of emulsifiers, which could be a useful instrument in the bioremediation of Crude oil pollution[2].The most commonly isolated biosurfactant are glycolipids, lipopeptide, lipopolysaccharide & oligosaccharides surfactants which are chemical materials are known as synthetic surfactants like Sodium dodecyl sulphate[3].

Biosurfactant producing microbes are considered a generous gift of nature due to their diversity, environmentally friendly nature, possibility for large scale production, selectivity, performance under extreme conditions & potential application in environmental protection [2].Mostly Yeast, Bacteria & Fungi are known to synthesized biosurfactant.

Biosurfactant increase the solubility of hydrocarbons which in turn increase it's bioavailability to micro-organisms [2]. Synthetic surfactants have also been used in biodegradation process of organic compounds but they are harmful to the environment.Recently interest in biosurfactant has increased because of it's flexibility in operation, diversity & more eco-friendly than chemical surfactant[1].Furthermore possibility of their production on large scale, selectivity, performance under intense conditions & their future applications in environmental fortification has also been increasingly attracting the attention of scientific & industrial community[1]. These molecules have a potential to be used in variety of industries like cosmetics,pharamaceutical,food

preservatives & detergents, But the production of biosurfactant on industry level is still challenge because of using high costly synthetic media for microbial growth [1]

Interest in biosurfactantis steadily increasing in the environmental sciences as well. Besides the bioremediation, biosurfactant also have the potential to be used in enhanced oil recovery herbicide & pesticide formulations, health care, pulp &paper ,coal, textiles, ceramics processing & mechanical dewatering of peat[2].

Although biosurfactant exhibit such important advantages, they have not yet been employed extensively used in industry due to relatively high production costs[4].Against these backdrops this study was aimed at isolating & screening characterizing biosurfactant producing micro-organism's from oil contaminated soil.

Aim and Objectives -

Aim - To isolate, characterized the biosurfactant producing bacteria from oil contaminated soil.

Objectives –

- To isolate the biosurfactant producing bacteria.
- To study characteristics of isolated bacteria

Materials and Methodology –

1. **Collection of soil sample** – Soil sample was collected from area around the Petrol pump(Nerul), sector – V. 5gm.of soil sample was collected & inoculated in 100 ml. of Mineral salt media(MSM) with 3ml.of Kerosene as a carbon source & then incubated for 72hrs/30^0c. Inoculated culture streak on Nutrient agar(NA) plates & then culture were serially diluted upto 10^{-6}. After that every dilution was spread on NA plate &inocubated at 30^0C/72hrs.
2. **Isolation of biosurfactant producing bacteria** – After the serial dilution $10^{-4,}$ 10^{-5} 10^{-6} these concentration were streak on NA plate for the selection of isolated colonies.From this plate 5 colonies of different morphology were selected and isolated.
3. **Pure culture preparation** – 5 isolated colonies were then streak on NA plates to get pure culture and NA slants for preservation of colonies for further study purpose.
4. **Screening ofbiosurfactant producing bacteria -**
   - Oil spreading technique
   - Emulsification assay
   - Foaming activity
   - Hanging drop method
   - Drop collapse method
5. **Physical characterization of isolated bacteria** –
   - Gram staining
   - Cell morphology
6. **Biochemical characterization of isolated bacteria-**
   - Catalase test
   - Citrate test
   - Urease test
   - Methyl red test
   - Starch hydrolysis test
   - Indole test
   - Gelatin test

Result& discussion –

1) Isolation of bacteria

Four strains observed withdifferent colony morphology were streaked on nutrient agar plate to obtain pure culture and they were taken for further study.

2) Screening of isolated bacteria –

All the 4 isolated strains were screened for by using different screening techniques.

A) Oil spreading technique –

Supernatant of isolated strain were added to the centre of kerosene oil. The isolated strains showed the oil displacement against the kerosene oil and showing clear zone.The results were noted down.

Result of oil spreading technique –

Bacterial strain	Diameter of clear zone (in cm.)	Interpretation
Pseudomonas aeurginosa	1.5	Positive
Bacillus subtilis	1.1	Positive
Actinomyces	0.7	Positive
Bacillus cereus	1.2	Positive

B) Emulsification assay –

The isolated strains showed the positive results against kerosene oil. These bacteria had ability to degrade the kerosene oil.The test was done by using 2ml.of kerosene oil and 1ml. Of supernatant from isolated strains & kept overnight. The results were noted down as follows.

Result of E_{24} index of isolated bacterial strain -

Bacterial strain	Emulsified layer (cm)	Total liquid layer	E_{24} (in %)
Pseudomonasaeurginosa	1.2	1.6	75%
Bacillus subtillis	1.0	1.8	55.5%
Actinomyces	0.9	1.3	69%
Bacillus cereus	0.8	1.9	42%

C) Foaming activity –

Isolated strain were grown separately in 250 ml of Erlenmeyer flasks which contain 100 ml of nutrient brothand then flasks were incubated at 30^0 c. on shaker incubator at 200 rpm for 72hrs.

Bacterial strain	*Pseudomonas aeuroginosa*	*Bacillus subtillis*	*Actinomyces*	*Bacillus cereus*
Foaming activity(cm.)	1.4 cm.	1.1 cm.	0.8 cm.	1.2 cm.

D) Drop collapse test –

These test was done by using a drop of cell suspension of surfactant producing bacteria which was collapsed on an oil coated surface. All isolated bacterial strains showed the positive result because they had surfactant producing ability

E) Hanging drop method –

Loopful smear was made on cover slip then was put on the slide(cavity slide) & observed at 10x and then at 40x. Motile bacteria gives positive results for these test. From the isolated bacteria, 3 bacterial strains gave positive results. One bacterial strain gave negative test as the microbe was non motile

3)Physical characterization of isolated bacterial -

a) Gram staining – By using this staining method gram positive bacteria were found show purple colour and gram negative bacteria showpink colour. Among the isolated bacteria, 3 bacteria were gram positive(rod shaped) in nature while 1 bacteria was gram negative (rod shaped).

b)Morphology –

Cell morphology includes following morphological characters

Bacterial strains	**Colour**	**Shape**	**Size**	**Margin**	**Elevation**	**Surface**	**Consistency**	**Oxygen requirement**	**Opacity**
Pseudomonasaeurginosa	White	Regular	5mm.	Entire	Low convex	Smooth	Moist	Anaerobic	Opaque
Bacillus subtilis	White	Irregular	8mm.	Irregular	Low convex	Rough	Dry	Aerobic	Opaque
Actinomyces	White	Regular	6mm.	Entire	Low convex	Smooth	Moist	Anaerobic	Opaque
Bacillus cereus	White	Regular	5mm.	Entire	Low convex	Smooth	Moist	Aerobic	Translucent

3) **Biochemical characterization isolated bacteria** –

Biochemical tests were performed to identify the species of bacteria or strain. For the Identification &Characterization of isolated bacterial strains Bergey' smanual of Determinative Bacteriology was used. On the basis of this manual the species was predicated.

Result of biochemical tests -

Biochemical test	Pseudomonas aeurginosa	Bacillus subtilis	Actinomyces	Bacillus cereus
Catalase test	Positive	Positive	Negative	Positive
Citrate test	Positive	Positive	Negative	Positive
Urease test	Negative	Negative	Negative	Negative
MR – VP test	Negative	Negative	Positive	Negative
Starch hydrolysis test	Negative	Positive	Positive	Positive
Indole test	Negative	Negative	Positive	Negative
Gelatin hydrolysis test	Positive	Positive	Positive	Positive
Motility test	Positive	Positive	Negative	Positive

Conclusion –

Biosurfactant is an active compound which is produced by bacteria andit has thecapability to degrade the oil which is major contaminant found in soil around the petrol pump area. Biosurfactant producing bacteria were isolated from oil contaminated soil and were screened by various techniques like oil spreading technique,

emulsification assay, foaming activity, drop collapse test, hanging drop method. All selected bacterial strains gave positive result for oil spreading technique.*Pseudomonasaeruginosa*showed more emulsification ability i.e. 75% as compared to other isolated bacterial strains. Also *Pseudomonasaeruginosa*showed more foaming activity. *Bacillus subtillis* formed1.1 cm foam and *Bacillus cereus*formed 1.2 cm. while*Actinomyces*displayed less capability to form the foam.

All isolated strains showed positive result for the drop collapse test because they spread on oil coated surface to produce the Biosurfactant. Hanging drop method is generally done for the checking of the motility of the isolated bacteria. From the isolated strains *Pseudomonasaeruginosa, Bacillus subtillis, Bacillus cereus*are found to be motile while*Actinomyces* is non-motile because there is absence of flagella so they gives negative results.it showed negative result to the Hanging Drop Test.

Gram staining is done to check the gram nature of isolated bacteria.*Bacillus subtillis,Bacillus cereus*were found to be gram positive purple colour rod shaped bacteria while *Pseudomonasaeruginosa* is gram negative rod shaped bacteria which appeared pink colour.Isolated bacterial strains demonstrated different cell morphology on the basis of their colour, shape,Size, margin, elevation, surface, opacity, consistency and oxygen requirement.

From the result of physical characterization & biochemical characterization we can conclude that isolated bacteria contain 4 different types of colonies. It may be of *Pseudomonasaeruginosa, Bacillus subtillis, Actinomyces, Bacillus cereus* bacteria. From result we can concluded that *Pseudomonasaeruginosa* can produce rhamnolipid type of Biosurfactant. *Bacillus subtillis, Bacillus cereus* (bacillus spp.) can produce lipopeptides type of Biosurfactant while *Actinomyces* can produce glycolipid type of Biosurfactant. This all type of Biosurfactant can be extracted by using isolated bacteria.

Recommendation –

Biosurfactant derived from living organismhas structural diversity, low toxicity, higher biodegradability, better environmental compatibility, dispersion efficiency so it can be used food industries, pharmaceutical and cosmetics industry also.

The isolated bacteria can be used for further environmental friendly applications such as Bioremediation, Industrial biotechnology.

References-

1. BS saharan, RK Sahu, D sharma. 2011. A Review on Biosurfactants: Fermentation, Current Developments and production, Genetic Engineering and Biotechnology Journal.
2. Eduardo J. gudi˜na, JOS´e A. teixeira, and L´ıgia R. Rodrigues. 2011. BiosurfactantProducing Lactobacilli: Screening, Production, Applied and Environmental Soil Science, Vol. 2011, pp. 9.
3. Jayshree R.C. et.al. Int J Pharm Bio Sci 2013 Oct; 4(4): (B) 904 – 912
4. V. Saravanan et.al. J. Acad. Indus. Res. Vol. 1(5) October 2012
5. Shoeb et.al/ Turk J Biol (2015)39:210 - 216

Groundwater Analysis and Comparing Its Effects on Public Residing In Rural and Urban Areas of Panvel

Karan J Patil*[1], Dr. Jyoti Koliyar[2].

1, 2- SIES (Nerul) College Of Arts, Commerce and Science

A-203, Sec-12, Plot No.31, Kohinoor Paradise, Kamothe, Navi Mumbai.

Contact:- 9167784763

*patilkaran3594@gmail.com

Abstract:-

This paper basically discuss about groundwater quality for public consumption and to identify effects of ground water on people. Groundwater (or ground water) is the water present beneath Earth's surface in soil pore spaces and in the fractures of rock formations which is often cheaper, more convenient and less vulnerable to pollution than surface water. Therefore, it is commonly used for public water supplies. This groundwater is used by rural and urban people as source of drinking, washing, bathing, and cleaning purposes. A comparison analysis of water samples of different sources of rural and urban areas is done by studying different parameters like pH, hardness, TDS, acidity, alkalinity, iron, Dissolved oxygen (DO), phosphate, salinity & chloride which are chemical parameters and physical parameters like odour, taste, colour, conductance, turbidity which determine ground water quality of different sources.

This paper focus on physico-chemical analysis in order to ascertain quality of water for public consumption.

Key words: - *Groundwater, physico-chemical parameters, public consumption, quality of water.*

Introduction:-

Groundwater resources support many urban and rural communities around region of Panvel. Aquifers are a source of water for drinking, irrigation, stock supply, bottling and many other uses in many areas of rural and urban areas of Panvel (Groundwater Sampling and Analysis – A Field Guide Pg.No.1). In areas of Panvel due to scarcity of rainfall in last year 2015 the City and Industrial Development Corporation- CIDCO passed an announcement in local newspaper which stated that "people residing in Panvel area is allowed to dug a bore well in their society and residential area for the consumption due to scarcity of water" to cope up with the problem of water scarcity. Hence increase in groundwater consumption in urban areas, where as in rural areas of Panvel many villagers were already dependent on ground water. Many people are consuming ground water for daily purpose, there is requirement to analyse quality of ground water and effects on people. This paper will show the usage and its positive and negative effect of ground water.

Aim & Objective:-

Aim:-

Groundwater analysis and comparing its effects on public residing in rural and urban areas of Panvel.

Objectives:-

a. Selection of rural and urban areas of Panvel.

b. Analysis of samples on the basis of physico-chemical parameter.

c. Comparing results.

Methodology:-

I. Sampling: - Sample was collected from six different groundwater location in rural and urban areas Of Panvel i.e. 1 samples each. And samples were collected in clean bottles.

II. Analysis: - The bottles containing water samples were of 1 litre volume. The determination of DO, pH, colour, odour and taste were performed at site of sampling. The determination of hardness, turbidity,

III. TDS, acidity, alkalinity, iron, phosphate, salinity & chloride was done in laboratory.

IV. Result: - The test result were obtained by performing above experiment upon which conclusion is dependent.

Results & Discussion:-

Table No.1 (Rural)

Parameters.	**Sample 1**	**Sample 2**	**Sample 3**
Dissolved oxygen (DO).	1.50	2.65	2.40
pH.	6.3	6.1	6.6
Total Hardness. (mg/l)	141	132	121
Total Dissolved solids (TDS) (mg/l)	600	1000	600
Chloride. (mg/l)	94.0	118.9	124.2
Iron. (mg/l)	0.00	0.00	0.00
Phosphate. (mg/l)	0.00	0.00	0.00
Salinity.	169.81	214.79	224.37
Conductivity.	0.755	0.936	0.834
Turbidity.	29.5	9.4	3.4
Acidity. (mg/l)	12.8	13.2	12.2
Alkalinity. (mg/l)	11.9	10.3	9.6
Taste.	Earthy	Earthy	Earthy
Color.	Colourless	Colourless	Colourless
Odour.	Odourless	Odourless	Odourless

Figure 1.1
(Rural)

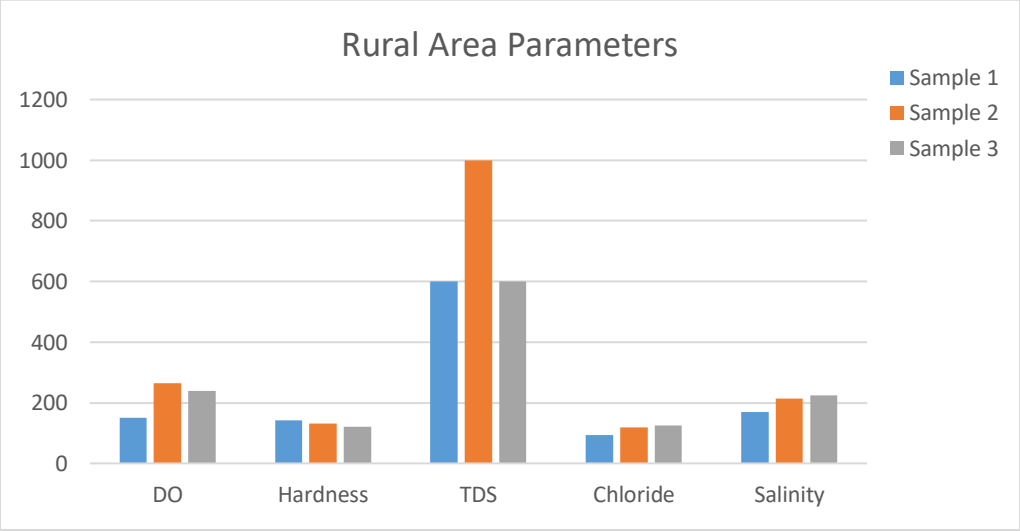


Figure 1.2 (Rural)

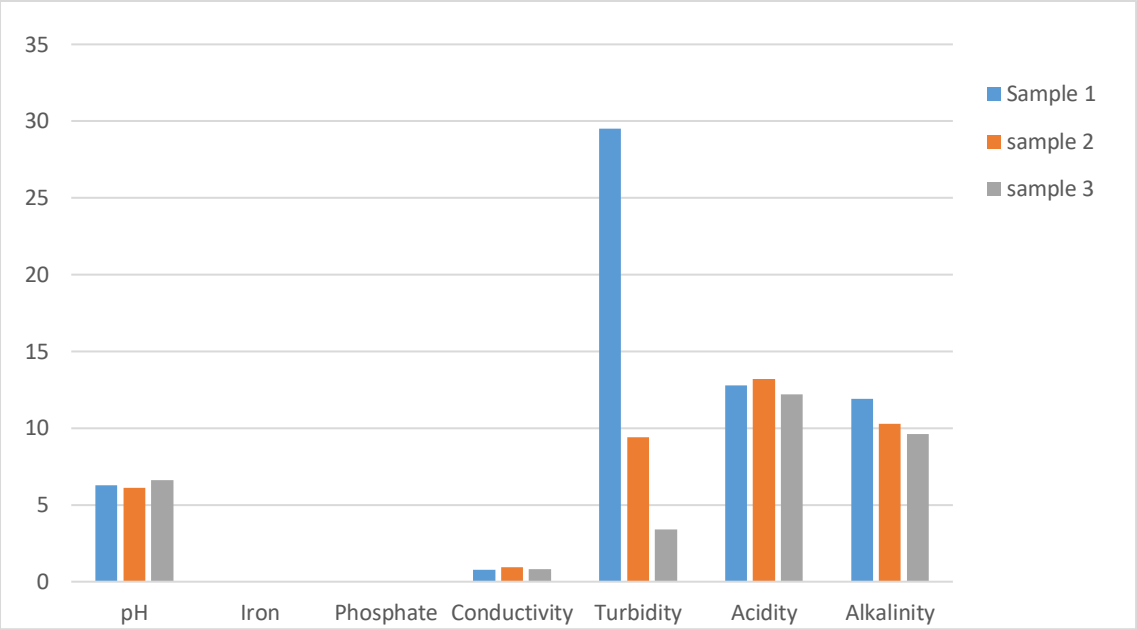


Table No.2 (Urban)

Parameters.	**Sample 1**	**Sample 2**	**Sample 3**
Dissolved oxygen (DO).	2.95	3.21	1.15
pH	6.5	6.4	6.2
Hardness. (mg/l)	130	121	156
Total Dissolve solid (TDS). (mg/l)	600	1200	400
Chloride. (mg/l)	143.7	161.5	177.5
Iron. (mg/l)	0.00	0.00	0.00
Phosphate. (mg/l)	0.00	0.00	0.00
Salinity.	259.73	291.79	320.65
Conductivity.	0.654	0.843	0.776
Turbidity.	5.6	6.2	4.8
Acidity. (mg/l)	12.2	12.6	12.0
Alkalinity. (mg/l)	11.4	10.5	13.6
Taste.	Earthy	Earthy	Earthy
Color.	Colourless	Colourless	Colourless
Odour.	Odourless	Odourless	Odourless

Figure 2.1
(Urban)

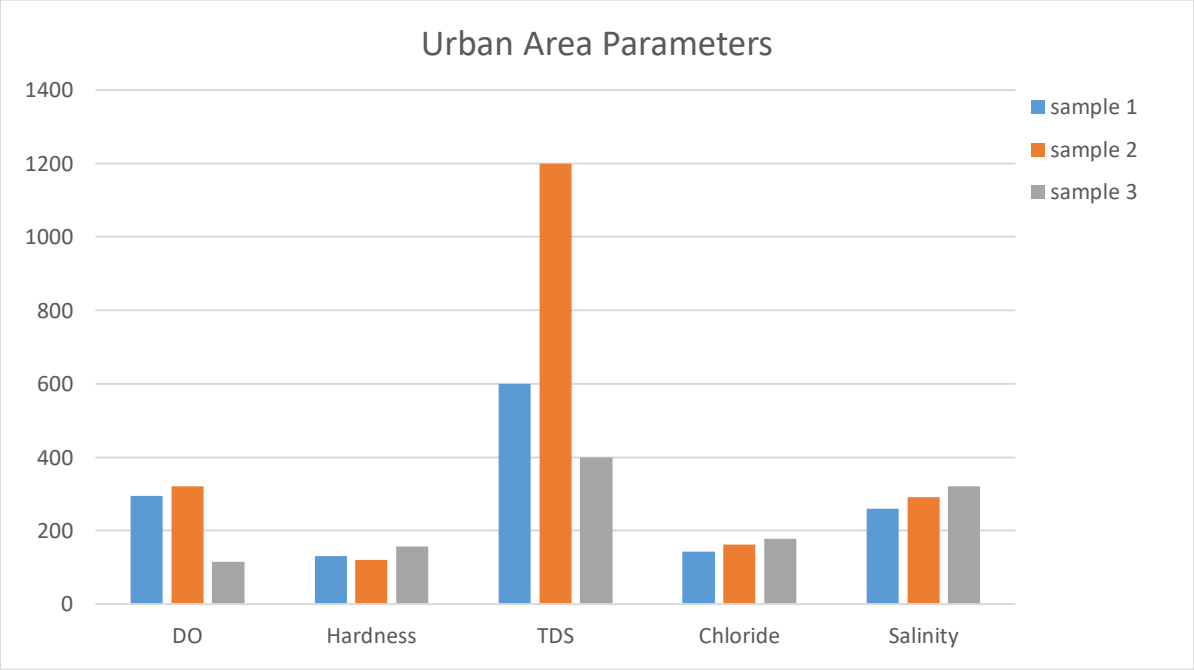
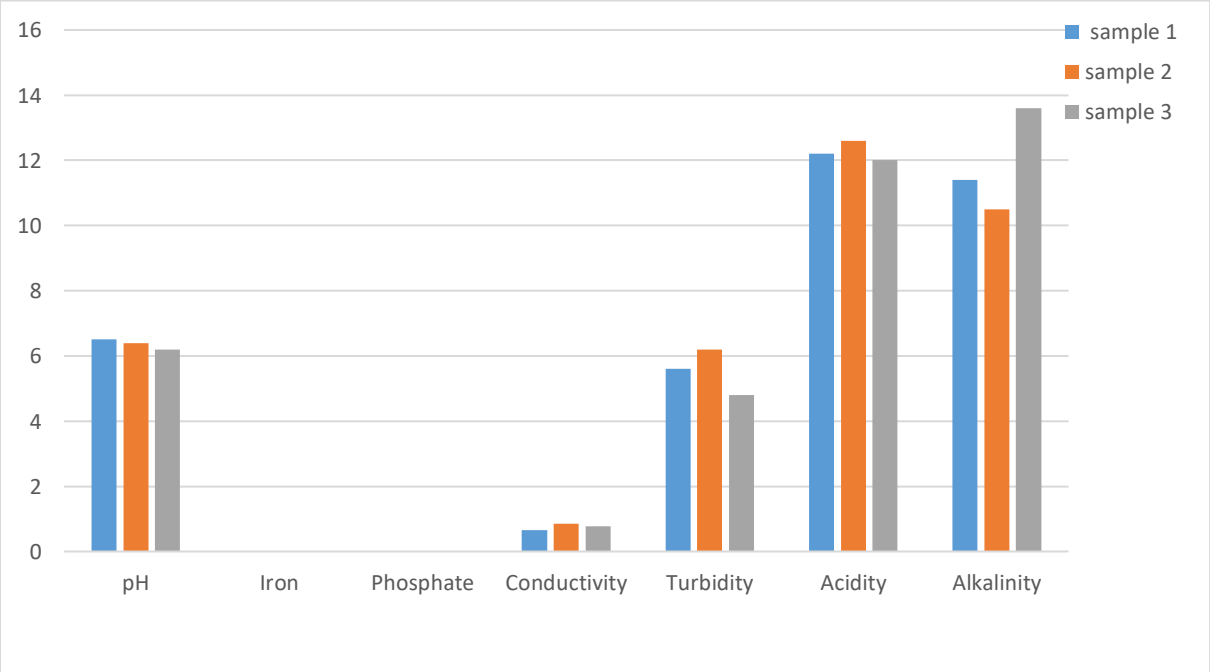


Figure 2.2
(Urban)



1. Standards: - (BIS – Bureau of Indian Standards.)

Parameters.	Units.	Standards.
Dissolved Oxygen (DO)	(mg/l)	6
pH	NA	8.5
Total Dissolved Solids (TDS)	(mg/l)	3000
Hardness.	(mg/l)	600
Chloride	(mg/l)	1000
Iron.	(mg/l)	1.0
Phosphate.	(mg/l)	1.5
Salinity.	NA	1500
Turbidity.	NTU	10
Acidity.	(mg/l)	600
Alkalinity.	(mg/l)	600

Discussion:-

i. Dissolved Oxygen (DO):-

The determination of dissolved oxygen of water samples of rural and urban areas was done successfully. The DO readings ranges from 150–240 mg/l for rural area & 115-295 mg/l for urban area. According to study the readings of sample 2 of rural area and sample 2 of urban area were high compared to rest but all samples of rural and urban areas lies within limits of BIS standards.

ii. pH:-

The determination of pH of water samples of rural and urban areas was done successfully. The pH readings ranges from 6.3-6.6 for rural area & 6.2-6.5 for urban area. According to study the readings of sample 3 of rural area and sample 1 of urban area were high compared to rest but all samples of rural and urban areas lies within limits of BIS standards.

iii. Total Dissolved Solids (TDS):-

The determination of TDS in water samples of rural and urban areas was done successfully. The TDS readings ranges from 600-1000 mg/l for rural area &600-1200 mg/l for urban area According to study the readings of sample 2 of rural area and sample 2 of urban area were high compared to rest but all samples of rural and urban areas lies within limits of BIS standards.

iv. Hardness:-

The determination of Hardness of water samples of rural and urban areas was done successfully. The readings range from121-141 mg/l for rural area & 121-156 mg/l for urban area. According to study the readings of sample 1 of rural area and sample 3 of urban area were high compared to rest but all samples of rural and urban areas lies within limits of BIS standards.

v. Chloride:-

The determination of chloride in water samples of rural and urban areas was done successfully. The readings range from 94-124.2 mg/l for rural area & 143.7-177.5 mg/l for urban area. According to study the readings of sample 3 of rural area and sample 3 of urban area were high compared to rest but all samples of rural and urban areas lies within limits of BIS standards.

vi. Iron:-

The determination of Iron in water samples of rural and urban areas was done successfully. According to study the readings of samples were null both in rural and urban areas.

vii. Phosphate:-

The determination of Phosphate in water samples of rural and urban areas was done successfully. According to study the readings of samples were null both in rural and urban areas.

viii. Salinity:-

The determination of salinity in water samples of rural and urban areas was done successfully. However there is no specific unit for measurement of salinity but the samples were below the permissible limits. The readings range from 169.81-224.37 in rural area & 259.73-320.65 in urban area. According to study the readings of sample 3 of rural area and sample 3 of urban area were high compared to rest but all samples of rural and urban areas lies within limits of BIS standards.

ix. Turbidity:-

The determination of turbidity of water samples of rural and urban areas was done successfully. The readings range from 3.4-29.5 NTU in rural area & 4.8-6.2 NTU in urban area According to study the readings of sample 1 of rural area and sample 2 of urban area were high compared to rest but all samples of rural and urban areas lies within limits of BIS standards.

x. Acidity:-

The determination of acidity of water samples of rural and urban areas was done successfully. The readings ranges from12.2-13.2 mg/l for rural area & 12-12.6 mg/l in urban area. According to study the readings of sample 2 of rural area and sample 2 of urban area were high compared to rest but all samples of rural and urban areas lies within limits of BIS standards.

xi. Alkalinity:-

The determination of alkalinity of water samples of rural and urban areas was done successfully. The readings ranges from 9.6-11.9 mg/l for rural area & 11.4-13.6 mg/l for urban area. According to study the readings of sample 1 of rural area and sample 3 of urban area were high compared to rest but all samples of rural and urban areas lies within limits of BIS standards.

Whereas the parameters of physical were done on base of taste, odour, colour which were earthy taste, colourless colour & odourless smell for all water samples of rural and urban areas.

Conclusion & Recommendation:-

The study was done on the basis of physico-chemical parameters and respective results were obtained. The results and study reviled that urban water samples has more impurities compared to rural water samples but both the water samples of rural and urban lies below permissible limits of BIS.

The water samples from urban area must be having high impurities because these ground water were initially not been used as source of water but in march 2015 the urban areas of Panvel faced lac of water for utility, hence to come up with this problem the CIDCO order the localities to use ground water for usage. Before this problem the groundwater were not regularly used so the groundwater in urban areas have more impurities compared to rural groundwater.

Where as in rural area the ground water were already been used hence having low impurities compared to urban groundwater but both the groundwater samples lies below permissible limit both water can be utilized. These water can be first treated then can be used treatment process like reverse osmosis (RO), chemical coagulants, sedimentation, trickling filters etc. for drinking purpose membrane filtration, UV treatment, electrolysis, & RO can be used but these processes are costly, so at regular day to day life water should be boiled or use of alum should be done to sediment the impurities.

Acknowledgement:-

This research was supported by my guide, Dr. Jyoti Koliyar. I thank her for providing insight and expertise that greatly assisted the research.

Reference:-

1. Journal of food, agriculture & environment vol.5, 2007.
2. Journal of Environmental Research and Development Vol. 3 No. 1, July-September 2008.
3. Journal of Environmental Research and Development Vol. 4 No. 3, January-March 2010.
4. http://shodhganga.inflibnet.ac.in/handle/10603/122074?mode=full
5. Physico-chemical hydrology of a tropical season river upper Oguen river Nigeria
6. Civil and Environmental Research ISSN 2224-5790 Vol.3, No.8, 2013
7. International Journal of Advanced Engineering Research and Studies ISAERS Vol.1,Octomber-Decemer,2011

To Study the Variation in Human Microbiota

Pooja Sontakke*
S.I.E.S (Nerul) College Of Arts, Science & Commerce
Nerul, Navi Mumbai 400076
*Corresponding author-9619235950, *poojasontakke04@gmail.com

Abstract
The human body is colonized by a vast number of microbes, collectively referred to as the human microbiota. They include bacteria, fungi, and archaea. The problem of elucidating the human microbiome is essentially identifying the members of a microbial community which includes bacteria, eukaryotes, and viruses. Thus decline in human microbiota can affect to health like pathogen susceptibility, obesity, auto-inflammatory disease and other potential health impact. This is due to environmental factors include variation in sun exposure, modernize lifestyle, geography, seasonal change, atmospheric conditions, age, diet, religious clothing, obesity, use of cosmetic's, addiction. This aims at study of human microbiota and analysis of factors responsible for decline the status of human health. There is growing recognition of the role of diet and other environmental factors in modulating the composition and metabolic activity of the human microbiota, which in turn can impact health. So we can suggest that, diet is an important driver in the development of the gut microbiome and could serve as a means of therapeutic intervention for prevention of diseases.

Key words- *Human microbiota, Environmental factors, Microbes, Addiction, Diet, Human health.*

1.0 Introduction

The human microbiota is the aggregate of microorganisms, a microbiome that resides on or within a number of tissues and biofluids, including the skin, mammary glands, placenta, seminal fluid, uterus, ovarian follicles, lung, saliva, oral mucosa, conjunctiva, and gastrointestinal tracts. They include bacteria, fungi, and archaea. Micro-animals which live on the human body are excluded. The human microbiome refers to their genomes.[1]

The physical and chemical features of the skin select for unique sets of microorganisms that are adapted to the niche they inhabit. In general, the skin is cool, acidic and desiccated, but distinct habitats are determined by skin thickness, folds and the density of hair follicles and glands.[3] Structurally, the epidermis is a formidable physical barrier, resisting penetration by microorganisms and potential toxins while retaining moisture and nutrients inside the body.[5–7] Some regions of the skin are partially occluded, such as the groin, axillary vault and toe web. These regions are higher in temperature and humidity, which encourages the growth of microorganisms that thrive in moist conditions (for example, Gram-negative bacilli, coryneforms and S. aureus).[4]

The nose is a primary defender against inhaled pathogens. The interior lining of the nose contains mucous secreting glands. A wide variety of microbes are normally found there. Staphylococcus epidermidis bacteria form a biofilm that coats the mucosal lining. *Corynebacterium accolens* bacteria is rarely a pathogen, but if it enters the bloodstream due to a torn blood vessel, it can cause serious infections.[2]The simple presence of bacteria can change the environment in the nasal passages if it is identified by the host's immune system. [10]

The environment present in the human mouth allows the growth of characteristic microorganisms found there. It provides a source of water and nutrients, as well as a

moderate temperature. [1] A wide variety of microbes regularly enter the oral cavity. Genera of fungi that are frequently found in the mouth include *Candida, Cladosporium,Aspergillus, Fusarium, Glomus, Alternaria, Penicillium, and Cryptococcus*, among others.[8] oral health and the resulting ability of the oral microbiota to invade the body to affect cardiac health as well as cognitive function.[9]. In the present study an attempt is made to study the variation in the human microbiota and analyze their microbial characteristics.

2.0 Methodology

The oral, nasal and dermal swabs of 12 individuals were collected from Panvel Region and plated on Nutrient Agar Media using streak plate method and the plates were incubated st 37^0C for 24 to 48 hours. After the incubation time, colony characteristics of the colonies grown on the plate were studied and biochemical tests were carried out for the same.

3.0 Result and Discussion

Media – Nutrient Agar

Time of Incubation – 24 to 48 hrs

Temperature of incubation - Room temperature

Addicted:

Sr no.	Age	Sex	Samples	Inference/ Organisms Found
1.	50	Male	Oral	*Proteobacteria,Spirochaete*
			Nasal	*Staphylococcus aureus, Cardiobacterium hominis*
			Dermal	*Corynebacteriumis*
2.	41	Male	Oral	*Proteobacteria*
			Nasal	*Staphylococcus aureus, Cardiobacterium hominis*
			Dermal	*Propionibacterium*
3.	35	Male	Oral	*Proteobacteria,Spirochaete*
			Nasal	*Staphylococcus aureus*
			Dermal	*Corynebacterium*
4.	60	Female	Oral	*Proteobacteria*
			Nasal	*Staphylococcus aureus Cardiobacterium hominis*
			Dermal	*Propionibacterium*
5.	29	Female	Oral	*Proteobacteria,Spirochaete*
			Nasal	*Staphylococcus aureus*
			Dermal	*Corynebacterium*
6.	40	Female	Oral	*Proteobacteria*
			Nasal	*Staphylococcus aureus Cardiobacterium hominis*
			Dermal	*Propionibacterium*

- **Non-addicted:**

Sr no.	Age	Sex	Samples	Inference / Organisms Found
1.	45	Female	Oral	*Bacteroidetes*
			Nasal	*Proteobacteria*
			Dermal	*Staphylococcus epidermidis*
2.	22	Female	Oral	*Bacteroidetes*
			Nasal	*Proteobacteria*
			Dermal	*No Growth*
3.	17	Female	Oral	*Bacteroidetes*
			Nasal	*Proteobacteria*
			Dermal	*Staphylococcus epidermidis*
4.	13	Male	Oral	*Bacteroidetes*
			Nasal	*Proteobacteria*
			Dermal	*Staphylococcus epidermidis*
5.	17	Male	Oral	*Bacteroidetes*
			Nasal	*Proteobacteria*
			Dermal	*No Growth*
6.	12	Male	Oral	*Bacteroidetes*
			Nasal	*Proteobacteria*
			Dermal	*Staphylococcus epidermidis*

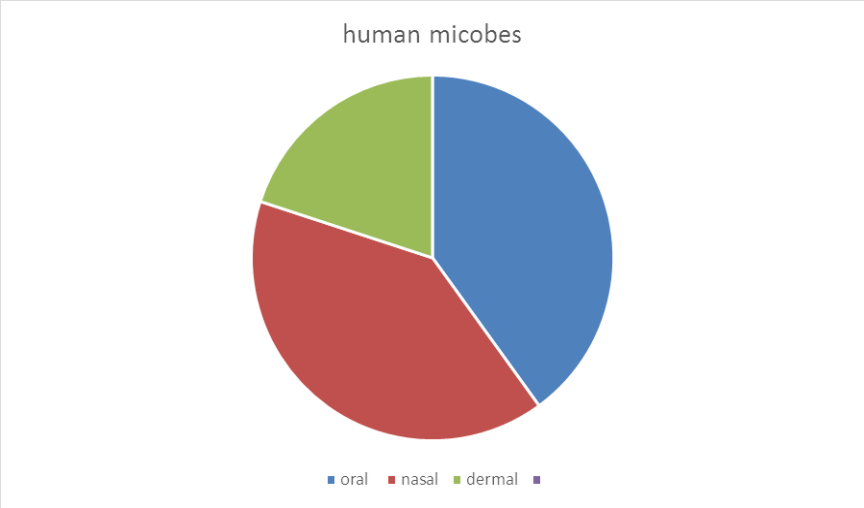


Fig.1: Percent Population of different microbiota

In figure.1 the population of different microbiota was found in oral, nasal and dermal samples taken from respective individual.

Maximum percent value observed on both oral and dermal microbiota i.e. 40%, where as 20% population observed by dermal microbiota.

4.0 Conclusion

The human body is colonized by a vast number of microbes, collectively referred to as the human microbiota. They include bacteria, fungi, and archaea. The problem of elucidating the human microbiome is essentially identifying the members of a microbial community which includes bacteria,

eukaryotes, and viruses. Thus decline in human microbiota can affect to health like pathogen susceptibility, obesity, auto-inflammatory disease and other potential health impact. This is due to environmental factors include variation in modernize lifestyle, geography, seasonal change, atmospheric conditions, age, diet.The main aim of this project is to study the variation inhuman microbiota.

The human microbiota is performed using 36 different samples taken from 12 individuals are collected using cotton swabs and are further isolated in **Nutrient agar medium** using streak plate method or **T-method** and incubated at room temperature for 24 to 48 hrs.

By observation Addicted samples shows growth of various microorganism from different body locations like oral, nasal and dermal. Oral samples shows presence of ***Proteobacteria, Spirochaete*** and nasal shows presence of ***Staphylococcusaureus,Cardiobacteriumhominis***organism. Also decline number of Human microbes observed on dermal samples, which shows ***Propionibacterium***

All Microorganism observed are Pathogenic in nature and can be lead to cause infectious disease in human which sometimes become fatal.

Non- addicted samples also variety of common observed flora of human microbiome. Oral samples shows presence of ***Bacteroidetes***whereas nasal and dermal samples shows presence of ***Proteobacteria*** and ***Staphylococcus epidermidis***respectively.

None of the samples showed presence of pathogenic and harmful micro biome.

Also some of the samples showed no growth which means the samples may not be contain any microorganism.

There is a lot of difference seen among the male and female result. Addicted male samples those who chew tobacco shows absence of helpful micro flora which may get replace by some pathogenic organism. Also the people intake with alcohol may show's diminished role of human micro biota. The similar results observed while looking at Nasal flora collected from Upper respiratory tract which does shows replacement and crowding of some other and useless airborne pathogenic organism.

Dermal flora vary by person to person depending upon the atmospheric organism and location. The females use variety of cosmetic product which may help to reduce population of microbes from skin.The people working for longer time may get sweated due to which various other flora get saturated on skin and decrease the require rate of human biome. This may be based of living lifestyle and stressful living.

Also pollution plays an important role to fluctuate number of microbes on human body. Thus environment plays a dual role for generating, protecting and decreasing presence of human microbiome.Age too is an important factor for showing greater variety of human micro biota as the people who are in adult stage may shows strong presence of microbes where and small age group may shows lower number of microbes.

Depending on diet of individual the intake of food, ingredients and metabolism may vary person to person which may show's direct or indirect impact of gut flora which may shifted to population size of human micro biome.

Protecting and conserving human micro biome is an integral part of lives of humans. But because of some environmental factors it doesn't become that much important. People take it as granted and negligence part of their

daily routine which further become a serious hazard to keep life in waves of disease.

7.0 Acknowledgement

It is a great privilege to express my deep sense of gratitude to all, who have helped me during the course of my research work. It is my prime duty to acknowledge my sincere gratitude to my guide Mrs. Pooja Desai, Professor, SIES College of Arts, Commerce and Science (Nerul), Construction for giving me an opportunity and constructive guidance, inspiration and all the help to complete my project work as a partial fulfillment for the degree of M.Sc. (Mumbai University) at SIES College Nerul.

I would like to thank my Lab assistants Rajesh sir and Nitin sir with whom I had the privilege to interact during my brief stint at SIES College without whose help this project would not have reached its successful completion.

6.0References

1. 1.*Sherwood, Linda; Willey, Joanne; Woolverton, Christopher (2013).Prescott's Microbiology (9th ed.). New York: McGraw Hill.pp. 713–721.ISBN 9780073402406. OCLC 886600661*
2. Summer 2012 Workshop in Biology and Multimedia for High School Teachers
3. Tagami H. Location-related differences in structure and function of the stratum corneum with special emphasis on those of the facial skin. Int. J. Cosmet Sci. 2008;30:413–434. [PubMed]
4. Roth RR, James WD. Microbial ecology of the skin. Annu. Rev. Microbiol. 1988;42:441–464. [PubMed]
5. Proksch E, Brandner JM, Jensen JM. The skin: an indispensable barrier. Exp. Dermatol. 2008;17:1063–1072. [PubMed]
6. Elias PM. The skin barrier as an innate immune element.Semin.Immunopathol. 2007;29:3–14. [PubMed]
7. Segre JA. Epidermal barrier formation and recovery in skin disorders. J. Clin. Invest. 2006;116:1150–1158. [PMC free article] [PubMed]
8. Cui L, Morris A, Ghedin E (July 2013). "The human mycobiome in health and disease". *Genome Med* **5** (7): 63. doi:10.1186/gm467. PMC 3978422.PMID 23899327
9. Noble JM, Scarmeas N, Papapanou PN (2013). "Poor oral health as a chronic, potentially modifiable dementia risk factor: review of the literature.". *Curr Neurol Neurosci Rep* **13** (10): 384. doi:10.1007/s11910-013-0384-x. PMID 23963608.
10. Kimpen, Jan L.L. and Ramilo Octavio, eds. The Microbe-Host Interface in Respiratory Tract Infections. Norfolk United Kingdom. 2005
11. .

Isolation, Identification and Characterization of Phosphate Solubilizing Bacteria from Soil Sample

Poonam Shinde*[1], Pooja Desai[2]
1, 2-SIES (Nerul) College of Arts, Commerce and Science
*pshinde725@gmail.com

Abstract
Phosphorous is important macronutrient required for plants but in fact most soils are deficient in soluble form of phosphorous .The bioavailability of soil inorganic phosphorous in the rhizosphere varies considerably with plant species, nutritional status of soil and ambient soil condition . Apart from nitrogen, phosphorous plays a very important role in plant metabolism such as cell division, growth and development, breakdown of sugar, and nuclear transport within the plants. A large number of microorganisms present in the rhizosphere are known to solubilize and make available the insoluble phosphorus in the available form to the plants. The phosphate solubilizing microorganisms were isolated from rhizosphere soil sample by serial dilution and spread plate method and these colonies were isolated on Pikovskaya's (PKV) agar medium, containing insoluble tri-calcium phosphate (TCP).These Phosphate solubilizing microorganism can be utilized for the production of biofertilizers which will enhance the nutrient quality of soil.

Key Words- *Biofertilizers, Rhizosphere, Phosphate solubilizing bacteria, Macroelement*

Introduction

Biofertilizers may defined as a substance which contain living microorganism which, when applied to seed, plant surfaces or soil induce growth of plants by increasing the supply or availability of important nutrients such as phosphorous.[2] Although phosphorous is important nutrient for plants most of it approximately 90-95% is unavailable to plants. [2] This unavailability is due to P-fixation, either it is adsorbed on the soil minerals or get precipitated by free Al3+and Fe3+in the soil solution [2]. The phosphate biofertilizer possess ability to convert insoluble phosphate into soluble form which can be easily metabolised by plants. [1] These biofertilizer consist of microorganisms such as pseudomonas, bacillus, aspergillus etc. [3]. Which are present in the soil and rhizosphere region of plants. The release of organic and inorganic compound by phosphate solubilizing microorganisms (PSM) has been reported as a primary mechanism of P-solubilisation. Besides organic acids (lactic, citric, glycolic, succinic, fumaric, malic, oxalic, tartaric, 2-ketogluconic and a ketobutyric acids), the production of chelating substances (2- ketogluconic acid), humic substances, mineral acids (sulphuric acids), siderophores and proton extrusion mechanisms also play an important role in phosphate solubilisation.[4] Therefore these microorganism can be used as phosphate biofertilizer to increase crop yield.

In the present study an attempt is made to isolate phosphate solubilizing microorganism from rhizosphere soilnearNerul railway station

Methodology

- Soil collection and serial dilution- about 1kg of rhizosphere soil was collected in sterile bags from Nerul railway station. The serial dilution of soil was done by taking 1gm of soil and 9ml of distilled water up to 10^{-9}diluton.
- Isolation of microorganisms & to study colony characteristics- serial dilution of 10^{-2}, 10^{-4}, 10^{-6}&10^{-8} were selected and spread plate method was carried out on Nutrient Agar plates. The plates were incubated at 37^{0}C for 24-48hrs. Colonies were observed and colony characteristics were studied. Only 10^{-2} plate showed presence of colonies (approx. =64 colonies).From this plate 4 different colonies were selected for screening procedure.
- The pure culture of these 4colonies were maintained on 4NA plate
- Screening of colonies-the colonies were picked and streaked on pikovaskya media agar plate by sterile nichrome wire loop. The fungal colonies were observed with halozone formation.
- The fugal colonies structure were observed by performing Lactophenol cotton blue staining. Further identification of these fungal colonies should be done.

Media and Reagents

- Nutrient agar media-for isolation of soil microorganism it consist of peptone-5gm, beef extract-3gm, NaCl-5gm, agar-18gm and distilled water-1000ml.
- Pikovaskya agar-for screening of phosphate solubilizing microorganisms it consist of glucose-10gm/ml, yeast extract-0.5gm/ml, ammonium sulphate-0.5gm/ml, magnesium sulphate-0.1gm/ml, calcium phosphate-5gm/ml, sodium chloride-0.2gm/ml, potassium chloride-0.2gm/ml, manganese sulphate-0.002gm/ml, ferrous sulphate-0.002gm/ml, agar- 1.8gm/ml and distilled water- 1000ml.

Result and Discussion

Table1: consist of isolated colonies and colony characteristics of soil microorganisms on nutrient agar plates only 10^{-2} NA plate showed presence of colonies which consist of 64 colonies. Out of which 4 colonies were selected for screening.

Figure1: consist of10^{-2} NA plate.

Figure2: consist of pure culture of 4 colonies found on 10^{-2} plate.

Figure3: consist of phosphate solubilizing microorganism (PSM) with halo zone formation.

Figure4: consist of lactophenol cotton blue staining method of fungal (PSM) colonies. The figure 3 showed the presence of fungal strains with halozone formation. The phosphate solubilizing microorganisms are capable of converting insoluble inorganic phosphate to soluble phosphate by various mechanism such as by releasing organic acids. These organism are potent microorganism for the production of biofertilizers which will increase the crop yield when applied to the soil or inoculated with seed

Table 1: Isolated colonies and colony characteristics of 10^{-2} NA plate

10^{-2}NA plate	1	2	3	4
Size	Moderate	Small	Moderate	Small
Shape	Circular	Circular	Circular	Circular
Margin	Entire	Entire	Entire	Entire
Colour	White	Yellow	Pale yellow	Clear white
Elevation	Flat	Punctiform	Flat	Flat
Opacity	Opaque	Opaque	Translucent	Transparent

Figure1: 10^{-2} plate showing isolated colonies from serial dilution of soil sample

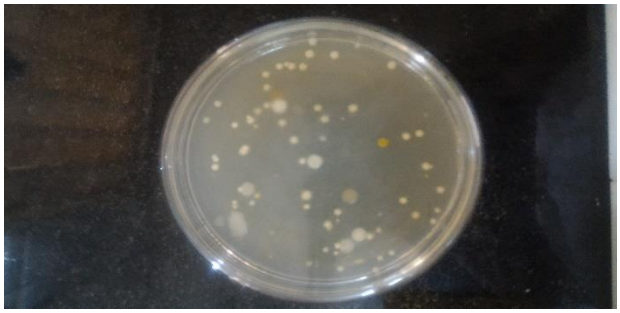


Figure2: consist of pure culture of 4 colonies found on 10^{-2} plate

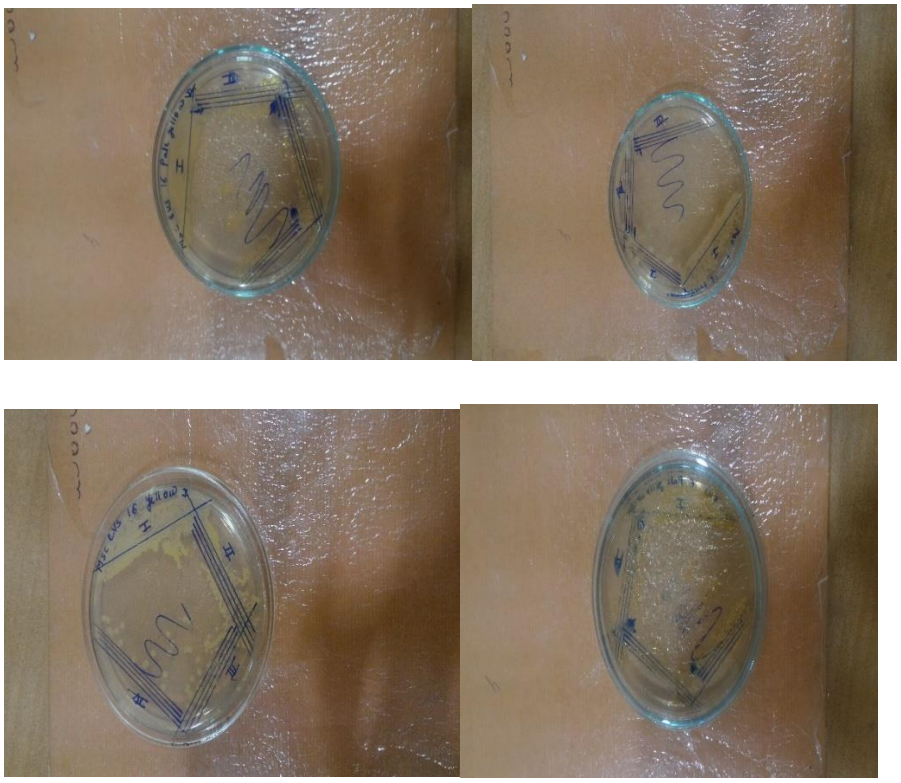


Figure3: consist of phosphate solubilizing microorganism (PSM) with halozone Formation

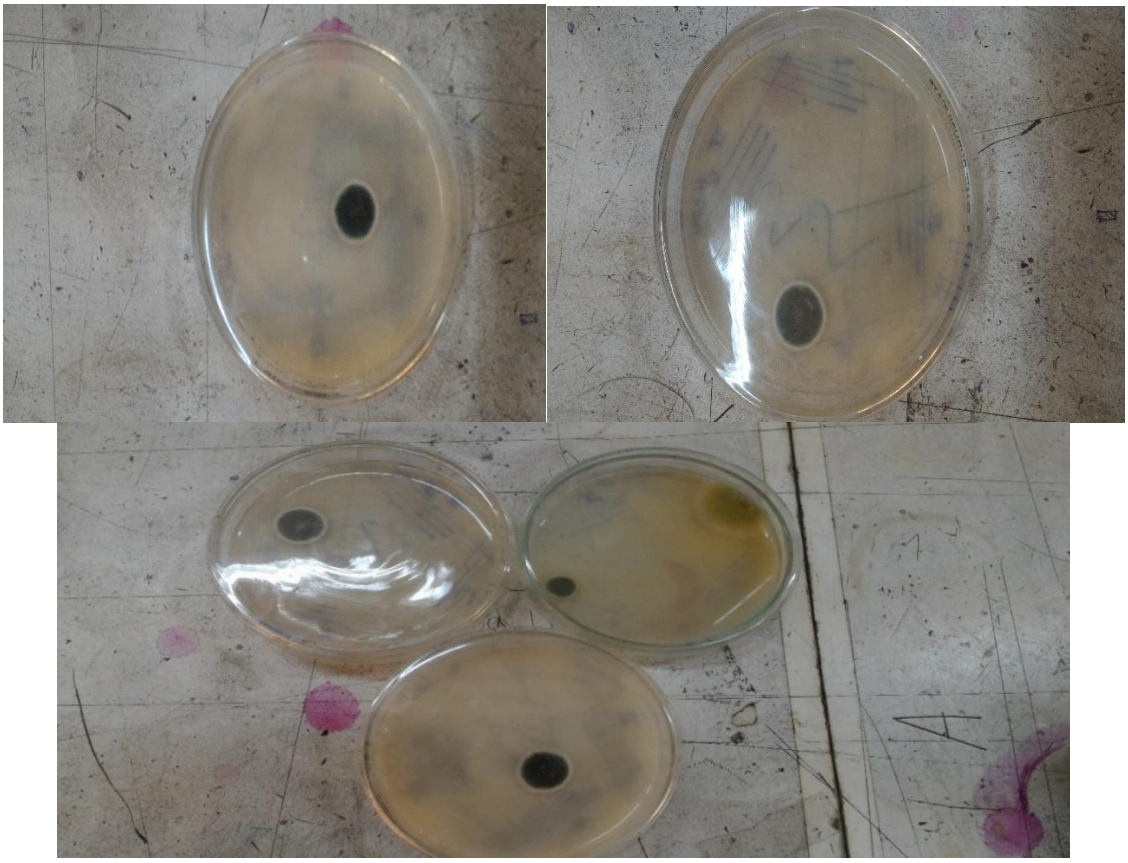


Figure4: consist of lactophenol cotton blue staining of fungal (PSM) colonies

Conclusion

Phosphate solubilizing microorganisms are important constituents of rhizosphere soil microflora. Which consist of various microorganisms such as Aspergillus, Azotobacter, and Bacillus sp. Pseudomonas sp. These microorganisms convert insoluble phosphate into soluble simpler forms

of phosphate by various technique such as organic acid (malic acid, lactic acid etc.) formation which plants can easily metabolized. In this experiment the phosphate solubilizing microorganisms were isolated by serial dilution and spread plate method on nutrient agar plate. Only 10^{-2} dilution plate showed presence of isolated colonies, from these 4 different colonies were selected for screening. The pikovaskya agar which contains main ingredient as tri-calcium phosphate which is insoluble .these PSM converts this into soluble form which is visible in the form of halozone formation. These PSM then can be used for the formation of biofertilizer which will enable plants to fulfil the requirements of phosphate and enhance crop yield without any adverse effects on environment.

Acknowledgement

I am thankful to prof. Pooja Desai. From SIES (Nerul) College of Arts, Science & for guiding the author for this research work.

Reference

[1]. Debojyoti Roychowdhury et al., "Isolation Identification and Characterization of Phosphate Solubilizing Bacteria from soil and production of biofertilizer" IJCMAS, ISSN:2319-7706 volume 4 number11(2015) pp.808-815.

[2]. International Journal of Pharmacy and Pharmaceutical Sciences ISSN- 0975-1491 Vol 8, Issue 2, 2016

[3]. R. Ivanova, D. Bojinova, and K. Nedialkova, "Rock phosphate solubilization by soil bacteria," Journal of the University of Chemical Technology and Metallurgy, vol. 41(3), pp. 297-302, 2006.

[4]. M. S. Khan, A. Zaidi, and P. A. Wani, "Role of phosphate-solubilizing microorganisms in sustainable agriculture - A review," Agron. Sustain. Dev., Vol. 27, pp. 29-43, 2007.

Comparative Assessment of Air Pollution Tolerance Index (APTI) of Selective Common Plant Species in Koperkhairane, Dombivli and Nerul Region

Sonal Bhoilkar[1]*, Pooja Desai[2]

1, 2- SIES (Nerul) College of Arts, Commerce and Science

*sonal.bhoilkar@gmail.com

Abstract:

Selection of plant species that are tolerant to air pollution and also that sensitive to air pollution has a significant impact in determination and reclamation of air pollution. The variation in biochemical parameter in the leaves can be used as indicator of air pollution for early diagnosis of stress or as marker for physiological damage. In this research paper examination of four physiological and biochemical parameters viz., leaf Relative Water Content (RWC), Ascorbic Acid content (AA), Total leaf Chlorophyll (Tch) and leaf extract pH were used compute the APTI values of selected common species in Koperkhairane, Dombivli, Nerul region(Industrial, residential, heavy traffic zone area). And their tolerance efficiency against the pollution can be studied. In this study, the common plant species selected for the assessment of APTI are Mangiferaindica, Ficusreligiosa, Saracaasoca, Psidiumguajava, Annovasquamosa, Azardicaindica, Ficusracemosa, PrunusDuluis, Hibiscus rosa-sinenis. On the basis of APTI, M.indica was found to be more tolerant species in industrial as well as residential area and P.dulcis in heavy traffic zone area. Plant species with higher APTI value will be consider as having high tolerance efficiency against air pollution.

***Key words**: APTI value, tolerance efficiency, common plant species, biochemical parameters*

Introduction:

Air pollution has become a major problem arising mainly from industrialization and urbanization during the last few decades. Particulate matter is of great concern in relation to their adverse impact on human health and vegetation [1]. Urban air pollution has become a serious environmental problem to trees, crops, animals and human beings. Motor vehicles account for 60-70% of the pollution load in urban environment, followed by industries (20-30 %) in India [2].

Plants exposed to the atmospheric pollution; they altered their physiological activity by expressing changes in its biochemical parameters. The plants can be used as a bio-indicator to monitor the local air quality. Trees being very important in providing medicinal and dietary values for human beings and also providing shelter in road side are the victims of the drastically increased air pollution [6]. Air pollution tolerance index (APTI) is an inherent quality of plants to encounter air pollution stress which is presently of prime concern particularly in industrial and non-industrial areas. Therefore, APTI of the plants needs to be monitored and checked for the predominant species that are present in the polluted and non-polluted areas. In the present study, APTI of common growing plants in industrial, heavy traffic and non-industrial site have been investigating [7]. This present investigation on air pollution tolerance indices of trees growing around the industrial, traffic and residential areas is to evaluate the tolerance levels of selected plants.

Aims and Objective:

- The present study aims to evaluate the air pollution tolerance index (APTI) of common plant species in residential, traffic zone and industrial site.

- To study tolerance efficiency of plant towards air pollution and their correlation with respective pollutants.

Methodology:

The study areas selected for the investigation are residential, industrial and traffic zone of Koparkhairane, Nerul and Dombivli region. The plants selected for investigation are *Mangifera indica, Ficusreligiosa, Saracaasoca, Psidiumguajava, Annona squamosa, Azardica indica, Ficusracemosa,Prunusdulcis, and Hibiscus rosasinensis.* The plant species selected for the study are those common for all the location. The leaf sample was collected in morning hours from all the locations. Standard maturated leaves of each species were randomly collected and taken to the laboratory in polythene bags for further investigations. The collected leaf samples were analyzed for the following biochemical estimations namely pH of leaf extract, total chlorophyll, Ascorbic acid and relative water content.

1. pH :
   1 gm of leaf sample was homogenized with 20 ml of deionized water and pH was measured with the help of electrode
2. RWC :
   Relative water content was calculated by using the initial weight (F), turgid weight (T) and dry weight (D) of leaf samples.
   $RWC = \frac{F - D}{T - D} \times 100$
   F = Fresh weight, T = weight of leaves after immersing in water for overnight that is turgid weight
   D = Dry weight at 80°C for 24 hrs.
3. Total Chlorophyll :
   1 gram of fresh leaf was macerated with 10 ml of 80% chilled acetone. The extract was filtered and the absorbance was measured at 620 & 660 nm using a colorimeter.
   $Tch = \frac{20.2(A_{620}) + 8.02(A_{660}) \times V}{1000 \times W}$
   Tch = Total Chlorophyll in mgg^{-1}
   A_{620} : Absorbance at 620 nm
   A_{660} : Absorbance at 660 nm
   V : Total volume of the extract in ml
   W : Weight of the sample in g
4. Ascorbic acid :
   1 gram of fresh leaf was macerated with 4% oxalic acid(10 ml). The extract was filtered and centrifuge at 1000rpm for 20 mins. About 5 ml of extract was titrated against standardized 2,6 – dichlorophenol-indophenol.
   $AA = \frac{I \times S \times D \times I}{A \quad W}$
   AA = Ascorbic acid in mgg^{-1}
   I = ml of indophenol used for titration.
   S = mg of ascorbic acid reacting with 1 ml indophenol
   D = Total vol. of extract in ml
   A = Aliquot titrated in ml
   W = Weight of the sample in g

- APTI

The APTI value of selected plant species was determined by the following equation.

$$APTI = \frac{AA(Tch + pH) + RWC}{10}$$

APTI = Air pollution tolerance index
AA = Ascorbic acid content in mgg^{-1}
Tch = Total Chlorophyll in mgg^{-1}
pH = Ph of leaf extract
RWC = Relative Water Content in %

Result and Discussion: APTI value estimated using the four biochemical parameters in plants leaves namely Relative water content, Total chlorophyll content and Ascorbic Acid value can be used as a predictor of air quality.

The APTI value calculated for each plant species different locations presented in the following tables:

Species Name	Industrial	Residential	Traffic Zone
M.indica	9.84	9.52	9.26
F.religiosa	9.42	9.39	9.55
S.sarcosa	9.33	8.53	9.11
P.guajava	7.42	8.97	8.33
A.squamosa	8.06	9.26	7.25
A.indica	9.14	6.49	6.81
F.racemosa	9.42	8.49	8.48
P.dulcis	9.26	9.63	9.41
Hibiscus rosa-sinensis	9.25	8.87	8.02

APTI Value of Nerul (Table no. 1)

Species Name	Industrial	Residential	Traffic Zone
M.indica	9.68	9.72	9.51
F.religiosa	9.78	8.38	9.21
S.sarcosa	9.11	9.62	8.35
P.guajava	9.05	7.40	9.01
A.squamosa	8.19	9.16	7.43
A.indica	9.48	9.11	6.65
F.racemosa	7.35	7.73	9.30
P.dulcis	8.04	8.90	9.70
Hibiscus rosa-sinensis	8.39	8.58	8.65

APTI Value of Koparkhairane (Table no. 2)

Species Name	Industrial	Residential	Traffic Zone
M.indica	9.14	8.59	9.40
F.religiosa	7.80	9.50	9.62
S.sarcosa	9.71	9.04	9.27
P.guajava	7.67	8.06	9.09
A.squamosa	7.46	7.07	7.68
A.indica	8.22	8.13	7.68
F.racemosa	7.98	8.42	8.22
P.dulcis	7.54	7.98	9.42
Hibiscus rosa-sinensis	8.61	7.89	7.97

APTI Value of Dombivli (Table No. 3)

In Nerul region, the maximum APTI observed in the case of M. indica in the industrial area. P. Dulcis in the residential area & F. religiosa in traffic zone area and are found to be more tolerant than other species. Plant species such as *M. indica, S. asoca, A. indica, F. racemosa, Hibiscus* show an increased in APTI value in the industrial area than that of residential & traffic zone area. *While P.guajava, A. squama* and*P.Dulcis* showed an increased in APTI value found higher in traffic zone area.

The low value of APTI was observed in the case of *P. guajava* in an industrial area &*A.indica* in residential & traffic zone area. The decreased APTI value might be because of low value found in biochemical parameters which show their plant species are sensitive towards the pollution.

In Koparkhairane region, the maximum APTI observed in the case of *F. religiosa* in the industrial area, *M. indica*residential area and *P. dulcis* in traffic zone area.

Plant species such *as F.religiosa, P. guajava, A. indica* showed an increased in APTI value in the industrial area than that of residential & traffic zone area. While *M. indica* and *S.asoca* showed an increased in APTi value in the residential area and *F. racemosa, P. dulcis, Hibiscus* showed an

increase in APTI value in traffic zone area. The low value of APTI was observed in the case of *P. dulcis* in an industrial area, *P. guajava* in a residential area and *A. indica* in traffic zone area are found to be sensitive species.

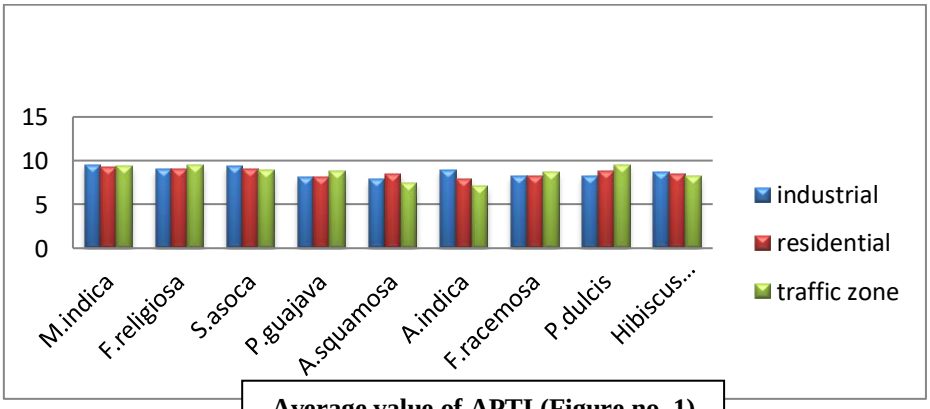
In Dombivli region, the higher APTI value observed in the case of *S. asoca*in industrial are and *F. religiosa*in the residential area as well as in traffic zone area and are found to be more tolerant than other species.

Plant species such as *S. asoca, A. indica*and *P. dulcis* showed an increased in APTI value in the industrial area than that of residential & traffic zone area. While *M. indica, F. religiosa, P.guajava, A. squamosa and P. dulcis*showed an increased in PTI value in traffic zone area and F. racemosa APTI value showed an increased in residential area.*A.squamosa* APTI value was found below in all three sites (Industrial, Residential and Traffic zone) which indicate *A.squamosa* is more sensitive species in Dombivli area.

By taking an average of APTI values of plants in industrial, residential & traffic zone for all three locations (Nerul, Koparkhairane, and Dombivli). The average values are shown in table 4.

Species Name	Indutrial	Residential	Traffic Zone
M.indica	9.55	9.27	9.39
F.religiosa	9	9.09	9.46
S.sarcosa	9.38	9.06	8.91
P.guajava	8.04	8.14	8.81
A.squamosa	7.9	8.49	7.45
A.indica	8.94	7.91	7.04
F.racemosa	8.25	8.21	8.66
P.dulcis	8.28	8.83	9.51
Hibiscus rosa-sinensis	8.75	8.44	8.21

Average value of APTI (Table no. 4)



Average value of APTI (Figure no. 1)

Results obtained from this study indicates that tolerance efficiency of plants varies from place to place. Some plants show tolerance in the industrial area while other plant shows tolerance in traffic zone area; depending on their tolerance efficiency. On the basis of the average value of APTI, *M. indica* was found to be tolerant in industrial as well as residential area and *P. dulcis* in heavy traffic zone area. Plant species such as *M. indica, F. religiosa*and *S.asoca*showed minimum difference in their APTI value in all three (Industrial, Residential & traffic zone) sites.

Some plant species such as *S. asoca, A. squamosal, A. indica*and *Hibiscus rosa-sinensis*showed a reduction in their APTI efficiency. Reduction in APTI value near roadside area is an indicator of automobile exhaust pollution. Due to excess vehicular emission, plant showed a significant reduction in their physicochemical properties such as total chlorophyll, ascorbic acid, relative water content and pH of leaf extract.

Plant such as *F. religiosa, P. guajava* and *P. dulcis* showed a reduction in their APTI value in the industrial area. This is because pollutant released by industries. Today, in a residential area also automobile exhaust pollution increases due to the number of vehicles are increased. Therefore in this study, the plant species such *as*

M. indica, F. racemosa showed a reduction in their APTI value in their residential area.

Conclusion:

An overview of the entire result obtained from this study reveals that different plant species showed considerable variation in their susceptibility to the local condition. The high and low APTI values can serve as tolerant and sensitive species respectively. The study clearly reflects that the tolerance of plants towards air pollution may be site specific.

From the above results obtained, it has been observed that *M.indica, F.religiosa, S.asoca and P.dulcis* were more tolerant species because of high APTI values in the polluted area. APTI values of plants can be used as indicator of presence of air pollutants and they are also very helpful in green belt development in urban-industrial areas. With the help of APTI values we can decide that which plants are sensitive against the air pollution and which plants are tolerant to air pollution.

Acknowledgement:

I am thankful to Prof. Pooja Desai from SIES(Nerul) college of arts, commerce, science for guiding me in this research project and also to all our non-teaching staff for their regular support and co-ordination**.**

Reference:

1. Rai PK (2013) Environmental magnetic studies of particulates with special reference to biomagnetic monitoring using roadside plant leaves. Atmos. Environ. 72:113-129.
2. Mishra Amit, Pandey Poonam and Singh Abhishekh Kumar, 2012 Selection of tolerant species of road side plants against air pollution in Varanasi, India ,J.Environ.Res.Develop,12(2). Pp 675-681.
3. Ashenden TW, Williams IAD (1980).Growth reduction in Loliummultiflorum Lam and Phleumpratense L as a result of sulphur dioxide and nitrogen dioxide pollution. Environ. Pollut. 21:131-139.
4. Wagh ND, Shukla PV, Tambe SB, Ingle ST (2006). Biological monitoring of roadside plants exposed to vehicular pollution in Jalgaon city. J. Environ. Biol. 27(2):419-421.
5. Bamniya BR, Kapoor CS, Kapoor K, Kapasya V (2011). Harmful effect of air pollution on physiological activities of Pongamiapinnata(L.) Pierre. Clean Technol. Environ. Policy 14:115-124.
6. M. Aklian S.Nandhakumar, 2016. Air pollution tolerance index of selected plant in industrial area and urban area of Vellore district, Agric.Sci.Digest,36(1),pp 66-68.
7. Prabhat Kumar Rai,LalitaL.S.Panda, Biku Moni Chutia Moni Singh,2013. Comparative assessment of air pollution (APTI) in industrial and non-industrial area of India- An eco-management approach,
   Afr.J.Environ.Sci.Technol.7(10), pp 944
8. D.I. Arnon, Copper enzyme in isolated chloroplasts, polyphenoloxidase in Beta vulgaris, Plant Physiology, 24, 1949, 1-15.

Study of Environmental Performance of New and Old Housing Societies in Selected Area

Prajakta Jambhale*[1], Pooja Desai[2]

1,2- SIES (Nerul) College of Arts, Science & Commerce

*prajaktajambhale199@gmail.com

Abstract:

*The **Environmental Performance Index** (EPI) is a method of quantifying and numerically marking the environmental performance. Environmental performance includes all water, waste and waste management. Study of environmental performance involves all parameters which is related to the environment. Taking this into consideration the survey has done on the housing societies. The current work examined all water, waste management, disposal issues and implications by survey method. For work 15 new and 15 old buildings were selected from selected area. Indoor and outdoor conditions in residential areas have serious implications for health, comfort & wellbeing. This research will benefit evolution of residential environmental quality, solid waste, e-waste management, development and improvement of residential environment. It would benefit to analyse overall environmental parameters. It also compares both new constructions and old constructions with respect to environment. This survey would create awareness among the people.*

Keywords:*Environmental performance, waste management, solid waste, e-waste, awareness*

Introduction:

With the rapid development of society and Economy and growing demands on lifequality,thedevelopment,improvement and management of residential environment are becoming more and more important [1], so studying Environmental Performance is considered as priority and useful inmost development planning and management.Nowadays construction of building is becoming more important as Environment point of view.While constructing all parameters are taken into consideration like Waste segregation system,waterquality,Energy conservation etc.Increasing pollution and problems associated with disposal of waste and its management are the challenges that Urban areas have to deal with.While increasing Urbanization poses great stress on natural resources and environment,urban areas also provides opportunities for Environmental management through measures such as recycling of waste and other management [2]. Thus it needs more innovative approach towards Environmental policy making and implementation. Citizen surveys are an important tool for making inclusive and informed policy decision. The surveys can provide valuable insights into Citizens, awareness, perceptions and opinion on environmental issues and intervention that can assist government in framing or reviewing policies for green and also new building construction and improving uptake and implementation [3]. The present study aims at studying and comparing the Environmental Performance of the old and new buildings in the Airoli Region of Navi Mumbai. The study also helps understand the mind-set of the people and aids in creating awareness about Environmental Conservation

Methodology:

This study is based on Survey method which includes following steps

1. Selection of Location

For this survey,Airoli as location is selected. As per the NMMC there are many rules which has to be followed by housing societies and people.So to check Environmental performance of that area is selected.

2. Preparation of Questionnaire

Two parts –

1. At Individual level:

- 100 Local people- open ended and close ended type questions
- Questionnaire included-waste segregation method, use of water, Electricity consumption, E-waste management, Awareness about environmental laws

2. At Society level:

- 15 New and 15 Old Housing societies
- 60 people- 2 persons from each building as Representative
- Questionnaire included-waste segregation system, Energy conservation, Environment beneficial systems, Eco-friendly products, Awareness and their suggestions

Analysis of data using proper Quantitative methods.

Results and Discussions: 1. At Society level:

Table No.1

Old housing societies (1990)				
Sr. No.	Questions	Percentage		
		YES	NO	N.D.
1	Segregation of waste at house hold level	77	23	0
2	Waste segregation system	80	20	0
3	Separate bins for dry and wet waste	77	23	0
4	Reduce, Reuse, Recycle Of waste	23	57	20
5	CFL/LED light inside building	53	47	0
6	Changes in electricity bills due to its use	53	37	10
7	Rain Water harvesting system	0	100	0
8	Solar system	0	100	0
9	Is it beneficial?	53	13	33
10	Frequency of reducing energy and water use	17	83	0
11	Planting of trees in premises	93	3	4
12	Necessity of Use of eco-friendly products	73	14	13
13	Eco-friendly products used	7	73	20
14	Aware about environmental law	57	43	0
15	Follow those laws	37	63	0

New Housing Societies (2010 & onwards)				
Sr. No.	Questions	Percentage		
		YES	NO	ND
1	Segregation of waste at house hold level	93	7	0
2	Waste segregation system	93	7	0
3	Separate bins for dry and wet waste	90	7	3
4	Reduce, Reuse, Recycle Of waste	47	0	53
5	CFL/LED light inside building	100	0	0
6	Changes in electricity bills due to its use	100	0	0
7	Rain Water harvesting system	57	43	0
8	Solar system	47	53	0
9	Is it beneficial?	70	0	30
10	Frequency of reducing energy and water use	50	50	0
11	Planting of trees in premises	100	0	0
12	Necessity of Use of eco-friendly products	73	14	13
13	Eco-friendly products used	16	0	84
14	Aware about environmental law	100	0	0
15	Follow those laws	83	17	0

Table no.1 and 2 represents overall survey at society level and it gives comparative environmental performance data between 1990's and 2010's housing societies present in Airoli area.

In Housing society which were constructed in 1990's 80% of residents carry out waste segregation at present were as societies in 2010 and onwards above 90% people use to carry out waste segregation at household level.80% people of old societies segregate their waste but they don't reuse, reduce or recycle it where as segregation level and use of 3R system was more in current new societies by 90%.Almost 20% people were not knowing the concept of reduce, reuse, recycle.

Use of CFL, LED lights were low as 50% in old societies where as 100% LED, CFL lights were used in new housing societies and there was reduction in electricity bill.

People were having their own ways to conserve electricity like switching of lights in premises in day time, minimum use of lights etc.

As per the survey there was no such energy saving systems were inside the old societies but 50% people was knowing benefits of using solar systems and Rain water harvesting systems where as in new societies they were having almost 50-60% energy systems and it was beneficial for them.

In old societies 20% of people were reducing energy use and water use where as in new societies 50% of people were following that.

In both old and new housing society's percentage of planting trees were 90-100% which means people were aware of importance of trees.

In old and new housing societies people knew the necessity of eco friendly products but use of it was not that much.

In old societies 50-60% people were aware about the Environmental laws where as in new societies almost all people knew it and they were following by 80%.old societies were following almost 40%.

2. At Individual level:

Environmental Performance At Individual Level				
SR. NO.	Questions	YES	NO	
1	Segregation of waste	67	33	
2	Segregation of waste at source	77	23	
3	Use of Wet Waste for composting	19	81	
4	Use of LED/CFL bulbs in House	83	17	
5	Is it affect on electricity bill	85	15	
6	Is there any star rated electronic appliances at home	79	21	
7	Knowing disposal of E-waste	46	54	
8	Any plants in house	90	10	
9	Know about reuse, reduce, & recycle	57	43	
10	Aware of environmental laws	46	54	
		A	B	C
11	Type of water system	24	76	
12	Quality of drinking water	19	66	17

Above table represents the environmental performance survey at Individual level which was carried out for create awareness amongst people and to check current status of Environmental performance.

As per the observation around 70-80% people segregate their waste at household level and almost 20% people use it for composting.

80-90% of people using LED/CFL lights in houses and they said that there was decrease in electricity bill by 10-15%.

80% of people uses Tap water for domestic and bath use whereas 20% people having shower system in their houses. Almost 70% people consume water of very good quality.

Almost 80% peoples were using Star rated appliances at home 40-50% people knew how to dispose E-waste and what to do with old electronic appliances which are not working.

Almost 90% people are having plants in their houses and almost 60% people were knew about Reduce, reuse, recycle.

Almost 40-45% people knew about Environmental laws whereas 50-55% people don't know what it is.

People gave many suggestions and their views like tree plantation, rain water harvesting system, solar energy use, pollution control etc.

Conclusion:

In this survey comprehensive model combining both subjective and objective questions system for Society level and for individual level is established.

Survey which was done at Society level gives overall Environmental performance of buildings present in Airoli area.From the survey **At Society level** percentage of waste segregation at household and building level is less in old housing societies as compared to new societies. This means that awareness about waste segregation is needed in old housing societies.Use of LED/CFL lights, conservation of electricity is higher in new societies where as in old societies there is not much use of energy conservation method. Each society must be aware about all these things.

Although 50% people knew the importance of solar systems and rain water harvesting systems there is no use of it at all in old buildings in Airoli. People think it is costly but there must be awareness program for those.

One thing which was common in both old and new housing societies was plantation of trees. This means people are aware about the importance of trees at present.

People of Old societies and New societies are aware about eco friendly products but use of it is very much less.

As per the Environmental laws All new societies follows those laws because it is mandatory in their societies but in Old societies there is very less people who knows about it.As per the rule it must be followed by All the people.

By all this we can say that environmental performance of All New housing societies is in very well condition as compared to Old societies. There must be awareness programs for all those societies.

From the survey **At Individual level** percentage of waste segregation at household level is much higher as expected which means people segregate their waste at household level daily. But not all the people use wet waste for composting. People should use their waste for composting as per the less waste generation concept.

80% people use LED/CFL lights at home for energy conservation and they said that it decreases electricity bill by 10-15%.

Most of the people are having plants in their houses and there is also more use of tap system inside houses. Most of the people are having star rated appliances at their home but many people are not aware about how to dispose E-waste and what it is. There must be awareness programs about e-waste.

There are 40% people who don't know and don't follow Environmental laws where as

60% people follows and they know about those laws.

From all the answers we can say that most of the people are aware about all the waste management systems, energy conservation systemsand environmental laws but there is need of more awareness. Even people gave suggestions like tree plantation, energy conservation, and water and electricity use minimization. There is positive response from people and which means that Environmental Performance at Individual level is in much good condition.

Recommendations:

- More Recycled products should be used.
- Reduce, Reuse and Recycle is important parameters in Environmental performance. It should be apply where it possible.
- Environmental laws are mandatory for all people so awareness about those laws must be created.
- E-waste disposal is major problem so proper E-waste segregation system should be there.
- Environment health indirectly affects Human beings so pollution control systems should be there.

References:

1. Geet al/J Zhejiang Univ SCI 2004 5(a):1028-1034

2. Journal of clean energy technologies,Vol1, No.4, October 2013

3. TERI Environmental survey 2014

4. E.H.W.chan, K.S.lam and W>S>Wong- Evaluation on Indoor environment quality of dense urban residential buildings

5.GBI Organization: www.greenbuildingindex.com

Comparative Study of Carbon Sequestered in Various Plant Species in Different Polluted Areas

Tanvi Sule*[1], Jyoti Koliyar[2]

1, 2 - S.I.E.S (Nerul) College of Arts, Science & Commerce

Abstract:

Pollution enters the environment from diffused sources. The causes can be outright, such as the emissions from auto exhausts. Other times, the source may be hard to identify, such as nonpoint source pollution (NSP). Pollution has tremendous ill-effects, which may cause damage to the environment.Carbon sequestration is the process involved in carbon capture and the long-term storage of atmospheric carbon dioxide. It involves long-term storage of carbon dioxide or other forms of carbon to either mitigate or defer global warming and avoid dangerous climate change. Plants are the biological method of carbon sequestration. The present study will reflect on the carbon sequestration of plant species selected from areas like Chembur, Vikhroli, Powai,Nerul, Vashi and Koparkhairane. A comparative study of these places was done to know which plant species stores more carbon. To make study more worthy and informative physical and chemical parameters like height, diameter, chlorophyll, and pH, moisture content and organic matter were determined. Thus, it can be concluded that the amount of Carbon Sequestered will determine the area with high carbon emissions and identify plant species that can store high amounts of carbon.

Key words: *Plants, Carbon, Pollution, Carbon Sequestration, Climate change, Carbon dioxide, Global warming, Emissions, Storage, Capture, Polluted areas*

Introduction:

Trees and forests are the main elements that get affected due to the change in climatic conditions .The major factors leading to the change are the hazardous releases of compounds like carbon dioxide, carbon monoxide, etc. Trees act as a sink for carbon dioxide by fixing carbon during photosynthesis and storing carbon as biomass. The net long-term carbon source/sink dynamics of forests change through time as trees grow, die, and decay. External influence mainly from humans may cause alterations in the carbon source/sink dynamics.

Carbon sequestration is the process involved in carbon capture and the long-term storage of atmospheric carbon dioxide. It involves long-term storage of carbon dioxide or other forms of carbon to either mitigate or defer global warming and avoid dangerous climatic changes. Thus, trees influence local climate, carbon cycles, energy use and climatic changes.[1]

The present study reflects on the carbon sequestration of plant species selected from areas like Chembur, Vikhroli, Powai, Nerul, Vashi and Koparkhairane. A comparative study of these places was undertaken to know which plant species stores more carbon.Chlorophyll content, moisture content, pH and organic matter were examined. The pH is slightly acidic to alkaline. This facilitates the growth of plants. The chlorophyll content was found to be low due to interfering factors like sunlight intensity, location, etc. Organic matter content was high. The moisture content was found to be moderate. The Carbon sequestration was found to be high at Vikhroli, whereas the species of trees was Ficus benghalensis. The present paper aims to determine the area with high carbon emissions and identify plant species that can store high amounts of carbon.

Materials and Methods:

Simple Random sampling was carried out for each of the locations. The species of trees were

identified; the leaves and soil of the trees were brought to the laboratory for chemical analysis.

Parameters such as chlorophyll, pH, moisture content and organic matter were examined out for basic analysis.

The carbon sequestrated was calculated by determining the total (green) weight of the tree, the dry weight, the weight of carbon in the tree, the weight of carbon dioxide sequestered in the tree.[2]

1) Determining the total (green) weight of a tree:

W= above ground weight of the tree in pounds

D= Diameter of the trunk in inches

H= Height of the tree in feet

For trees with D < 11: $W= 0.25D^2H$

For trees with D >=11: $W= 0.15D^2H$

The root system weighs about 20% as much the above ground weight of the tree. Therefore to determine the total weight of the tree, the above ground weight of the tree is multiplied by 120%.[3]

2) Determine the dry weight of the tree:

As the average tree is 72.5% dry matter, multiply the weight of the tree by 72.5%.[4]

3) Determine the weight of carbon in the tree:

The average carbon content is 50% of the tree's total volume. Therefore, the dry weight of the tree is multiplied by 50%.[5]

4) Determine the weight of carbon dioxide sequestered in the tree:

The weight of carbon is multiplied by 3.6663.[6]

Results and Discussion:

The parameters such as pH, moisture content, chlorophyll content and organic matter were analyzed for ten different species at six locations over a period of two months. The method used was Simple Random Sampling.Further, the quantity of carbon sequestered was determined. Each parameter is discussed separately.

pH:

The photosynthetic efficiency depends on the leaf pH. Metal cations (calcium, potassium, magnesium) in high concentrations will give high pH, while organic acids such as tannins in high concentrations tend to give low pH. Fresh leaves were crushed with acetic acid to give an extract which was filtered and a colorimeter was used to measure the intensity. The present study shows that the pH values were in the range between slightly acidic to alkaline.The pH ranges from6.42-7.64 (Refer Figure 1). The tree species with the highest pH was determined asTamarindus indica and the lowest pH was determined asSaraca asoca(Refer Table 1). The difference in pH may be due to reduced amounts of nutrients, increase in pollution as well as increase in SO_2, Nitrogen oxides.

Chlorophyll Content:

Chlorophyll is a light-absorbing pigment. Hence, chlorophyll is called a photoreceptor.There are two types of chlorophyll: chlorophyll a and chlorophyll b.Fresh leaves were crushed with distilled water to give an extract which was filtered and the intensity was measured using a colorimeter. The chlorophyll content ranges from 0.028–0.443% (Refer Figure 2). In the present study the chlorophyll content was found to be highest in Delonix regia (Refer Table 2).The low concentration on chlorophyll may be due to low sun light intensity, short photo period, temperature stress and decrease in nutrients.

Moisture Content:

The growth of plants depends on the moisture content.Moisture content is the ratio of the weight of water to the weight of solids in a given mass of soil.In soil science, hydrology and agricultural sciences, water content plays an important role ingroundwater recharge, agriculture, and soil chemistry. The beakers

and the soil (100gms) were weighed, the beakers containing the soil samples were kept in the oven at 105^{o}C for 24 hours. After the specified duration the beakers from the oven were measured for moisture content. The moisture content ranges from 2.33- 20.27 % (Refer Figure 3). In the present study the highest amount of moisture content in soil was found in Ficus religiosa (Table 3). The factors affecting moisture may be temperature, salt content, organic matter, texture and structure.

Organic Matter:

Organic matter is a component of soil, consisting of plant and animal residues at various stages of decomposition, cells and tissues of soil organismsand substances synthesized by soil organisms. The organic matter helps in providing nutrients like nitrogen, phosphorous and many more trace elements. The microorganisms carry out processes such as nitrogen mineralization, sulphate reduction, etc. The Walkley-Black rapid dichromate oxidation method was adopted. The organic matter content ranges from 0.81-8.87 % (Refer Figure 4).The tree species with the lowest organic matter content was Azadirachta indica whereas the one with the highest was Ficus religiosa (Refer Table 4).

Carbon Sequestration:

The plants are the major carbon sinks.Carbon or CO_2 sequestration means putting carbon into long-term storage. There are two major types of CO_2 sequestration: terrestrial and geologic.In the present study the carbon sequestered in ten different species at six locations was measured. The height was measured using an application named iHandy level and the diameter was measured manually. Further the carbon sequestered was measured as mentioned in Materials and Methodology. The carbon sequestered ranges from120.82- 1096.91 kg (with respect to tree species, Refer Figure 5) and 366.49 -479.77 kg (with respect to location, Refer Figure 6).According to species the highest carbon sequestration was found in the tree species Ficus benghalensis, whereas the lowest was found in Magnolia champaca(Refer Table 5). Similarly, location-wise the highest carbon sequestration was seen at Vikhroliand lowest at Nerul (ReferTable 5).

Table 1:Leaf pH

			pH			
Name of Species	**Nerul**	**Vashi**	**Koparkhairane**	**Powai**	**Vikhroli**	**Chembur**
Azadirachta indica	7.32	7.02	6.97	7.27	7.01	6.99
Ficus religiosa	7.28	6.78	6.94	6.81	7.05	6.72
Mangifera indica	6.98	6.62	7.09	7.26	7.16	6.6
Delonix regia	7.58	7.24	7.06	7.4	6.94	7
Magnolia champaca	7.29	7.03	7.1	7.24	7.06	6.99
Tamarindus indica	7.28	7.02	7.06	7.64	6.97	6.92
Ficus benghalensis	7.48	7.04	6.98	7.22	7.38	6.92
Saraca asoca	7.39	6.62	6.95	6.73	6.95	6.42
Prunus dulcis	6.98	6.62	6.72	6.73	6.84	6.46
Bauhinia racemosa	6.93	7.05	6.96	7.01	6.9	6.89

Figure 1: Leaf pH

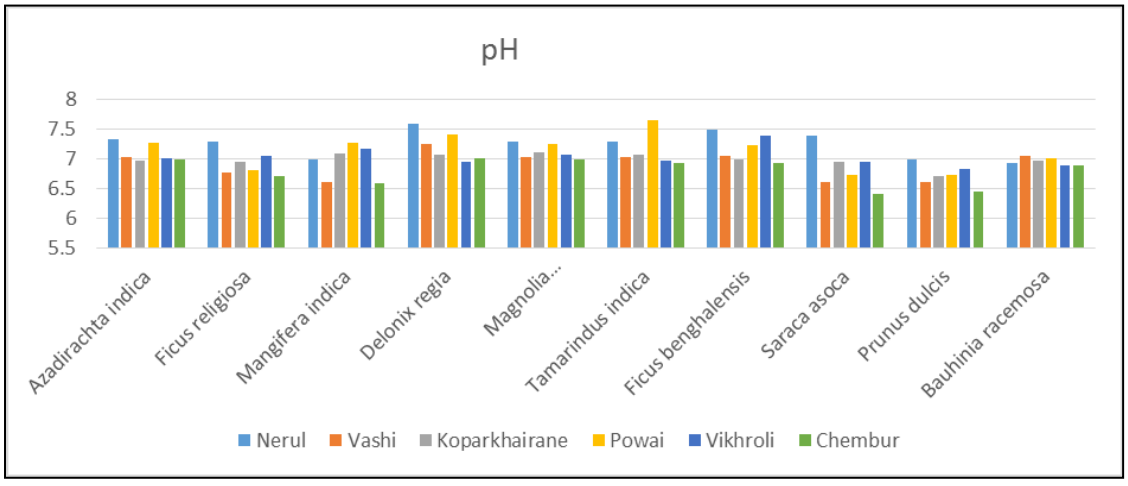


Table 2: Chlorophyll content

			Chlorophyll Content(mg/gm)			
Name of Species	**Nerul**	**Vashi**	**Koparkhairane**	**Powai**	**Vikhroli**	**Chembur**

Azadirachta indica	0.034	0.037	0.037	0.184	0.265	0.195
Ficus religiosa	0.079	0.082	0.095	0.137	0.185	0.192
Mangifera indica	0.052	0.014	0.033	0.093	0.093	0.092
Delonix regia	0.028	0.242	0.337	0.052	0.123	0.443
Magnolia champaca	0.101	0.075	0.087	0.101	0.101	0.046
Tamarindus indica	0.125	0.104	0.171	0.140	0.121	0.143
Ficus benghalensis	0.055	0.057	0.049	0.059	0.071	0.054
Saraca asoca	0.039	0.043	0.036	0.073	0.081	0.064
Prunus dulcis	0.049	0.186	0.032	0.060	0.060	0.060
Bauhinia racemosa	0.150	0.181	0.173	0.144	0.159	0.109

Figure 2: Chlorophyll content

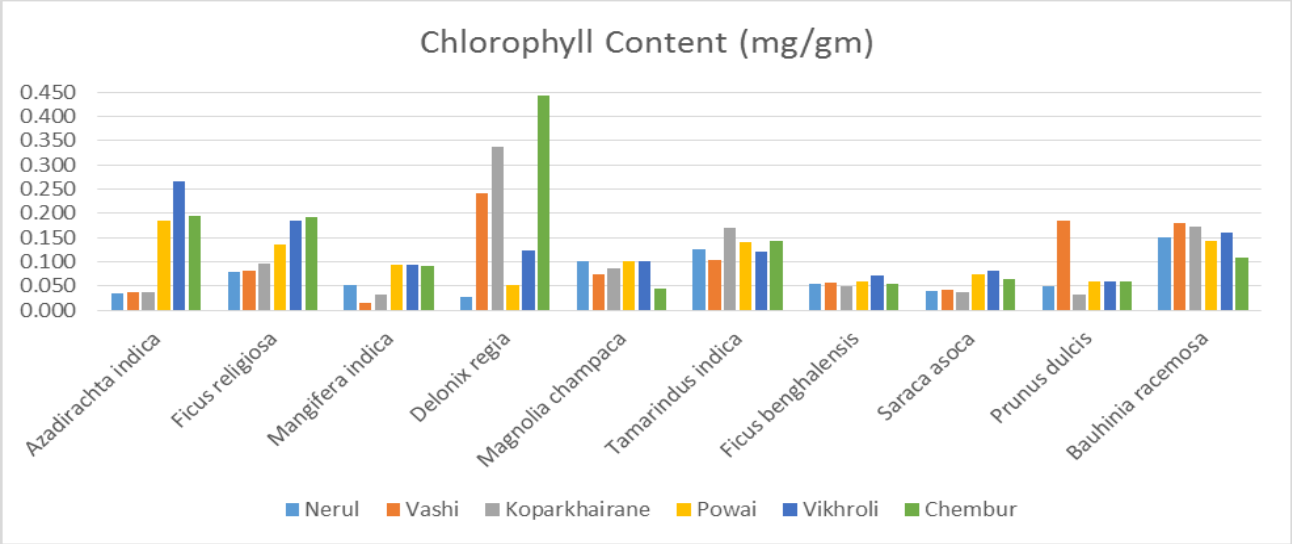


Table 3: Moisture content of Soil

			Moisture Content %			
Name of Species	**Nerul**	**Vashi**	**Koparkhairane**	**Powai**	**Vikhroli**	**Chembur**
Azadirachta indica	3.85	4.18	4.28	9.96	9.94	9.21

Ficus religiosa	3.63	3.20	2.33	13.77	18.3	20.27
Mangifera indica	8.08	8.21	6.97	11.09	10.68	9.45
Delonix regia	3.91	3.93	3.21	14.12	14.48	19.64
Magnolia champaca	3.82	4.32	3.23	11.09	3.37	9.63
Tamarindus indica	3.23	3.99	4.26	4.86	4.98	5.25
Ficus benghalensis	3.91	4.08	5.1	4.33	4.25	4.13
Saraca asoca	4.01	7.08	9.06	3.99	2.96	5.07
Prunus dulcis	3.35	8.21	4.31	5.25	3.73	3.59
Bauhinia racemosa	3.93	4.32	3.93	5.31	6.17	5.92

Figure 3: Moisture content of Soil

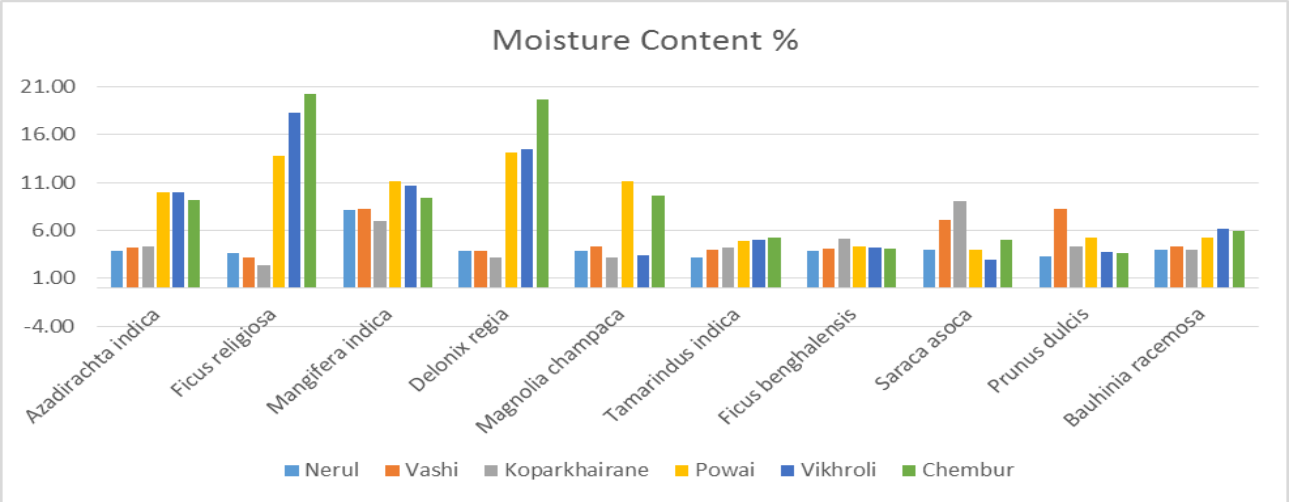


Table 4: Soil Organic matter

			Organic Matter%			
Name of Species	**Nerul**	**Vashi**	**Koparkhairane**	**Powai**	**Vikhroli**	**Chembur**
Azadirachta indica	4.31	5.17	4.41	1.98	0.81	5.17
Ficus religiosa	4.46	7.10	8.77	6.69	7.91	8.87

Mangifera indica	2.48	1.98	2.64	2.54	2.74	5.78
Delonix regia	4.56	2.79	1.77	4.97	4.01	5.78
Magnolia champaca	4.41	2.99	2.74	2.59	1.27	5.83
Tamarindus indica	5.48	6.59	7.56	6.03	8.11	4.61
Ficus benghalensis	4.36	4.01	6.85	7.96	3.09	4.72
Saraca asoca	5.27	3.40	2.99	4.56	1.37	5.27
Prunus dulcis	4.51	1.77	1.83	2.54	3.40	2.13
Bauhinia racemosa	2.74	3.09	3.25	2.23	0.86	2.94

Figure 4: Soil Organic matter

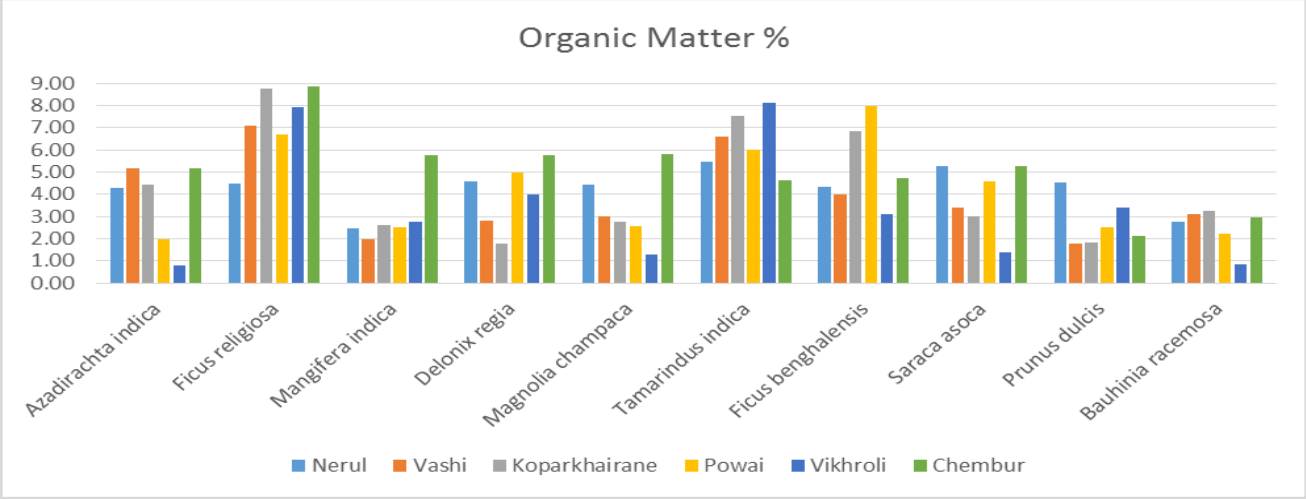


Table 5: Carbon Sequestered

			Carbon Sequestered in Kg				
Name of Species	**Nerul**	**Vashi**	**Koparkhairane**	**Powai**	**Vikhroli**	**Chembur**	**Average**
Azadirachta indica	202.41	259.28	366.02	288.11	408.72	558.91	**347.24**
Ficus religiosa	495.82	1381.19	1667.48	708.05	695.99	479.88	**904.73**
Mangifera indica	306.83	165.86	585.19	856.66	976.68	787.24	**613.08**
Delonix regia	240.17	111.31	43.48	217.51	171.49	66.04	**141.67**
Magnolia champaca	53.70	14.60	71.26	162.78	116.51	306.08	**120.82**

Tamarindus indica	328.07	216.15	194.35	252.93	410.12	264.33	**277.66**
Ficus benghalensis	1469.52	893.02	1145.94	1101.46	1092.60	878.95	**1096.91**
Saraca asoca	44.19	405.07	70.44	525.79	423.84	796.38	**377.62**
Prunus dulcis	155.03	914.84	143.00	465.53	272.30	275.37	**371.01**
Bauhinia racemosa	369.18	348.07	378.31	189.96	229.46	260.37	**295.89**
Average	**366.49**	**470.94**	**466.55**	**476.88**	**479.77**	**467.35**	

Figure 5: Carbon Sequestered (Tree Species)

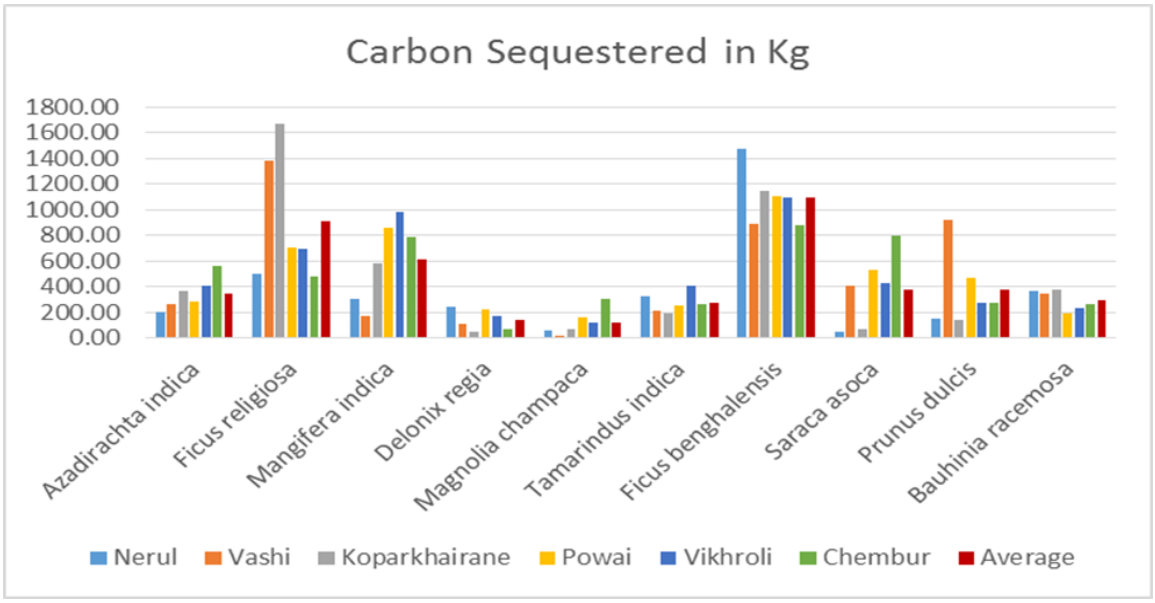
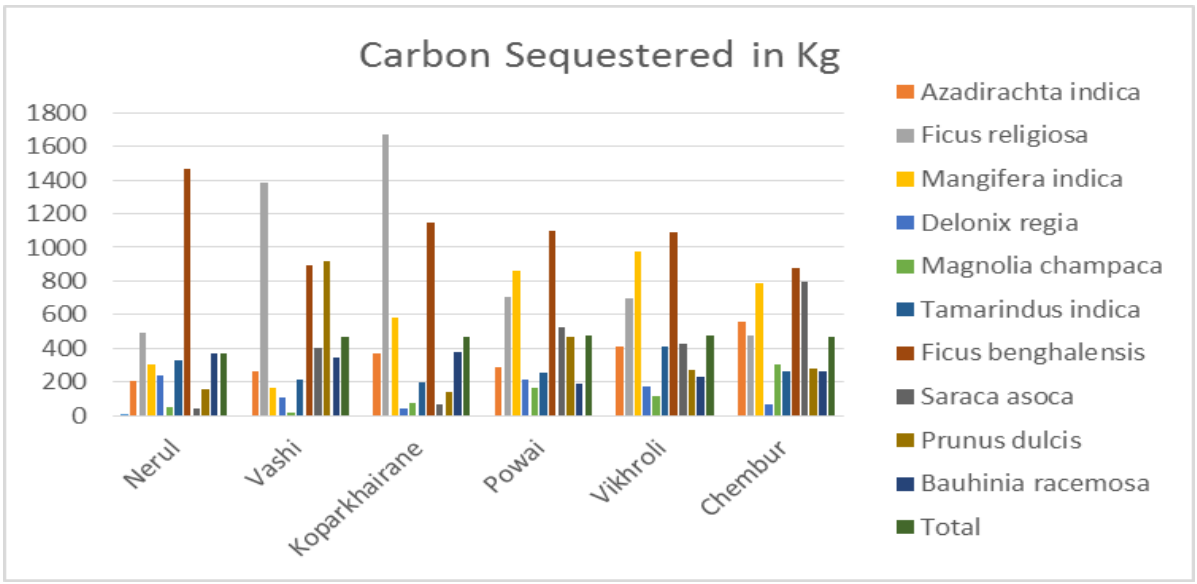


Figure 6: Carbon Sequestered (Location)



Conclusion:

The study was carried out over a period of two months. Ten species namely Azadirachta indica, Ficus religiosa, Mangifera indica, Delonix regia, Magnolia champaca, Tamarindus indica, Ficus benghalensis, Saraca asoca, Prunus dulcis and Bauhinia racemosa at six different locations were analyzed. Most of the research work revealed that the pH was slightly acidic to alkaline, the chlorophyll content was low, and moisture content was found to be moderate whereas the organic matter content was high.Carbon sequestration was highest in the tree species Ficus benghalensis, whereas location-wise the highest carbon sequestration was seen at Vikhroli.

Surveys and monitoring of trees should be carried out at regular intervals in areas with high levels of pollution. This helps to determine the capacity of the tree species to accumulate carbon as well as the extent of pollution in the area. Greater the number of trees,greater is the reduction in the amount of carbon in the atmosphere. Older, taller, greater in diameter are the factors that influence the quantity of carbon sequestered in trees. Further studies on the various characteristics of tree species should be carried out to determine the capacity of sequestering carbon in accordance with the terrain, climatic conditions in addition to extra beneficial aspects.Knowledge regarding such trees should be made available at local level via workshops, seminars, banners, etc.Educational institutions should also introduce courses that explain the importance of carbon sequestration and other beneficial aspects of planting certain trees, in their curriculum

Thus, the sequestration activities can help prevent climatic changes taking place globally by enhancing carbon storage in trees and soils, preserving existing tree and soil carbon, and by reducing emissions of CO_2, methane (CH_4) and nitrous oxide (N_2O).

Recommendations:

- Prevent the planting of ornamental plants along roads, instead plant trees such as neem, eucalyptus which are beneficial for medicinal purpose along with carbon sequestration.
- Plant trees in locations where maximum sunlight can be utilized.
- Tree plantation programs should be undertaken by educational institutes, NGO's, citizen forums, etc.
- Information regarding beneficial plants should be imparted at local levels.
- Vigorous knowledge regarding planting trees in large numbers so as to reduce pollution should be imparted.
- People should be educated about trees as carbon sinks.
- Promote afforestation and not deforestation.
- Illegal cutting of forest areas, trees for construction sites, etc. should be strictly prohibited.
- Cutting of trees for fuel, paper, etc. should be prevented.
- Promote non-destructive methods for analysis.

References:

1. Abdollahi et al., 2000; Wilby and Perry, 2006; Gill et al., 2007; Nowak, 2010; Lal and Augustine, 2012.
2. [1]The National Computational Science Leadership Program http://www.ncsec.org/cadre2/team18_2/students/purpose.html and The Shodor Education Foundation
3. Http: //www.shodor.org/succeedhi/succeedhi/weightree/teacher/activities.html
4. "Total-Tree Weight, Stem Weight, and Volume Tables for Hardwood Species in the Southeast,"Alexander Clark III, Joseph R. Saucier, and W. Henry McNab, Research Division, Georgia Forestry Commission, January 1986.

5. Http: //www.forestdisturbance.net/publications/GF%20RP60-Clark.pdf
6. "Heating With Wood: Producing, Harvesting and Processing Firewood," Scott DeWald, Scott Josiah, and Becky Erdkamp, University of Nebraska – Lincoln Extension, Institute of Agriculture and Natural Resources,March 2005.
7. http://www.ianrpubs.unl.edu/epublic/live/g1554/build/g1554.pdf
8. "Carbon Storage and Accumulation in United States Forest Ecosystems, General Technical Report W0-59," Richard A. Birdsey, United States Department of Agriculture Forest Service, Northeastern Forest Experiment Station, Radnor, PA, August 1992.
9. http://www.ilea.org/birdsey/fcarbon_index.html#toc
10. http://www.ncsec.org/cadre2/team18_2/students/helpCalcCO2.htm
11. http://www.ces.iisc.ernet.in/energy/lake2010/Theme%201/prachi_u.pdf
12. http://www.ipublishing.co.in/ijesarticles/thirteen/articles/volthree/EIJES31169.pdf
13. http://www.forestclimatecenter.org/files/1997-10%20A%20Guide%20to%20Measuring%20Carbon%20Storage.pdf

Xanthan Gum: The Natural Food Additive from Cheap Waste Substrate

Salunke P.*, Tambe D., Ronghe S.

SIES College of Arts, Science and Commerce, Sion (West), Mumbai 400022,Maharashtra,India.

Abstract

With the aim of producing xanthan gum using different organic waste as substrate the study proved to be high yielding.Xanthan gum is a microbial polymer produced by bacteria Xanthomonas campsteris. It is used extensively as a natural food additive which serves as a thickener and also has various other industrial applications. It is an excellent alternative for synthetic additives. Industries produce this gum using synthetic media which increases its cost. Using organic wastes will not only cut the production cost but will also help manage waste. The gum produced using shrimp shell extract, agro waste, cheese whey was found to be 1.69g/L, 0.86gm/L, 1.36gm/L respectively. The apparent viscosity was found to be 45.53 mPa-s, 53.68 mPa-s and 51.32 mPs-a respectively. The gum produced from these wastes was compared with sucrose (control). The production of gum from shrimp shell extract was slightly lesser but then sucrose (1.82gm/L). The wastes produced are low cost residue and can be used in making industrially important product like xanthan gum.

Key words*: xanthan gum, natural food additive, organic waste, low production cost, waste management*

Introduction:

Food additives are used extensively in food industries for their various applications. Food additives are substances that become part of a food product when they are added during the processing or making of that food. These when added improve the texture, flavour, taste, life of the food products.Xanthan gum is one such food additive. It is a natural polysaccharide secreted by *Xanthomonas campsteris* bacteria. It is a microbial exopolysaccharide produced by the gram-negative bacterium *Xanthomonas campestris* by fermenting glucose, sucrose, or other carbohydrates.This biopolymer is applied in the food, cosmetic, pharmaceutical, and petrochemical industries and in other sectors as a thickening agent, stabilizer, or emulsifier and combined with other gums it can act as a gelling agent. Its primary structure is composed of repeating units of pentasaccharides consisting of two glucose, two mannose, and one glucuronic acid residues.

In commercial production of xanthan gum involves the use of yeast malt medium or sucrose as carbon source. Use of such synthetic media increase the production cost. In today's date the amount of organic waste generated is increasing. Wastes like shrimp shell take a good amount of time to get degrade due to its complex nature.Also, other wastes like cheese whey-which is a major byproduct in cheese preparation-, agro waste, sugar cane molasses have a greater hold in waste. These wastes are rich in carbon and nitrogen source. Hence such compounds can be used as carbon source for production of xanthan gum. This will not only cut the production cost but will also manage waste.

The other objective behind using different carbon sources is to gain high yields. Also the apparent viscosity is expected to be more.

This study is innovative in providing information about use of different organic waste as carbon source.

1. Materials and methods:

2.1.1Microorganisms and cultivations:

Three strains of *Xanthomonas campestris* were obtained from the National Chemical Laboratory, Pune. The strains were cultured on yeast malt(yM) medium containing (w/v) 0.3% yeast extract, 0.3% malt extract, 0.5%

bacteriological peptone, 1.0 % glucose, and 2.5% agar.

2.1.2 Shrimp Shell Aqueous Extract (SSAE):

SSAEwas preparedbydispersingshrimpshellpowderinwatera t25°C and stirring at 160 rpm for 30 minutes. The suspensions were filtered through Whatman paper no. 1 and the filtrates (SSAE) used for fermentation. 80ml of this extract was added with 0.1% K_2HPO_4 and 0.01% urea.

2.1.3 Whey:

Cheese whey was obtained by curdling of the milk using acetic acid. The collected whey was then used as substrate. 0.1% $K_2HPO_4$and 0.1% $MgSO_4$was added.

2.1.4 Agro waste:

Fresh potato peelswere collected from local potato processing shops.50g of potato peel was taken and was trimmed and grounded thoroughly by adding 20ml of water in order to moisturize the substrate. The pH was adjusted to 7.2 throughout the process. The substrate was used after sterilization.

2. Cell Production:

To obtain the inoculants, strains of *Xanthomonas campestris* were cultured in yeast malt (YM) medium (0.3% malt extract, 0.3% yeast extract, 0.5% bacteriologicalpeptone,and 1%glucose)andincubatedat28∘C for24hourswithagitationat180rpm.

3. Xanthan gum production:

80ml of each prepared substrate was inoculated with 20 ml of 24hrs old culture in 250ml flasks. 0.5 gm of bacteriological peptone was added. The experiment was carried out in duplicates. The media was used after sterilization. Apart from agro substrates all other substrates were kept at room temperature in shaking condition for 160 rpm for 5 days. Solid state fermentation was carried out with agro substrate.

4. Xanthan gum recovery:

The broth was centrifuged to remove cell at 4°C with 9000 rpm for 15min. The supernatant was collected. 96% of ethanol was added in 3:1 ratio. The precipitated gum was then filtered using filter paper. The gum was then dried at 40°C for 24hrs till a constant weight was obtained.

5. Rheological analysis:

The apparent viscosity was determined by using Ostwald viscometer[10]. The viscosity is calculated by:

- $\eta_1 = \eta_2 \cdot \rho_1 t_1 \boxed{\rho_2 t_2}$

where η_1 and η_2 are viscosity coefficients of the liquid and water, and ρ_1 and ρ_2 are the densities of liquid and water, respectively.

6. Results:

Gum production:

Sr. No.	Substrate	Gum produced/L
1.	Shrimp shell extract	1.69gm
2.	Cheese whey	1.36gm
3.	Agro waste	0.86gm
4.	Sucrose	1.82gm

Table no. 1; xanthan gum production from different substrates

Rheological analysis:

Sr.No.	Gum obtained from substrate	Viscosity
1.	Shrimp shell extract	55.53 mPa-s
2.	Cheese whey	53.68 mPa-s
3.	Agro waste	51.32 mPa-s
4.	Sucrose	56.12 mPa-s

Table no. 2; viscosity of xanthan gum produced from different substrates

From table 1 it can be seen that all the different substrates were utilized by *Xanthomonas campsteris* to produce gum. Amongst them the highest production obtained was from shrimp shell extract. The gum produced from it was almost same that of the sucrose which the control was. The chitin-derivative of glucose-present in shrimp shell served as a good source of sugar which acted as a precursor to *Xanthomonas* to produce the gum. Also there is good amount of protein present in it namely, glucornic acid. Cheese whey gave comparatively less production of gum. This may be due to less carbon source in it. Potato peels gave a production of the starch in the peels served as a tough source of sugars.

Rheological analysis carried out with Ostwald viscometer. Gum produced from shrimp shell extract had the viscosity of 55.53mPa-s, cheese whey of 53.68mPa-s, and agro waste of 51.32 mPa-s.

7. Discussion:

The production of xanthan gum using all the four organic wastes i.e., shrimp shell extract, cheese whey, agro waste and, gained marginal yield. Table 1 shows the gum yield using different substrates.

The shrimp shell when used as substrate yielded highest production amongst other. The gum produced from shrimp shell is slightly lesser than the control i.e., sucrose. SSAE produced almost same gum as the sucrose.But further optimization can give better yield than the sucrose. This can be taken into consideration for using shrimp shell extract as an alternative substrate.According to Assis et al. [2], shrimp waste is basically composed of protein, minerals, chitin(a glucose derivative), and carotenoids, the contents varying according to species, body part, fishing locationandseasonalvariation,andsoforth.Thus, shrimp shell can be used effectively as a cheap substrate.

The use of cheese why and potato peels which are also regular wastes can be used in producing gum. Even if potato peels showed less production than the control, a mixture of agro waste can produce much larger amount of the gum.

The viscosity plays an important role too. The high viscosity of the gum is the reason why it is being used as a thickener and gelling agent. The rheological analysis showed the viscosity of the gum. The gum extracted from shrimp shell had a viscosity of 55.53 mPa-s which was almost same that of the control. Table 2 shows the rheological analysis of other two substrates.

Industries use a lot of synthetic media to produce gum. Use of synthetic media increases the production cost. Thus using these cheap waste residues will cut down the production cost.

These wastes especially shrimp shell and cheese whey are of complex nature and take time to get degraded. Hence using this waste in production of some industrially important polymer like

xanthan solves the problem of waste management.

Xanthan gum is used extensively in food industries. It is also used in cosmetic industries as a gelling agent and stabilizer. The gum has its application in paints and emulsions as well.

8. Conclusion:

This study represented the production of xanthan gum using different organic wastes. Also its rheological analysis was studied. The use organic waste in production will be cost effective.

Acknowledgements:

S.I.E.S. College of Arts, Science, Commerce, Sion, Mumbai, India is greatfully acknowledged for providing necessary infrastructure and facilities. National chemical laboratory, Pune is alsogreatfully acknowledged for providing *Xanthomonas campsteris* culture.

References:

1. **Abu-Huwaij R, Obaidat R M, Sweidan K, Al-Hiari Y.** "Formulation and In Vitro Evaluation of Xanthan Gum or Carbopol 934-Based Mucoadhesive Patches, Loaded with Nicotine". AAPS PharmSciTech, **Vol. 12.**
2. **Assis A. S., Stamford M. T.**, and**Stamford M. L.**, "Bioconversaoderesıduosdecamarao.Litopenaeusparaproducaodebiofilmedequitosana,"RevistaIberoamericanadePol´ımeros, **vol.9**,pp.480–499,2008.
3. **Bradbury JF.** 1984. Genus II: Xanthomonas. In: Krieg NR, Holt CG, editors. Manual of systematic bacteriology. Baltimore, MD: Williams & Wilkins. **pp. 199±210**
4. **Byong H L. 1996.** Fundamentals of food biotechnology.
5. **Cadmus MC, Knutson CA, Lagoda AA, Pittsley JE, Burton KA.** 1978. "Synthetic media for production of quality xanthan gum in 20 liter fermenters". BiotechnolBioeng. **20:**1003±14.
6. **Cadmus MC, Lagoda SP, Burton KA, Pittsley JF, Knutson CA, Jeanes A.** 1976. "Colonial variation in Xanthomonascampestris NRRL B-1459 and characterization of the polysaccharide from a variant strain". Can J Microbiol**. 22:**942±8.
7. **Costa A, Campos M, Druzian J I, Oliveria A, Oliveria Junior E**. 2014. "Biosynthesis of xanthan gum from fermenting shrimp shell: yield and apparent viscosity". International jurnal of polymer science, **14.**
8. **Ferreira1 D, Costa L, Campos M, Bispo M, Krause L, Macedo M, Lopez J.** 2014. "Production of xanthan gum from soybean biodiesel: a preliminary study". Biomed central. **8(4)**: P174.
9. **Flickinger F C, Draw S W**.1999. Encyclopedia of Bioprocess Technology: Fermentation. **5:**2706-2707
10. **GarcõÂa-Ochoa F**, **Casas J A, Mohedano A F**. 2000. "Xanthan gum: production, recovery, and properties". Sep Sci Technol**. 28:**1303±13
11. Generalic, Eni. "Ostwald's viscometer." *Croatian-English Chemistry Dictionary & Glossary*. 15 Dec. 2015. KTF-Split. 31 Jan. 2017. <http://glossary.periodni.com>.
12. **Jeanes A, Rogovin P, Cadmus MC, Silman RW, Knutson CA**. 1976. "Polysaccharide (xanthan) of Xanthomonascampestris NRRL B-1459: procedures of culture maintenance and polysaccharide production purification and analysis. Agricultural Research Service.
13. **Jen-fen fu' and Yi-Hsiung Tseng.** 1990**.** Applied and environmental Microbiology
14. **Kalogenianis S, Iakovidou G, Liakopoulou-Kyriakides, Dimitrios A, Kyriakidis C, Skaracis G**. 2002. "Optimization of xanthan gum production by Xanthomonascampestris grown in molasses". Process biochemistry: **39**. 249-256.
15. **Katzbauer B,** 1998. "properties and applications of xanthan gum". Polymer degradation and stability **59** : 81-84.
16. **Kennedy J F, Bradshaw I J.** 1984. "Production, properties and applications of xanthan". Prog Ind Microbial. **19:** 319-71.
17. **Kidby D, Sandford P, Herman A, Cadmus MC**. 1977. "Maintenance procedure for the curtailment of genetic instability: Xanthomonas campestris NRRL-B1459". Applied Environment Microbiology. **33:**840±5

PHA: Biodegradable Green-Polymer Production Using Endophytic Bacteria of *Mangifera indica*

Khatu S.*, Ronghe S. and Tambe D.

Department of Microbiology

SIES College of Arts, Science and Commerce. Sion (W), Mumbai 40002

Abstract

The main objective of the present study is to isolate endophytic bacteria of Mangifera indica and to check their ability to produce PHA under nutritionally stressful condition. The accumulation of petrochemical plastic waste in the environment is an increasing problem. PHA has not only served as an alternative for synthetic plastic but is also effectively used in medicinal applications due to its biocompatibility and biodegradability. Various bacterial species accumulate intracellular polyhydroxyalkanoates granules as energy and carbon reserves inside their cells. Traditionally PHA producers have been isolated from various sources like soil, sewage, sludge, marine environment etc. The present study is aimed to isolate PHA producing endophytic bacteria from plant sources. Bacterial endophytes were isolated from healthy tissues of M.indica and were screened for PHA production in M9 medium. Isolates obtained were qualitatively screened for PHA production using Sudan Black B and Nile blue A staining. Extraction of the polymer was carried out using hypochlorite method. Spectrophotometric analysis was done to quantify the extracted PHA. For medical applications, the biocompatibility of the PHA was analysed. It was found that the PHA did not activate phagocytosis by macrophages. Hence it was further studied for the controlled drug release in vitro which showed that PHA allows slow and steady drug release.

Key words: *Polyhydroxyalkanoates, Biodegradable plastic, Endophytes, Biocompatibility.*

Introduction

Synthetic plastics are one of the greatest inventions of mankind and have been developed into a major industry and indispensable commodity in human's life. They are designed in a way to suit the constant performance and trustable qualities that are used for long life span, therefore causing them to be inert to natural and chemical breakdown. As the natural environment is continuously polluted by these hazardous plastics, the development and production of environmental-conserved biodegradable plastics are rapidly expanding in order to trim down our reliance on synthetic plastics.(Jiun-Yee Chee.,2010)

Bioplastics are a special type of biomaterials, derived from plant sources or microbial sources, rather than traditional petrochemical. Many bacteria can synthesize polyesters of hydroxyalkanoic acids and can accumulate water-insoluble PHAs in the cytoplasm as inclusions and as storage compounds for energy and carbon. Accumulation of PHAs in the bacterial cell usually occurs under conditions of depleted nutrients.

Majority of polyhydroxyalkanoates producing bacteria have been isolated from soil and activated sludge. On the contrary, only a few studies have been made on plant-associated microbiota for production of PHAs. As against the free-living autotrophic and heterotrophic phyllospheric and rhizospheric microorganisms, the endophytic bacteria, have not been explored for the production of natural compounds including biopolymers. Since plants are known to produce an array of phytochemicals, it is expected to create stressful environment for the bacterial flora possibly resulting in selection of bacteria that could produce PHA.(Das et al.2015)

PHA has a wide range of potential applications because of its desired features such as

biocompatibility, biodegradability and negligible cytotoxicity to the cells. PHAs have numerous medical applications.(Valappil, S et al.2006) The main advantage in the medical field is that a biodegradable plastic can be inserted into the human body and does not need to be removed again. In pure form or as composites with other materials, PHAs are used as sutures, repair patches, orthopedic pins, adhesion barriers, stents, nerve guides and bone marrow scaffolds.(Zhu and Chen.2014) Polymer implants for targeted drug delivery, an emerging medical application, can be made out of PHAs.(Shrivastav, A. et al.2015)

The main objective of the present study is to isolate endophytic bacteria of *Mangifera indica* leaves and to check their potential to produce PHA under stressful condition. As the PHA has properties like biocompatibility, biodegradation, it can be efficiently used as coating material for control and sustained drug delivery.

MATERIALS AND METHODS

1. Collection of sample:

Healthy, fresh leaves of *Mangifera indica* (Mango) plant were collected from Kurla and Panvel (Maharashtra, India). The leaves were transported to laboratory in airtight plastic bag and were used quickly on same day.

2. Isolation of Endophytic Bacteria:

The leaves samples were washed thoroughly with running tap water to get rid of superficial dust and particulate matter and subjected to surface sterilization. The plant parts were disinfected superficially with the treatment of 70% alcohol for 30 s, ethanol for 30 s, 0.5% sodium hypochlorite for 2-3 minutes followed by rinsing with sterile distilled water. After several washings in sterile distilled water, the segments were aseptically cut into 2 mm^2 sections and plated on M9 agar plates containing glycerol as a sole source of carbon. The plates were incubated at 37°C for 2-4 days and observed for growth of bacterial colonies surrounding plant tissues. Isolates differing in colony morphology were obtained in pure form by subculturing on the M9 agar media and were maintained at 4°C on slants of M9 agar by subculturing at regular interval.

3. Primary Screening:

i. Sudan Black B staining:

Sudan Black B staining was used as a primary staining method for the detection of PHA producing bacteria. (Dube and Maheshwari,2006)

ii. Nile Blue A staining:

The isolated bacterial colonies were suspended in sterile saline and the suspension cultures were streaked on M9 agar incorporated with Nile Blue A stain to a final concentration of 25 ppm. The plates were incubated at 37˚C up to 48h and observed under UV light for detection of fluorescent colonies as potential producers of PHA. (Wagle A.R.2016).

4. PHA Production:

The isolates obtained after primary screening were subjected for PHA production by aerobic fermentation. The cultures were inoculated in 50 ml M9 broth containing glycerol as a sole source of carbon in a 250 ml conical flask and cultivated at 150 rpm/37 ˚C for 48 hrs. After incubation the cell pellets were recovered by centrifugation at 9000 rpm for 15 minutes.

5. Extraction of PHA:

A simple hypochlorite method was used for the extraction of PHA from cell mass. The pellet obtained was treated with 25 ml of Sodium Hypochlorite and incubated at 37 ˚C for 10 minutes. After incubation the mixture was centrifuged at 5000 rpm for 15 minutes and then pellet was washed with diethyl ether and was evaporated by pouring in empty petriplate. After evaporation the powder was collected for further analysis. (Rawate T.et al. 2000).

6. Determination of PHA content:

The purity of the PHA was measured by the crotonic acid assay. (Law and Slepecky 1961). The sample containing the polymer is transferred to a clean test tube.10 ml of concentrated sulphuric acid was added to the

sample and tube was capped with glass marble and heated for 10 minutes at 100˚C in a water bath. The solution after cooling is transferred to cuvette and the absorbance was measured at 235 nm against sulphuric acid as blank. The quantitative comparison of the sample was done from the standard curve obtained using standard crotonic acid. The concentration of crotonic acid obtained from the extracted broth corresponds to the concentration of PHB. The yield of PHB was also calculated as per the formula below:

Yield of PHA= – Y*Dilution factor*100

Whe orbance 0.924
(mg/L)

7.Bi y testing of PHA:

Immune response to PHA

Fresh human blood was collected and buffy coat was obtained. The buffy coat containing active neutrophils were then incubated with PHA granules stained with 0.1% crystal violet stain. Then the formation of any engulfing neutrophils was checked. The slides were observed under 45x for every 5, 10, 15 min for at least 2 hours.

8. Control drug release:

In order to check the effect of PHA on the release of the drug, an antimicrobial susceptibility disc containing Levofloxacin is coated with PHA. Two controls were maintained: Levofloxacin disc coated with chloroform (in order to eliminate the effect of chloroform on the drug or test organism. An untreated Levofloxacin disc was used as a second control.

18 hours old cultures of *Staphylococcus aureus* and *Escherichia coli* were adjusted to OD 0.5 in saline suspension was surface spread on sterile nutrient agar medium. Aft leaving the plates for absorption the discs we placed in plates. The plates were incubated at 37^0C for 24 hours. After incubation the zone of inhibitions were measured.

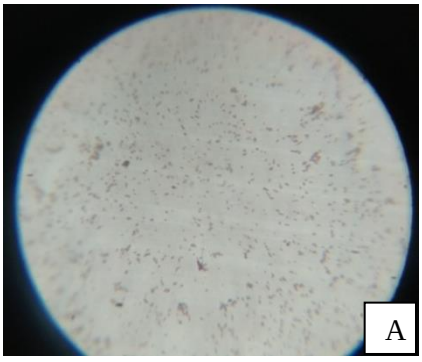
Results:

1 Isolation of Endophytic Bacteria:

rilized leaf segments of *M.indica* incubated on M9 agar plates showed growth of morphologically distinguishable bacterial colonies surrounding the segments after 2-4 days of incubation. Total of 5 bacterial endophytes were isolated in pure form.

2. Screening of Isolates for PHA Production:

All endophytic bacterial isolates obtained from *M.indica* were screened for the accumulation of PHA during growth in M9 medium using Sudan black B and Nile blue A staining.(Figure 1) Sudan Black B staining showed presence of blue-black granules inside the pink coloured cells. In Nile Blue A screening all the isolates showed fluorescence under UV light, but isolates PC2 and DD1 showed brightest fluorescence.



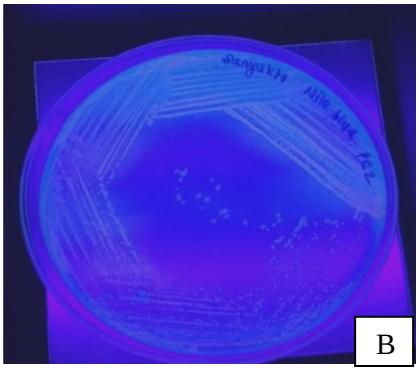


Figure 1A shows the presence of Blue-black granules as a result of Sudan black B staining and in Figure1B PHA producers gives bright fluorescence under UV light.

PHA Production:

l the 5 isolates were subjected for production in M9 medium with glycerol.PHA was extracted using Hypochlorite method.

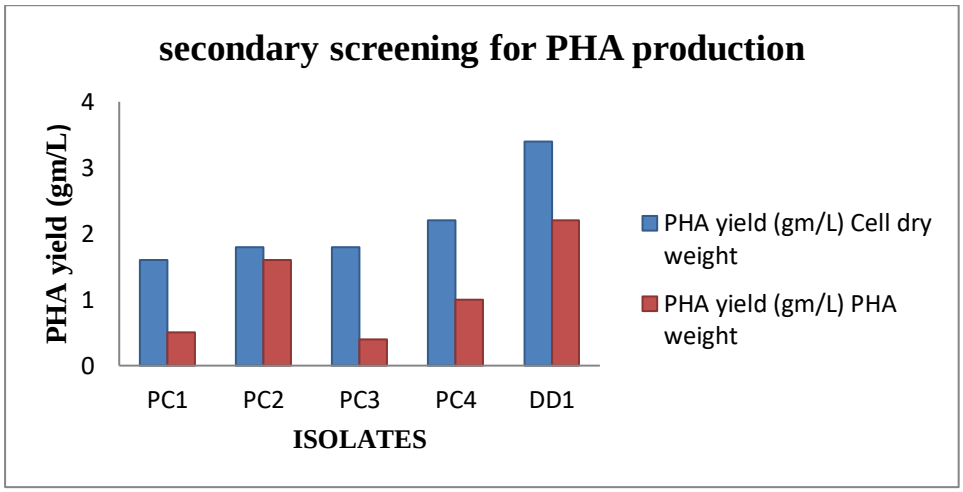


Figure 2. Secondary screening of the isolates for maximum PHA production

Among all the 5 isolates PC2 and DD1 gives efficient amount of PHA production. In figure 2, blue coloured bars indicates cell dry weight (gms/ L) while orange coloured bars shows the yield of PHA (gms/L). Though cell mass of the isolate DD1 was much higher than the PC2, PHA yield obtained was less than the former isolate. The PHA yield given by PC2 and DD1 was 88.88% and 64.70% respectively.

4. Determination of PHA content:

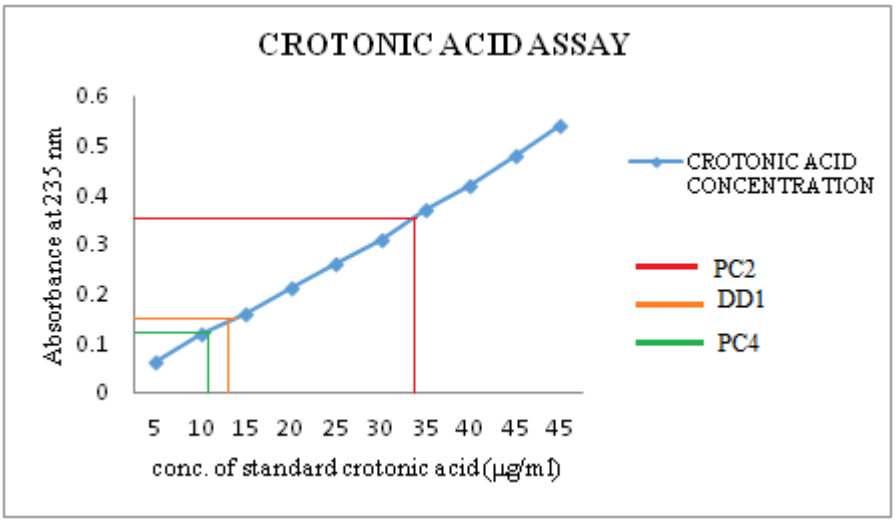


Figure.3 Graph of standard crotonic acid assay.

Crotonic acid assay was done to check the purity of the extracted PHA. Standard graph of crotonic acid concentration (Figure 3) gave value of crotonic acid concentration in extracted PHA sample. From the graph concentration of crotonic acid in the extracted sample were found to be 0.34 gm% for PC2, 0.14 gm% for DD1 and 0.10 gm% for PC4. The yield of PHB was calculated as per the formula. Isolate PC2 gave higher concentration of crotonic acid i.e., 3908 mg/L

5.Biocompatibility testing of PHA:

Immune response to PHA:

The immune response against PHA was studied in vitro by examining the phagocytic action of neutrophils in presence of PHA granules. The PHA granules were not phagocytosed by the active neutrophils. (figure 4)

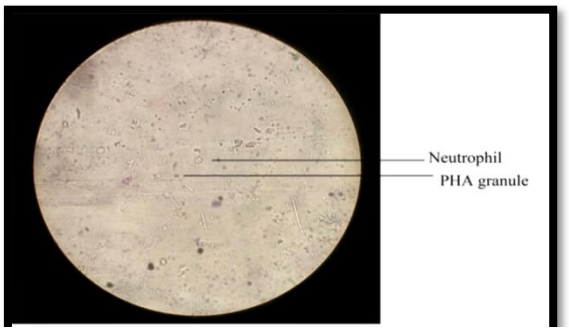


Figure 4. shows no engulfment of PHA granules by neutrophils

5. Control drug release:

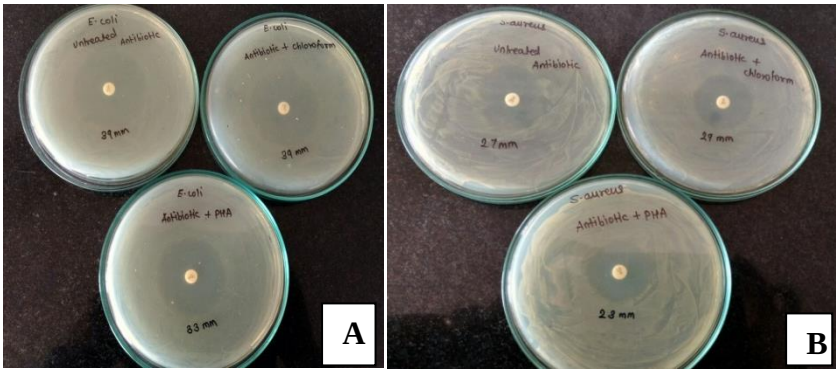


Figure 5. Zone of inhibitions by untreated Levofloxacin disc, Levofloxacin disc with chloroform and Levofloxacin disc with PHA in anti-clock wise direction against *E.coli* (Gram negative) and (B) *S.aureus* (Gram positive).

It was seen that the test organisms *E.coli* and *S.aureus* were sensitive to Levofloxacin as it showed an inhibition zone size of 39 mm and 27 mm respectively. The inhibition zone size of the drug coated with chloroform was found to be same as the uncoated drug. The drug coated with PHA gave inhibition zone size of 33 mm for *E.coli* and 23 mm for *S.aureus.* Sudan Black B and more sensitive fluorescent dyes like Nile Blue A are considered as rapid, reliable and reasonably sensitive primary screening methods and allow detection of PHA producers without affecting their growth. Being lipid soluble Sudan Black B stain gets accumulate in lipid granules. Since PHAs are nothing but the lipids, as a result of staining,

the positive isolates shows presence of black-blue granules in pink coloured cells. Nile Blue A is fluorescent but only in the presence of hydrophobic environment. The dye is soluble in lipids it is intended to show (Greenspan P.et al.1985).On Nile Blue A primary screening all the 5 isolates shows fluorescence under UV light which indicates that the isolates have the potential to produce PHA. (Pierce & Schroth, 1994).

Discussion:

Occurrence and diversity of culturable endophytic bacteria colonizing the internal tissues of the *Mangifera indica* has been studied for their potential for production of PHA (WagleA.R.et al 2016).After incubation morphologically different colonies were observed around the leaf section. Primary screening of PHA producing bacteria using

Secondary screening for PHA production revealed that majority of the isolates produced variable amount of PHA. The accumulation of PHA is higher in the presence of glycerol than the glucose when provided as a sole carbon source. Two isolates showed significant amount of PHA production. From both qualitative and quantitative assay for PHA production, isolate PC2 was found to give maximum PHA production.

The suitability of PHA polymer for inclusion in drug delivery or other biomedical applications will not only depend on the biodegradation properties but also on its biocompatibility. The immune response against PHA was studied in vitro by examining the phagocytic action of neutrophils in presence of PHA granules.

Drugs can be entrapped or microencapsulated in a PHA homopolymer or copolymer. Microsphere-or microcapsule based delivery systems have been extensively used for the delivery of a number of drugs such as anesthetics, antibiotics, anti-inflammatory agents, anticancer agents, hormones, steroids, and vaccines.(Shrivastav A. et al 2013**)**.

The test organisms were sensitive to Levofloxacin as they show zones of inhibtion. As PHA was present in chloroform while coating, it is necessary to check if chloroform has any effect on the release of drug. As the inhibition zone size of the drug coated with chloroform was same as the untreated drug, it was concluded that any change in the release of the drug coated with PHA was solely because of the PHA. Antibiotic disc coated with PHA shows slow release of drug as compared to untreated disc. This indicates that PHA involves in control drug release.

Conclusion:

Endophytes have been proven to be rich sources of novel natural compounds with a wide spectrum of biological activities and a high level of structural diversity. Endophytic bacterial isolates of *Mangifera indica* appeared to be potential producers of biodegradable biopolymer, PHA. Therefore this study introduced us to a new area of research where endophytic bacteria can be used for mass production of biodegradable polymer.

References:

1. **Budde,C.F., Sebastian L. Riedel, Florian Hübner,Stefan Risch,Milan K. Popović, ChoKyun Rha, and Anthony J. Sinskey.**2011."Growth and polyhydroxybutyrate production by Ralstonia eutropha in emulsified plant oil medium." Appl Microbiol Biotechnol.DOI 10.1007/s00253-011-3102-0.
2. **Chee,J-Y.,Y Tan, M-R Samian and Kumar Sudesh.** 2010. "Isolation and Characterization of a Burkholderia sp. USM (JCM15050) Capable of Producing Polyhydroxyalkanoate (PHA) from Triglycerides,Fatty acids and Glycerols." J Polym Environ **18**:584-595.
3. **Chen, G.Q. and Wu, Q**. 2005. "The application of polyhydroxyalkanoates as tissue engineering materials." Biomaterials **26**, 6565–6578.

4. **Das, R., A.Pal, S. Mandal and A. K. Paul.** 2015. "Screening and Production of Biodegradable Polyester Poly(3-hydroxybutyrate) by Bacteria Endophytic to *Brassica nigra L."* British Biotechnology Journal **7(3)**: 134-146.
5. **Law JH., and R.A. Slepecky.**1961. "Assay of Poly-β-Hydroxybutyric acid." J. Bacteriol.vol. **82** no. 133-36.
6. **Misra, S.K., S.P. Valappil,I.Roy and A.R.Boccaccini**.2006. "Polyhydroxyalkanoate (PHA)/Inorganic Phase Composites For Tissue Engineering Applications."Biomacromolecules, Vol**.7**. No.8.Pg.2250-2258.
7. **Phithakrotchanakoon,C.,V.Champreda, S.Aiba, K.Pootanakit, and S.Tanapongpipat**.2014. "Production of Polyhydroxyalkanoates from Crude Glycerol Using Recombinant Escherichia coli." Journal of Polymers and the Environment.DOI: 10.1007/s10924-014-0681-8.
8. **Phukon,P., M Phukan, S. Phukan, and B. Konwar**.2014. "Polyhydroxyalkanoate production by indigenously isolated Pseudomonas aeruginosa using glycerol by-product of KCDL biodiesel as an inexpensive carbon source."Annals of Microbiology DOI 10.1007/s13213-014-0800-8.
9. **Pierce, L., Schroth, M.** 1994. Detection of Pseudomonas colonies that accumulate poly-β-hydroxybutyrate on Nile blue medium. Plant Dis., 78(7): 683–685.
10. **Pouton C.W. and S. Akhtar.**1996. "Biosynthetic polyhydroxyalkanoates and their potential in drug delivery." Advanced Drug Delivery Reviews, 1996. **18(2)**: p. 133162.
11. **Rawate T.,and S. Mavinkurve.**2002. "A Rapid Hypochlorite Method For Extraction of Polyhydroxyalkanoates from Bacterial Cells."Indian Journal of Experimental Biology. Vol.**40**, August 2002, pp.924-929.
12. **Shrivastav,A.,H-Y.Kim,Y-R.Kim.**2013."Advances in the Applications of Polyhydroxyalkanoate Nanoparticles for Novel Drug Delivery System." BioMed Research International Volume2013, ArticleID581684.
13. **Valappil, S., S.K.Misra,A.R.Boccaccini, and I.Roy**.2014. "Biomedical applications of polyhydroxyalkanoates, an overview of animal testing and *in vivo* responses.Expert Review of Medical Devices." Volume **3**, 2006 - Issue 6,Pages 853-868.
14. **Verlinden,R.A.J., D.J. Hill, M.A. Kenward, C.D. Williams and I. Radecka.**2007. "Bacterial synthesis of biodegradable polyhydroxyalkanoates." Journal of Applied Microbiology 102 (2007) 1437–1449.
15. **Wagle A.R., Y M.Dixit and B V. Vakil.** 2016. "Screening and Isolation of PHB Producers from Plant Sources." Int.J.Curr.Microbiol.App.Sci.**5(4)**: 413-423.
16. **Zhu. C., and Q.Chen**. 2014."Polyhydroxyalkanoate- Based Biomaterials for Applications in Biomedical Engineering."Advanced Healthcare Materials (431–456).

Bibliography:

Dube R.C.and D.K. Maheshwari. Practical Microbiology,2006,Second edition,page no.68-69.

Survey on Perception of School Students Regarding Waste and Conducting Awareness Programme towards Waste Management Techniques

Neha Patil*[1] Dr. Jyoti Koliyar[2]

1,2 – SIES (Nerul) College Of Arts, Science and Commerce

8898163503*patilneha5563@gmail.com

Abstract

Waste is any product or by-product that is eliminated or discarded as it no longer has any use or required after the completion of its purpose. When waste is not properly disposed off, causes real impacts on the environment. Waste generally ends up in the landfill where chemicals within it have a tendency to leech into the soil, polluting it. This automatically hampers the plants along with animals and ultimately the humans. To prevent the damaging of Earth's ecosystems and maintain a high quality of life for the planet's inhabitants, humans must manage and store their waste efficiently and safely. Awareness about the same is therefore important amongst the public. The paper focuses mainly on the awareness of waste management among the school children along with their attitude towards the same. The school going children are targeted as they have a mind that can be shaped and moulded by the teachers and elders for the betterment of environment along with the development of nation. Inculcating the values of waste management techniques in children will lead to a much better nation in the future. The paper encourages the techniques of waste management viz. Waste minimization, reduce, reuse and recycle among the children. The aim of this study is to assess the viewpoint and perception level of waste in the youngsters. A validated questionnaire survey of the students of three schools located in Mumbai and Navi Mumbai was carried out. 100 random students were selected for the filling of the questionnaire though the awareness sessions were made mandatory for all the students in the schools. Also feedback from teachers was taken. This study intends to raise the knowledge of the students about the dealing of waste in their present and future as well.

Keywords*: waste, management, disposal, awareness, viewpoint, waste minimization*

1. Introduction:

Solid waste generation has continued to increase globally along with the problem of its disposal. In India, the ratio of waste generation is directly proportional to the increase in the population and development of economies. So is the case in almost all of the developing countries. There is a continuous pressure on the government and society regarding the management of the waste generated in an appropriate manner. Inappropriately managed waste can pose a significant risk to health and environmental concerns. Improper handling of waste is associated with a wide range of problems from polluting of water, increased floods by blocking the drains, polluting the air by increasing emissions of green house gases, thus contributing to Climate Change. It is also responsible for uncontrolled dumping of waste at the roadside bins and ultimately to the landfills. Waste that is not properly managed, especially excreta and other liquid and solid waste from households and the community, are a serious health hazard and lead to the spread of infectious diseases. Unattended waste lying around attracts flies, rats, and other creatures that in turn spread disease.

Normally it is the wet waste that decomposes and releases a bad odour. This leads to unhygienic conditions and thereby to a rise in the health problems.

In urban areas like Mumbai, a single individual produces approximately 1.5 kilogram of waste per day and the city is said to be having a population of 20.5 millions currently, this gives a real big amount of waste that is being generated in the city on a daily basis. The burden of waste is ultimately taken up by the dumping grounds in Mumbai (Deonar, Mulund and Kanjurmarg) leading to serious environmental issues. This generally is the result of lack of training and awareness on dangers of unsustainable waste management practices. It is therefore the need of the hour to take up the management of waste in action as proper waste management is the fundamental key towards the sustainable future.

All that we require is having a comprehensive waste management system for efficient waste collection, transportation, and systematic waste disposal along with activities to reduce waste generation and increase waste recycling. For this, it is important that every individual should have enough knowledge about the waste and waste management practices and best results would be achieved when the youth of the nation would be targeted and made sensitive towards the environmental problems and concerns. It can be done by effectively including the subject of environment in their curriculum or by conducting awareness workshops for the students. This paper deals with the latter part as a step to attain a sustainable future. The strategy of targeting school students was made keeping in mind 'them as our future ', as they follow what they have been taught in the school and pass on the information to their family. This could be their step today for the sustainable tomorrow.

2. Aim & Objectives

To conduct workshops and surveys in the secondary section of the schools amongst the children which are at their perfect age to be made conscious about the concept of waste, the problems arising due to the waste and possible solutions.

Objectives

- To inform the school children about the problems arising due to improper management of waste through workshops. To know the level of knowledge that exists among them regarding the waste management practices. To acquaint them with the techniques that they could follow in their day-to- day life.

3. Materials and Methods:

The idea of the project was chiefly qualitative and the data was gathered utilizing a variety of tools as mentioned below for creating better involvement and understanding of the students.

For conducting the awareness programme, students were given knowledge through discussions, power point presentations, demonstrations through videos.

Waste, problems due to waste, waste as a resource, proper disposal, segregation of waste, composting, reuse, reduce and recycle of waste etc were the major topics talked and discussed about. They were well briefed with the current status of Dumping ground and the problems faced by the rag pickers due to the same.

A validated questionnaire was made to examine the minds of the youth concerning the waste and its management. The study was carried out in the secondary section of the schools. A total of two schools were targeted and 60 Students were randomly selected to fill the questionnaire from each school. Even

teachers were welcome for the awareness workshop. Feedback form with all the required data was taken from the faculties of the schools well after the waste management awareness workshop.

4. **Result and Discussions:**

A total of 120 samples were collected from 2 schools, one from Mumbai and 1 from Navi Mumbai. Samples were gathered randomly from the schools. On evaluation of the data, following observations were obtained.

	No. of students that are aware	% of Students that are aware	No. of Students that practice	% of Students that practice
Waste segregation	30	50	56	93.33
Waste minimisation	56	93.33	30	50
e-waste	48	80	0	0
Dumping grounds	28	46.66	56	93.33

Table 4.1: Indrayani English Medium School, Koparkhairane, Navi Mumbai

The data collected from the children of Indrayani school (table 4.1) revealed that 50% of the students are aware about the waste segregation technique and without knowing the motto behind following waste segregation, 93.33% of them actually practice the technique and contribute to the betterment of the nation. A strange but a true fact that is that the students are unknowingly kicking in for the improvement of the environment. But it is equally important for everybody to know what they are contributing to environment either good or bad. The student are practicing same as it is made a mandatory norm by the NMMC for everybody in Navi Mumbai to separately dump their wet and dry waste, right from the household level.

	No. of students that are aware	% of Students that are aware	No. of Students that practice	% of Students that practice
waste segregation	57	95	9	15
waste minimisation	51	85	30	50
e-waste	57	95	0	0

dumping grounds	59	98.33	1	0.6

Table: 4.2: Maravli M. U. P. Marathi School, Chembur, Mumbai.

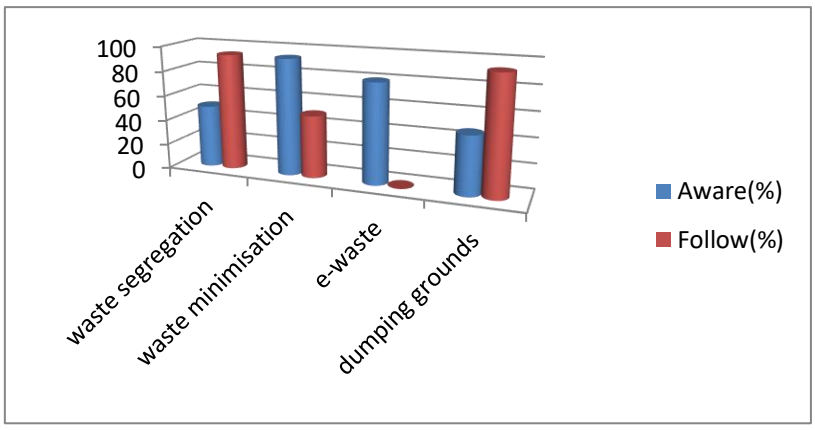
Students from Maravli School (table 4.2) were well aware about the waste segregation technique and its benefit to the environment as 95 % of the students gave a positive response but obeying to what they know is poor. The students don't practice waste segregation at their home. Only 9% of the students practice the waste segregation technique at their home. Though the school had made arrangements for separate dumping of the wet and dry waste, only one waste collecting BMC van arrives for the collection of the waste which empties both the bins in the same container.

Students at both the schools are well aware about the Electronic waste that is being generated in their day to day life and their percentage was as good as 93.33% at Indrayani and 85% at Maravli School. But unfortunately they were not aware about the problems that are associated with the open dumping of the e-waste. It was observed that not a single child was aware about the disposal techniques of the e-waste.

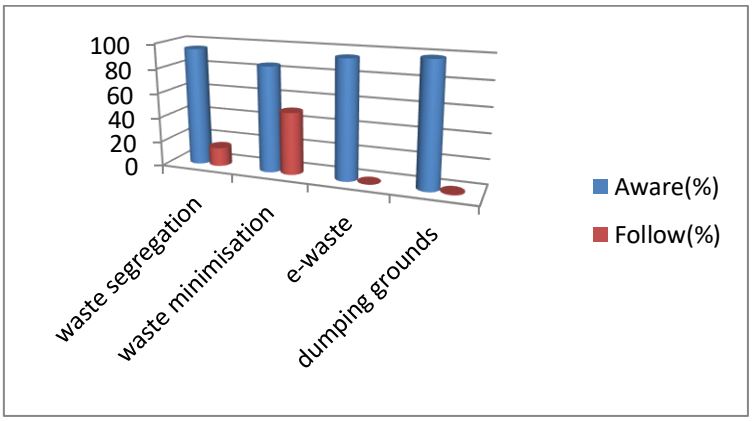
Knowledge about the dumping ground was at its peak amongst the Maravli School students giving highest percentage of 98.33% while that of from the Indrayani revealed that 46.66% were aware about dumping ground. The percentage was high amongst the Maravlis due to the recent news about the Deonar Dumping ground's fire that had affected nearly all the areas surrounding Deonar from which Chembur falls in the list. But again due to no proper follow up of the management plans in BMC, practice among the people for lowering of the burden on dumping grounds is still not observed.

The teachers found the waste awareness and management workshop good. It helped the students in appropriately understanding the concept of waste and the ways in which it can be dealt with. Feedback was collected from the teachers well after the awareness campaign and it was perceived that students were following the techniques taught to them. The teachers would like to have such sessions in their school in future as they want their students to bestow their role for the sustainable environment.

The graphical representation of the information obtained above is as follows



Graph 4.3: Indrayani English Medium School, Koparkhairane, Navi Mumbai



Graph 4.4: Maravli M. U. P. Marathi School, Chembur, Mumbai.

5) Conclusion:

Proper methods of waste disposal have to be undertaken to ensure that it does not affect the environment around the area or cause health hazards to the people living there. Rise in the amount of waste is no longer accepted. It is very important to tackle this problem of waste on an urgent basis and the start should take place from our homes itself.

Waste segregation being followed in the Navi Mumbai region is an appreciable effort taken up by NMMC. Same is expected to be undertaken by the BMC in order to lessen the burden on the dumping grounds. People from Mumbai and Navi Mumbai should approach towards accepting waste minimization techniques like Reuse, Reduce and Recycle so that waste is curtailed. There is an urgent need for students to be made conscious about the disposal of e-waste and the adverse effects it may have in the environment when dumped as waste after its use. Students being our future, they should realize the importance of waste management in order to have a sustainable environment.

6) Acknowledgement:

We are thankful to Tai Dnayanoba Mane, Head, Indrayani English medium School, Koparkhairane, Navi Mumbai and Mrs. Jayashree Chavan, Principal, Maravli Municipal Marathi School for permitting and supporting in carrying out the study. I address my appreciation to Ms. Jyoti Sakhore, Ms. Sayali Mhatre, Ms. Ankita Bagwe for their kind support for survey. A special credit to Er. Anthony D'souza for technical aid.

7) References:

1. Vivek et a,l Awareness, Attitude and Practice of School Students towards Household Waste Management Journal of Environment (2013), Vol. 02, Issue 06, pp. 147-150
2. T.V. Ramachandra* and Shruthi Bachamanda Environmental audit of Municipal Solid Waste Management Int. J. Environmental Technology and Management (2007), Vol. 7, pp. Nos. 3-4
3. Patrick Akata Nwofe, Management and Disposal of Municipal Solid Wastes in Abakaliki Metropolis, Ebonyi State, Nigeria, International Journal of Scientific Research in Environmental Sciences (2015), 3(3), pp. 0107-0118
4. Integrated Solid Waste Management (ISWM) – An Overview https://www.thebalance.com/integrated-solid-waste-management-iswm-an-overview-2878106

Assessment of Bore-Well Water of Kharghar, Navi Mumbai, Maharashtra Using Water Quality Index

Vinaya Shinde*[1], Dr.Jyoti Koliyar[2]
Department of Environmental Sciences
SIES (Nerul) College of Arts, Science & Commerce – 400706
vinaya.shinde24@gmail.com

Abstract

One of the natural resource for drinking water in India is groundwater. Many people do not have access to clean and safe drinking water and hence they will get prone to waterborne diseases by which death can occur in critical situations. Every individual should have an access to healthy and safe drinking water. The quality of water varies from region to region due to several factors. Materials from the land surface can move through the soil and end up in the groundwater. Untreated waste from septic tanks and toxic chemicals from underground storage tanks and leaky landfills can contaminate ground water, thereby reducing quality of fresh water resources. The current work is aimed at assessing the water quality index for the bore-well water samples of Kharghar, Navi Mumbai. A total of 6 samples were taken from bore-well water distribution and subjected for a comprehensive physicochemical analysis and microbial quality of gathered samples. The purpose of this study is to provide an overview of present ground water quality for 13 parameters (pH, conductivity, turbidity, TH, TDS, alkalinity, chlorides, calcium, iron, fluoride, COD, DO and MPN) and were considered for calculating WQI. Each parameter was compared with the standard desirable limit prescribed by BIS/ ICMR/WHO and were found to be within the permissible limits except COD and DO. The results obtained by WQI method when compared were found to be on the higher side indicating unsuitability of water for drinking purposes.

Key words: *Bore-well water, water quality parameters, desirable limit, water quality index*

Introduction

Water makes up about 71% of the earth's surface and the oceans hold about 97% of all Earth's water, but that isn't drinkable. About 2% is frozen at the poles or in glaciers and the remaining 1% is ground water. All living organisms consist of 60% water and it requires as a basic building material as well as to regulate internal body temperature, transport nutrients through the bloodstream and flush out wastes. It is essential to life and needed by all living things for various purposes. Ground water is used for drinking, domestic, industrial and irrigation purposes all over the world. The importance of groundwater for the existence of human society cannot be over emphasized. Prolonged discharge of industrial effluents, domestic sewage and solid waste dump causes the groundwater to become polluted and created health problems. A Water Quality Index (WQI) is defined as a rating, reflecting the composite influence of different water quality parameters which gives the public a general idea of the possible problems with the water in the region. It is calculated to check the suitability of groundwater for human consumption. Before, water can be described as potable; it has to comply with certain physical, chemical and microbiological standards to ensure that the water is potable and safe for drinking. Water is a vehicle for the transfer of wide range of microbial diseases. The existence of indicator bacteria (*E. coli*) in high amounts indicates the probable presence of pathogenic bacteria. This makes it necessary to disinfect the groundwater before human consumption. Hence, the current work is aimed at assessing the water quality index for the bore-well water samples of Kharghar, Navi Mumbai city.

Aim and Objective

- To assess the physico-chemical and microbiological properties of bore well water
- To assess the quality of water using WQI
- To discuss the suitability of ground water for human consumption based on water quality index (WQI)

Methodology

- **Study area:** Total 6 samples were collected from different sectors (Sectors - 5, 10, 11, 12, 13, 15) in Kharghar, Navi Mumbai. The groundwater was collected from the borewells located in these areas.
- **Analysis of water samples:** The collected water samples were analyzed for various physico-chemical and microbiological parameters. The parameters analyzed were pH, conductivity, total hardness, total dissolved solids, alkalinity, chloride, calcium, COD, dissolved oxygen, turbidity, iron, fluoride and most probable number (MPN) of coliform bacteria.
- **Instruments and methods:** pH was measured using standard pH-meter, conductivity by conductometer, turbidity by turbidometer, total hardness and calcium content by EDTA titrimetric method, total dissolved solids by gravimetric method, alkalinity by acid-base titration, chlorides by Argentometric method, COD by open reflux method, DO by Winkler method, iron and fluoride by colorimetric method, and coliform test by MPN method.

Results and discussion

- **pH:** pH is considered as an important preliminary test that provides an useful information for geochemical equilibrium. The pH of all the water samples ranged from 6.54-6.91 which is within the permissible limits 6.5-8.5 given by BIS. The pH is controlled to produce water that minimizes corrosion or incrustation.
- **Conductivity:** It is a measure of capacity of water to conduct electric current and also it is a tool to assess the purity of water. The conductivity was found in the range of 0.63-0.69mʊ. Water with high mineral content tends to have higher conductivity which is a general indication of high dissolved solid concentration of the water. Therefore, conductivity measurements can be used as a quick way to isolate potential water quality problems.
- **Total hardness (TH):** Hardness is the property which makes water to form an insoluble precipitate with soap and is primarily due to the presence of calcium and magnesium ions. The total hardness was found to be in the range of 75-150mg/L which is within the desirable limit 300mg/L of $CaCO_3$ as per BIS. Hard water is primarily of concern because it requires more soap for cleaning, causes yellowing of fabrics, toughens vegetables cooked in the water and forms scales in boiler, water heater, pipes and utensils.
- **Total dissolved solids (TDS):** The term total dissolved solids refer to materials that are completely dissolved in water. The samples were checked for TDS and were found to be in the desirable limit of 500mg/L which is measured in the range of 204-390mg/L. The effects of TDS on drinking water quality depend on the levels of its individual components.
- **Alkalinity:** It is a measure of the capacity of water to neutralize acids. The alkalinity of all samples was in the range of 65-105mg/L which is within the desirable limit of 120mg/L given by BIS. The value of alkalinity in water provides an idea of natural salts present in water.
- **Chlorides:** The amount of chloride present in S_1, S_2, S_3, S_5 & S_6 were within the desirable limit of 250mg/L prescribed by BIS. The presence of chloride in S_4 was found to be above desirable limit but within the permissible limit i.e. 1000mg/L prescribed by BIS. This may be due to natural processes such as the passage of water through natural salt formation in the

earth or it may indicate possible pollution from human sewage, animal manure or any other domestic waste.

- **Calcium:** The presence of calcium in water results from deposits of limestone, gypsum, etc. It is one of the principal cations involved in water hardness. The calcium ion concentration in all the samples except S_4 were found to be within the permissible limit of 75mg/L while in the S_4 it was exceeding the desirable limit but is within the permissible limit of 200mg/L as per BIS.
- **Chemical Oxygen Demand (COD):** COD is the measurement of the amount of oxygen in water consumed for chemical oxidation of pollutants. The observed values in all samples ranged from 260-460mg/L. The permissible limit of COD is 10mg/L. Hence, the observed values are more than the permissible limit which may be an indication of pollution from domestic waste.
- **Dissolved Oxygen (DO):** DO is a very important parameter of water quality. It is used to evaluate the pollution strength of domestic and industrial waste. The observed values of DO in all samples were in the range of 1.4-4.0 which is within the permissible limit of 4mg/L.
- **Turbidity:** Turbidity refers to the cloudiness of a solution and it is a qualitative characteristic which is imparted by solid particles. It indicates the presence of solids like clay, organic matter, silt, algae and other micro-organisms. The turbidity of all the samples ranges from 0.5-1.5NTU which is within the desirable limit i.e.5NTU.
- **Iron:** The desirable limit recommended by BIS is 0.3mg/L and the maximum permissible limit is 1.0mg/L. Iron concentrations were found absent in S2, S3, S5 & S6. It was found 0.004 and 0.005 in S1 and S4 Iron is an essential element in human nutrition but high concentration may have toxic effects.
- **Fluoride:** The fluoride concentration in the samples ranged from 0.28-0.52mg/L which is within the desirable limit of 1mg/L as per BIS. The presence of small quantities of fluoride in drinking water may prevent tooth decay.
- **Most probable Number (MPN):** This technique is also called as multiple tube fermentation technique to detect the total coliforms. No gas formation was found in any tube and hence, the samples were found to be negative for total coliform count.

SAMPLE NO.	LOCATIONS	SOURCES
S_1	Sector-11	Bore well
S_2	Sector-12	Bore well
S_3	Sector-15	Bore well
S_4	Sector-13	Bore well
S_5	Sector-5	Bore well
S_6	Sector-10	Bore well

Table-1: Sampling locations and their sources

Table-2: Comparison of groundwater quality with drinking standards of BIS /ICMR/WHO

Sr.No.	Parameters	S_1	S_2	S_3	S_4	S_5	S_6	BIS/ICMR/WHO	
								Desirable Limit	Permissible Limit
1	pH	6.81	6.58	6.91	6.82	6.71	6.54	6.5-8.5	-
2	Conductivity (mʊ)	0.63	0.67	0.69	0.65	0.67	0.66	300	-
3	Total hardness (mg/L)	145	137	80	100	90	85	300	600
4	Total dissolved solids(mg/L)	390	342	356	218	204	218	500	2000
5	Alkalinity (mg/L)	105	82	72	83	69	65.5	120	600
6	Chlorides (mg/L)	45.44	51.12	180.34	461.5	59.64	142	250	1000
7	Calcium (mg/L)	44	64	14	160	74	56	75	200
8	COD (mg/L)	260	380	460	420	440	400	-	255
9	Dissolved oxygen (mg/L)	2.2	2.8	1.6	3	1.4	4	-	4
10	Turbidity (NTU)	0.5	0.7	1	1.4	0.5	1.5	5	10
11	Iron (mg/L)	0.004	0	0	0.005	0	0	0.3	1.0
12	Fluoride (mg/L)	0.35	0.39	0.41	0.28	0.52	0.44	1.0	1.5
13	MPN	0	0	0	0	0	0	0	<2

Estimation of water quality index (WQI)

Table 3: Water quality classification based on WQI value

WQI Value	Water Quality
<50	Excellent
50-100	Good
100-200	Poor
200-300	Very poor
>300	Unsuitable for drinking

Parameters	pH	Cond	T H	TDS	Alkalinity	Chl	Ca	Turbidity	Iron	Fluoride	MPN	COD	DO	WQI
Desi. Limit	6.5	300	200	500	200	250	75	1	0.3	1	0	0	7	
Perm.	8.5		600	2000	600	1000	200	5		1.5	<2	10	5	

Limit														
S1	6.81	0.63	145	390	105	45.44	44	0.5	0.004	0.35	0	260	2.2	**256.06**
S2	6.58	0.67	137	342	82	51.12	64	0.7	0	0.39	0	380	2.8	**364.09**
S3	6.91	0.69	80	80	72	180.34	14	1	0	0.41	0	460	1.6	**432.97**
S4	6.82	0.65	100	100	83	461.5	160	1.4	0.005	0.28	0	420	3	**403.86**
S5	6.71	0.67	90	90	69	59.64	74	0.5	0	0.52	0	440	1.4	**419.15**
S6	6.54	0.66	85	85	65.5	142	56	1.5	0	0.44	0	400	4	**426.14**
												Avg. WQI		**383.71**

CONCLUSION

The analysis of the water quality parameters of groundwater from 6 different sectors in Kharghar shows that the pH, conductivity, TH, TDS, alkalinity, calcium, turbidity, iron and fluoride values are well within the permissible limit. All the samples were found to be negative for total coliform count but COD (260-460mg/L) found was well above the standard permissible limit i.e.10mg/L for all the samples indicating pollution from domestic waste and polluted surface water. The DO was also found very low (i.e. 1.4-2.8mg/L). The WQI for samples S1, S2, S3, S4, S5 and S6 were found to be 256.06, 364.09, 432.97, 403.86, 419.70 and 421.26 respectively. When these values are compared with WQI table, they are found to be very high as the COD level is very high and DO levels are very low. This indicates water of very poor quality and is found unsuitable for drinking purposes. However, it can be used for other domestic purposes like washing clothes and utensils, bathing, flushing, etc. and for drinking purpose after treatment for COD removal. There is need to increase awareness among the people to control the groundwater pollution by maintaining hygiene and sanitation in and around their surroundings. This can be achieved through proper disposal of garbage, avoid defecating in open, minimizing the use of chemicals, etc.

References

1. K. Chandra Mohan, J. Suresh and P. Venkateswarlu*, "Physico-chemical analysis of bore well water of Kurnool environs, Andhra Pradesh" JOCPR, ISSN:0975-7384, 2014, 6(9):77-80
2. Parihar S.S. and et al., "Physico-chemical and Microbiological analysis of underground water in and around Gwalior City, MP, India" Research Journal of Recent Sciences, ISSN: 2277-2502, Vol.1(6), 62-65, June (2012)
3. Shivaprasad H, Nagarajappa D P, Sham Sundar K M, "A study on physic-chemical characteristics of borewell water in Sugar town, Mandya city, Karnataka State, India" IJERA, ISSN:2248-9622, Vol. 4,Issue 7(Version 1), July 2014
4. Ramesh alias Thirumalesh D. H. and Kauser Fathima, IJCMAS, ISSN:2319-7706 Vol. 4 No.10 (2015) pp.263-272
5. APHA, American Public Health Association(2003), standard method for examination of water & waste water specifications, Washington DC, 6, 19th edition

A Comparative Study of Noise Level Analysis

Shridhar Shinde*[1], Dr. Jyoti Koliyar[2]

1, 2- SIES (Nerul) College Of Arts, Commerce And Science

101,Commonwealthbuilding,Plot no:-135,Sector 28,Vashi,Navi Mumbai

Contact:- 9969596480

*shrimanutd1994@gmail.com

Abstract

Noise pollution is not a new problem to the common man in most of the metropolitan cities. Noise is unwanted sound. The effect of sound on human depends upon its frequency and time of exposure.The seriousness of noise pollution is totally ignored by the people.Elevated noise levels in and around the schools and hospitals (silence zone as per CPCB) may cause ill-health (non –auditory effects) as opposed to industrial noise which causes hearing impairment (auditory effects) because environment noise levels are much lower than that of industries. Sound levels above 80dB is harmful to individuals living in urban areas belonging to all ages.

The study aims to analyze and compare the noise level at selected sites which come under various zones as per CPCB, at an interval of 15 minutes for 2 hours and to assert the reason of the noise source on the locations.Duration of the project is of 2 months.Silence zone is referred as areas upto 100 meters around premises such as hospitals, educational institutions and courts.Use of vehicular horns and loudspeakers must be banned in these zones. Digital Sound Level Meter was used for the measurement of noise.

The paper aims to study the noise levels using sound level meter at selected sites in Vashi and KoperKhairane which come under residential, commercial, industrial and silent zones. Also to identify the effects of noise on patients in hospital and suggest mitigation measures to control noise pollution.

Keywords:-*Multiple zones, noise level, noise pollution, CPCB*

Introduction:-

The term “noise” may be defined as unwanted sound at a wrong time and a wrong place. The word noise is derived from the Latin Word “NAUSEA”, meaning a feeling of sickness It directly or indirectly influences our behavior, cognition, mental performance, normal sleep duration and studies of students.

Generally, high exposure to noise level can causes feeling of annoyance and irritation, damage to auditory mechanisms, number of health related effects like physiological disorders, psychological disorders, disturbances of daily activities and performances, hypertensions and schematic heart diseases[1].Noise has also been shown to disrupt cognitive and problem-solving capabilities in healthy adults.

In recent studies by various world organizations noise has emerged as the third largest affected source for the people of urban areas. Noise in big cities is considered by the World Health Organization (WHO) to be the third most hazardous type of pollution, right after air and water pollution[2].

A growing body of medical studies shows that it causesmore than just irritation to patients. In fact, side effects such as elevated blood pressure, quickened heart rate, and increased metabolism have led researchers to conclude noise even slows recovery rates, lengthening hospital stays.

Aim and Objectives:-

Aim:-

Noise level analysis in multiple zones according to CPCB standards, spread awareness about the impacts on patients and students and on the people residing nearby.

Objectives:-

- To study noise levels inresidential zone, commercial zone,industrial zone and silence zone (as per CPCB) using Sound Level Meter.
- To identify the effects of noise on school and college students and patients in hospital.
- To suggest mitigation measures to control noise pollution.
- To provide data for public awareness.
- Traffic management and to suggest some remedial measures.

Materials and Methods:-

Instrument:-

Noise level will be recorded using Sound Level Meter

Methodology:-

- The present study was conducted at 4 locations in Vashi and 1 location in KoperKhairane which come under residential zone, commercial zone,industrial zone and silence zone.
- The ambient noise level was monitored with the help of Sound Level Meter from 5pm to 7 pm for silence zone during Ganesh Utsav.
- The ambient noise level was monitored for residential,commercial and industrial zone from 4pm to 6 pm.
- Readings were recorded after interval of 15 minutes for 2 hours at the selected site.
- The study undertaken is for 2 months.
- Noise levels were compared with that of the standards prescribed in Environmental Protection Act, 1986 and standards of CPCB.

Study Area:-

Silent zone:-

- NMMC General Hospital Sector 10A,Vashi.

Industrial zone:-

The noise levels at an industrial zone was measured at KoperKhairane. The values obtained for industrial area was according to Table 3.The average value was found to be

- MGM New Bombay Hospital Sector No 3, Vashi.

Residential zone:-

- Commonwealth Co-Operative Housing Society,Plot -135,Secotor 28,Vashi Navi Mumbai,400703.

Commercial zone:-

- Vashi Plaza, Vashi Road, Sector-17, Vashi, Navi Mumbai -400703.

Industrial zone:-

- CETP,Plot No P/60, Thane Belapur Road, KoparKhairane, Navi Mumbai - 400709, MIDC.

Result And Discussions:-

Residential zone:-

The noise levels in residential zone at Vashi was measured.The values obtained for residential area was according to Table 1.The average value is 56.6dB.The permissible standard of noise level for residential area as stated by CPCB is found to be 55dB and the noise levels are well within the limits. On some days the noise levels crossed the normal range. This may be due to haphazard parking and unnecessary honking.

Commercial zone:-

The noise levels at a commercial zone was measured at Vashi.The values obtained for commercial zone was according to Table 2.The average value is 73.2dB.It can be inferred that the noise levels exceed the normal range. This is due to incessant honking at signals.It affects the nearby people adversely.Heavy vehicles like trucks ply during day time which leads to traffic congestion and causes noise pollution.The permissible standard of noise level for commercial area as stated by CPCB is found to be 65 dB and the noise levels far exceeds the limits.

76.9dB. The noise levels arising from traffic and industrial noise are above the normal limits. It can be inferred that the noise levels slightly exceed the normal range.Heavy vehicles ply in the zone.The daily wage

workers return during the evening hours and due to absence of footpath, they are forced to walk on the road which causes bottleneck of traffic and endangers civilian life.

Silence zone:-

During the study period noise levels were recorded at 2 selected locations of Vashi which has hospitals considered to be included in the silence zones as per the Central Pollution Control Board norms (CPCB).It can be inferred from the Table 4.1 and 4.2 that the noise levels exceed the normal range.The average reading for MGM hospital is 68.8dB. The average reading for NMMC hospital is 64.9 dB.

The readingsobtained is shown in table 4.1 and 4.2 which clearly indicate that noise levels in silence zones aremuch higher than that of the prescribed standard limits ofCPCB.Following the Bombay High Court orders, the state has notified four days of Ganeshotsav as relaxation time limit for loudspeakers up to 12 midnight.[3].But these relaxations do not apply in silence zones.

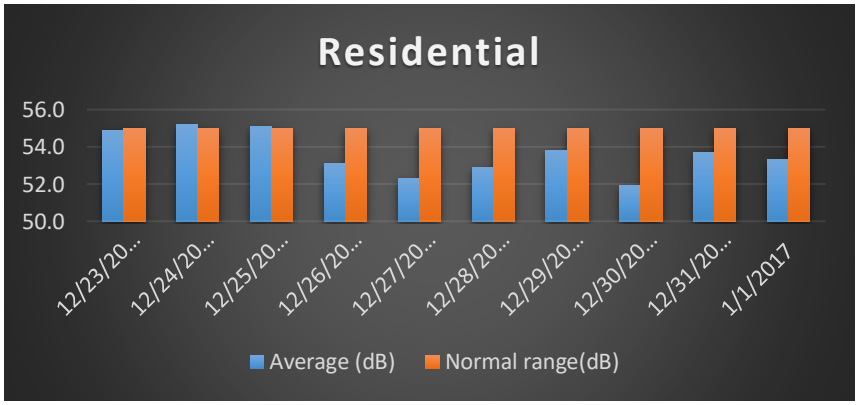
The MGM hospital route is a major area through which the Ganpati immersion route takes place.Musucal instruments like tasha,dhol,loudspeakers and drums were very loud in the silence zone.Traffic congestion was also observed.The NMMC hospital area had less noise level compared to MGM hospital.Police personnel were deployed along immersion routes but they did not take any action against those flouting the rules.

Code	Area	Day time(dB)	Night time(dB)
A	Industrial area	75	70
B	Commercial	65	55
C	area	55	45
D	Residential area	50	40
	Silent zone		

Table A- Noise Standards as per Central Pollution Control Board.

Silence zone is referred to as areas up to 100 meters around such premises as hospitals, educational institutions and courts. The Silence zones are to be declared by the Competent Authority. Use of vehicular horns, loudspeakers and bursting of crackers shall be banned in these zones.

Table 1

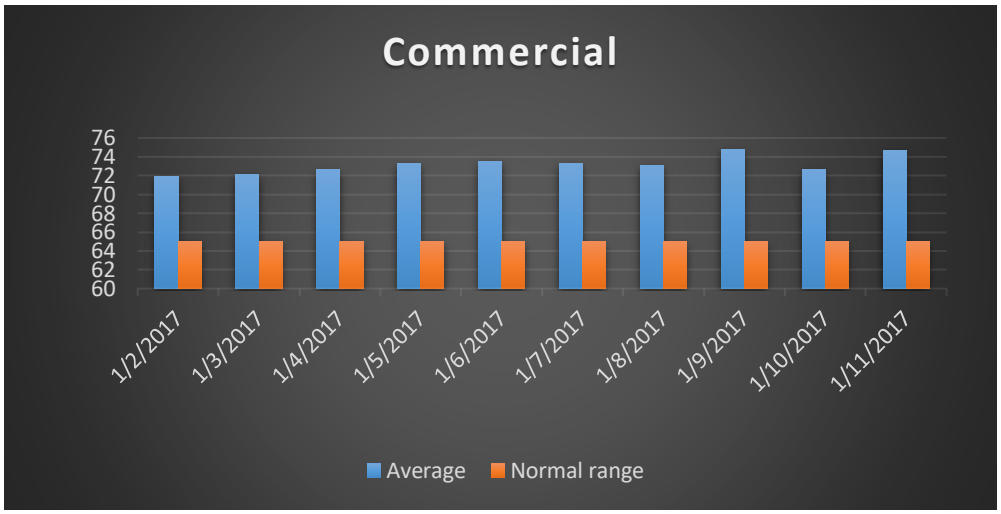


Date	Average (dB)	Normal range(dB)*
23-12-16	54.9	55
24-12-16	55.2	55
25-12-16	55.1	55

26-12-16	53.1	55
27-12-16	52.3	55
28-12-16	52.9	55
29-12-16	53.8	55
30-12-16	51.9	55
31-12-16	53.7	55
01-01-17	53.3	55

***= Noise level standard according to CPCB**

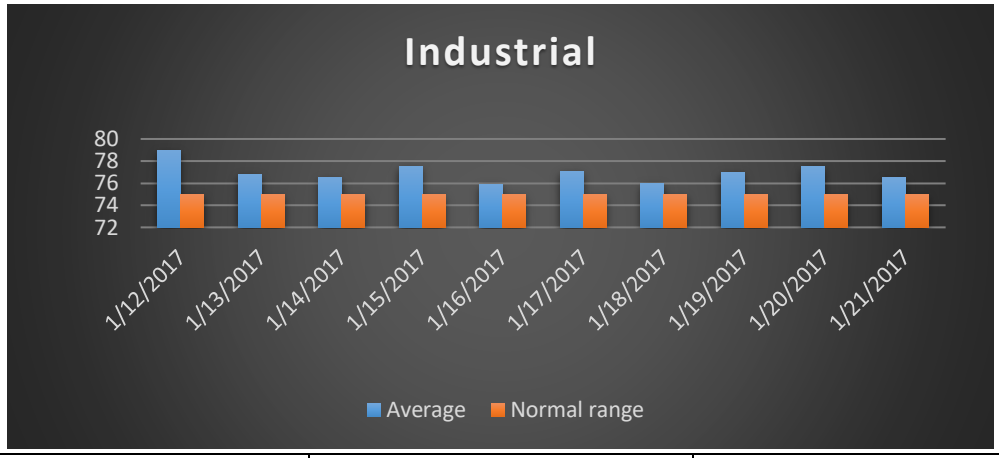
Table 2



Date	Average	Normal range*
02-01-17	71.9	65
03-01-17	72.1	65
04-01-17	72.6	65
05-01-17	73.3	65
06-01-17	73.5	65
07-01-17	73.3	65
08-01-17	73.1	65
09-01-17	74.8	65
10-01-17	72.7	65
11-01-17	74.7	65

***= Noise level standard according to CPCB**

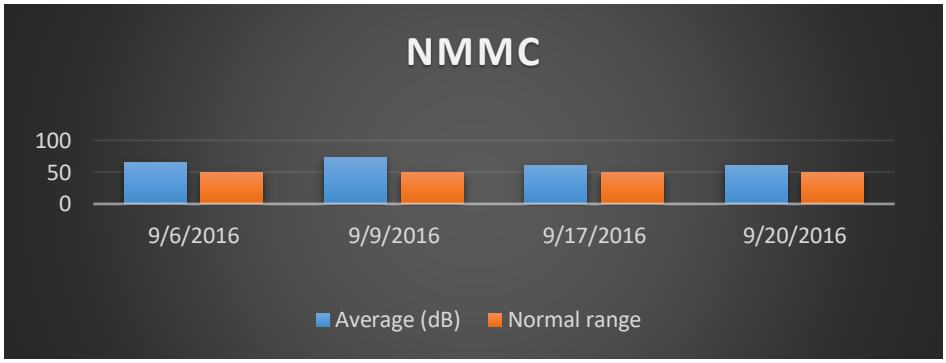
Table 3



Date	Average	Normal range*
12-01-17	79	75
13-01-17	76.8	75
14-01-17	76.5	75
15-01-17	77.5	75
16-01-17	75.9	75
17-01-17	77.1	75
18-01-17	76	75
19-01-17	77	75
20-01-17	77.5	75
21-01-17	76.5	75

***= Noise level standard according to CPCB**

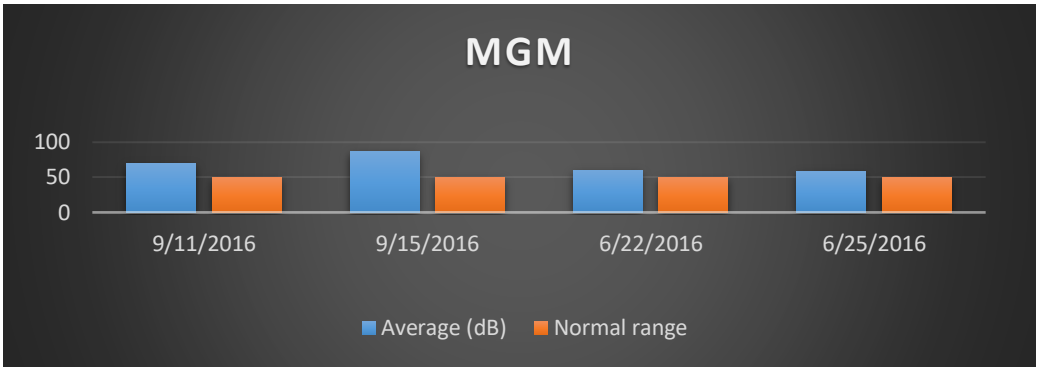
Table 4.1



Date	Average (dB)	Normal range*
06-09-16	65.1	50
09-09-16	72.5	50
17-09-16	61.2	50
20-09-16	61	50

***= Noise level standard according to CPCB**

Table 4.2



Date	Average (dB)	Normal range*
11-09-16	70.4	50
15-09-16	87	50
22-06-16	60	50
25-06-16	57.9	50

***= Noise level standard according to CPCB**

Conclusion:-

The noise levels observed at various zones slightly exceed the prescribed limits given by CPCB.Noise has become a part of environmental pollution, which is a serious concern as it prevents people from enjoying their surroundings[4].We should try to control this environmental problem as it affects us.Festive celebrations can be done at community levels so as to decrease noise pollution.People are becoming increasingly aware about the ill-effects of noise pollution.People exposed to high noise levels should use precautionary measures to avoid noise induced hearing loss. Use of eco-friendly Ganpati can be promoted to decrease environmental degradation.Noise mapping should be carried out to map various areas which exceed standard noise levels.

Recommendations

Following are the recommendations that are suggested in order to reduce or mitigate the noise levels:

Residential zone:-

- Heavy vehicular traffic through residential areas should be banned completely during the day time.
- Digging of roads to lay drains, electric andtelephone cables should not be allowedevery now and then.
- Infrastructure should be designed with the use of absorbing material for wall/window/ceiling/door etc.
- Growing of these trees inside the compoundof dwelling houses, up to a certain distancefrom the busy roads should be encouraged.
- Haphazard parking should be avoided as it chokes the roads.

Commercial zone:-

- Proper adherence of traffic signals should be followed.
- Maintain vehicles so as to reduce noise generation.
- Strict implementation of one way trafficrules in congested locations at the citymarket places.
- Car or motorbike engines should be turned off whenever not in use as it not only produces sound but also causes air pollution.
- Proper parking plot should be marked and well organized.
- There should be no hawkers on the footpaths.

- Proper footpath should be designated for pedestrians.

Industrial zone:-

- Wearing protection, such as ear plugs or ear muffs is strongly advised when in noisy environments or using loud equipment.
- The industrial areas should be away from the residential and silent zones.
- The noisy parts should be isolated.
- Heavy instruments should be mounted at a certain height.
- Trees with dense foliage are found to behighly effective in absorbing the acousticnoise and act as very good screens inbringing down the noise levels.

Silent zone:-

- Horns in areas that have hospitals and schools should be avoided.
- There should be no bursting of fire crackers during day or night time.
- Public education/awareness program should be arranged by government and NGOS regarding control / reduction of noise pollution.
- Use the public transport facilities to reduce the number of vehicles and noise on the road.

Acknowledgement:-

This research was supported by my guide, Mrs. JyotiKoliyar. I thank her for providing insight and expertise that greatly assisted the research.

Reference:-

1. Canter, L. W (1996), Environmental Impact Assessment, McGraw-Hill Publishers, Second Edition, New York, USA.
2. World Health Organization, (2005). United Nations Road Safety Collaboration: A Handbook of Partner Profiles (Geneva: World Health Organization).
3. http://timesofindia.indiatimes.com/city/mumbai/Implement-HC-order-on-noise-activists-urge-cops-and-CM/articleshow/54134944.cms
4. Study On Noise Pollution In Navsari City Of South Gujarat, India Patel Darshana,* Shrivastava P.K. and Patel D.P,JERAD ,Vol. 8 No. 2, October-December 2013

Survey on Awareness about Solid Waste Management and the Impacts of Dumping Ground on Health of Residents and Water Analysis

Sayali Mhatre*[1] Pooja Desai[2]

1,2 – SIES (Nerul) College Of Arts, Science and Commerce

Mobile no: 8070086314

*sayalimhatre2410@gmail.com

Abstract

Dumping ground is a site for the disposal of waste materials by burial and is the oldest form of waste treatment (although the burial part is modern; historically, refuse was just left in piles or thrown into pits). Some dumping grounds are also used for waste management purposes, such as the temporary storage, consolidation and transfer, or processing of waste material (sorting, treatment, or recycling). Dumping grounds are often the most cost-efficient way to dispose of waste, especially in countries like the India with large open spaces. While resource recovery and incinerationboth require extensive investments in infrastructure, and material recovery also requires extensive manpower to maintain dumping. These dumping grounds pose a potential threat to environment and health of the people residing in the nearby areas due to a number of issues like release of dangerous gases, leachates and spread infections. The risk of these threats increases when the dumping grounds are not managed properly. For eg: episode of fire in the Deonar Dumping Ground in February 2016 which resulted in increasing level of air pollutants and smog in the city that showed its impact on the people of entire city. This paper deals with 2 dumping grounds -- 1. Deonar and 2.Koparkhairane. Deonar dumping ground is the ongoing dump yard and Koparkhairane dump yard has been beautified into a nature park few years before. The health effects caused due to the dumping grounds were analyzed by carrying out a survey of people living in nearby areas and working in the dumping ground around Deonar dumping ground. The improvement of health after the conversion of dump yard into a nature park was studied in Koparkhairane. The underground water were analysed near Deonar dumping ground using different water quality parameters.

***Keywords**: Dumping ground, waste disposal, incineration, resource recovery, leachates*

Introduction

Due to rapid increase in population and change in life style in India, dramatic increase in the generation of municipal solid waste has occurred. Municipal Solid Waste includes domestic as well as commercial. A large amount of waste accumulation may create several problems to inhabiting populations. Quality and variety of waste is increasing with increase in population. The waste collection, transportation and handling if not properly dealt creates a number of problems, many of which are related to human health and environment. The major part of waste management was direct disposal open dumps. The developing countries where the waste is dumped directly in unscientific and uncontrolled manners can be detrimental to the urban environment. Municipal Solid Waste leachate contains variety of chemicals like detergents, inorganic chemicals and complex organic chemicals and metals. These components are themselves very much toxic for the environment. Additionally uncontrolled microbial action may result in release of more toxic elements which were not present in a free or reactive form in the waste. During rainfall, water already present in the waste, or water

generated by biodegradation cause the leachate to leave the dumping ground laterally or vertically and cause contamination. The impact of leachate on groundwater and other water resources has attracted a lot of attention. Leachate migration from wastes sites or landfills and the release of pollutants from sediments pose a high risk to groundwater resource if not managed properly.

Groundwater is an important water resource in both the urban and rural areas of India but in the cities, pipe borne water is also available. People living in rural areas depend basically on hand-dig wells for potable water supply as the surface water source usually dry up in summer. Protection of groundwater is a major environmental issue. The recent concluded that it is the high rate of exploitation of groundwater than its recharging Inappropriate dumping of solid and liquid wastes are the main causes of deterioration of ground water quality. Thus, there is a need to look for some useful indicators, both chemical and physical, which can be used to monitor both drinking water operation and performance. Therefore, the present investigation deals with assessment of groundwater (drinking water) quality near municipal solid waste dumping sites at DEONAR.

The DEONAR dumping is a waste dumping ground or landfill in the city of Mumbai (INDIA). Located in eastern suburb of the city, it is India's oldest and largest dumping ground, set up in 1927. The dump rises to around 114 ft. high but after 2012 with permissions it was increased to around 164 ft. Recently the dumping ground caught fire and around 65% of the land was burnt which caused tremendous hazard to the people living in the vicinity.

Koparkhairane dumping ground which was once a stinking, dirty dumping ground in the back alley of Koparkhairane is now a green expanse, unique experiment undertaken by the Navi Mumbai Municipal Corporation (NMMC) few years back. The place was once owned by CIDCO which was handed over to NMMC in 2004 and which was a dumping ground for over 20 years. Out of 1,04,000 sq m land, 52,000 sq metres had been beautified in the first phase and phase two has included more planting of trees and increasing its scenic beauty.

Aim and Objectives

The main aim of this paper is to compare the health effects on people living in vicinity of a dumping ground and the people living in the vicinity of a nature park which was once a dumpyard, to spread awareness about the 3Rs waste minimization technique i.e. REDUCE, REUSE AND RECYCLE.

Objectives:

- To spread awareness among the residential areas the technique of reducing waste at its place, reusing the used materials, and recycling the materials used.
- To study the effects of dumping ground on people's health.
- To study whether the dumping grounds are affecting the water system around the vicinity.
- To compare the 2 dumping grounds i.e. the one which has been used for long time for dumping waste and has been causing pollution due to the disaster (Deonar Dumping Ground) effecting the health of people and the one which has been closed after some years of dumping and converted into a nature park (Koparkhairane Nature Park).
- To suggest some preventive techniques to reduce the health hazard of the people living there.

Materials and Methods

1. Survey and Sample collection

The survey of approximately 70 individuals residing in that area was carried out at each- Deonar Dumping Ground and Koparkhairane Nature Park. The people were given a questionnaire to get information about the effects of dumping ground on their health. The survey questionnaire included questions

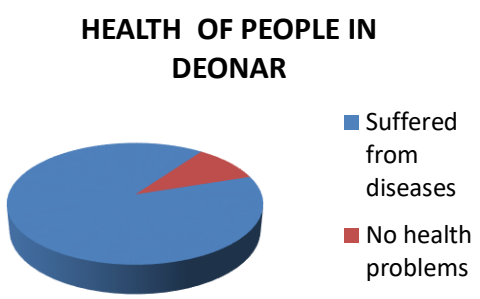
regarding their health and condition of the dumpyard and nature park. The people were given the knowledge of 3Rs- Reduce, Reuse and Recycle and even waste segregation at source.

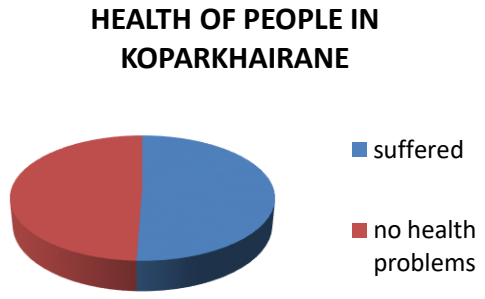
2. Water analysis parameters

The underground water sample was collected at Deonar Dumping Ground site and was analysed with reference to different water parameters. Different parameters like pH, turbidity, conductivity, chlorides, hardness, dissolved oxygen; total dissolved solids and alkalinity and MPN were analysed using standard methods from APHA

Result and Discussion

People living in Deonar area have more health problems as compared to Koparkhairane as the Deonar dumping Ground is still taking in waste which has no space left and Koparkhairane dumping ground is already converted to a nature park.





The people living in area near DEONAR dumping ground are not much familiar to the concepts like Reduce, Reuse, Recycle, waste Segregation and Global warming compared to the people living in area near Koparkhairane.

The people working for Deonar dumping ground notified that the fire caught few years back has burnt over 65% of the waste. The dumping ground will continue to dump waste for around 10 more years.

The water analysis parameters for Deonar water sample showed following results:

Parameters	Values	Permissible limits(Indian Standards)
pH	7.22	6.5-8.5
Turbidity	2.7	
Chlorides	93mg/l	250mg/l
Hardness	145mg/l	300mg/l
Dissolved oxygen	2.5mg/l	6mg/l
Total dissolved solids	400mg/l	500mg/l
Alkalinity	106mg/l	200mg/l
Acidity	146mg/l	200mg/l
Coliform test (MPN)	absent	absent

Thus the water analysis parameters are all under the permissible limits. The underground water is not contaminated due to the leachates. The current drinking water source is provided by BMC. But the water parameters result show that the water can be used for drinking purposes

Sr. no	Questions	YES%	NO%
1	Health problem since living in that area	86	14
2	Contamination due to landfills	94	6
3	Do you know the concept of 3 R's?	21	79
4	Do you reuse waste ?	14	86
5	Do you follow the concept of 3 R's?	3	97
6	Do the municipality trucks come daily?	4	96
7	Do they use safety equipments?	87	13
8	Do you know concept of waste segregation?	27	73
9	Segregate waste at source	0	100
10	Collectors segregate?	0	100
11	Stopped plastic use	13	87
12	Use of eco-friendly things?	15	85
13	Aware of environmental effects	11	89
14	Actions taken?	1	99
15	Would you like to be in an initiative?	99	1
16	Should plastic be banned?	100	0
17	Do you know the concept of global warming ?	15	85
19	Consume nearby water	0	100
20	Water borne disease?	6	94
21	Epidemics of water borne diseases	3	96

Deonar Dumping Ground

Koparkhairane Nature Park

Sr. no	Questions	YES%	NO%
1	Health problem since living in that area	47	53
2	Contamination due to landfills	15	85
3	Do you know the concept of 3 R's?	61	39
4	Do you reuse waste ?	69	31
5	Do you follow the concept of 3 R's?	61	39
6	Do the municipality trucks come daily?	99	1
7	Do they use safety equipments?	80	20
8	Do you know concept of waste segregation?	86	14
9	Segregate waste at source	78	22
10	Collectors segregate?	48	52
11	Stopped plastic use	87	13
12	Use of eco-friendly things?	81	19
13	Aware of environmental effects	75	25
14	Actions taken?	32	68
15	Would you like to be in an initiative?	100	0
16	Should plastic be banned?	100	0
17	Do you know the concept of global warming ?	25	75
18	Is pollution reduced?	100	0
19	Consume nearby water	0	100
20	Water borne disease?	0	100
21	Epidemics of water borne diseases	0	100

Conclusion

From the survey we conclude that, in DEONAR the health of the people is been affected due to the emissions from the dumping ground which are due to some accidental fires taking place. The people living in nearby area are affected. During survey we also came to know that they are suffering from the breathing problems and also diseases like malaria, dengue, fever, cold due to gas that releases from the dumping ground. The people living in area complain about the waste not been segregated properly and the waste bins in that area are been flooding with waste and the nallas are full of waste inside it choking all the way.

The water quality is analysed using different parameters like pH, turbidity, conductivity, chlorides, hardness, DO, TDS, alkalinity, acidity and mpn. All the values are under permissible limit and can be thus used for drinking purposes.

The waste generated is not segregated and only the rag pickers do it to some extent for their livelihood. The waste that can be sold out is only removed and the plastic to some extent is removed by the workers.

The area in Koparkhairane that has been converted into Nature Park has been giving positive results and healthy environment. The health of people is improving compared to the time when dumping ground was open. The

waste is segregated at source as well as while collection. The plastic is banned in this area Landfills should not be open and the degradable waste should only be sent to landfills. The waste that emits gas should be given an outlet and should be collected so that it can be used for generating energy.

Recommendations

1. Reduce, Reuse, Recycle are the foremost way to reduce waste generation.
2. The segregation process should be followed by waste generators as well as collectors.
3. The plastic should be banned as of in some places.
4. There should be an outlet for gas emissions which goes into a collector and then be used to generate energy. The gas should be processed in the pipelines itself to remove its contaminants.
5. Food waste can be reduced by donating food to those in need.
6. Recycled process should be used more and biodegradable materials should be used for composting purposes

Acknowledgement

The authors are thankful to our colleagues Preeti Dalvi, Aavesh Mukadam, Priyanka More, and Priyanka Ambulkar who greatly assisted the research. We are also grateful to ou rLab Assistants, Mr.Rajesh Chavan Sir and Mr.Nitin Mane Sir to assist us with water analysis parameters.

References

1. Physicochemical Analysis Of Ground Water Near Municipal Solid Waste Dumping Sites In Jabalpur
2. Environmental and Health Impact Of Solid Waste Disposal in Developing Cities: A Case Study Of Granville Brook Dumpsite, Freetown, Sierra Leone
3. Solid Waste Management on Dumping Ground In Mumbai Region – A Study
4. A Study On The Effect Of Solid Waste Dumping On Geo-Environment At Bilaspur

Study of Waldhuni River

Priya Ravindra Patil*[1]Dr.Jyoti Koliyar[2]

1, 2 SIES (Nerul) College of Arts Science and commerce
Nerul, Navi Mumbai 400076
Corresponding author-7276153231, *piuptl20@gmail.com

***Abstract**:*

Waldhuni, a tributary of Ulhas River, originates at Kakola hills (800m altitude), Kakola Lake near Ambernath and unites with Ulhas River near Kalyan. Its total length is 31.8km. Waldhuni along with its tributaries run over a length of 9.5 km in Ambernath town. It enters Ulhasnagar Municipal Corporation through Ambernath Municipal area and runs over a length of 6.5 kms and finally into the Kalyan creek.
The Waldhuni, which flows along the Ulhasnagar station, is popularly known as the Waldhuni Nallah for the heavy pollution it receives along its course. Though the industrial stretch of Ulhasnagar and Ambernath and others township like Vithalwadi, Shahad and Kalyan, through which the Waldhuni flows, contribute in polluting it visibly, the river gets polluted at the source itself.

This paper deals with study of various analysis of water parameters and their effect on plants and mammals due to presence of chemicals and foreign substances which would lead to contamination of water. Water pollution is series of ecological threat. The study is carried out on physico-chemical parameters quality of water. The analysis of parameters indicates the water bodies are affected by its pollution. The analysis was done for theparameters such as conductivity, turbidity, Chemical Oxygen Demand (COD), TDS, acidity, alkalinity, chloride, total hardness, pH, phosphorous, potassium. Heavy metals are found naturally in the earth, and become concentrated as a result of human caused activities. Common sources are from mining and industrial wastes; vehicle emissions; lead-acid batteries; fertilizers; paints. The analysis of heavy metals such as iron, and chromium is determined and their effect on water bodies and environment was studied. The study of Waldhuni River was done for period for two season i.e July 2016 and December 2016.

***Key Words:** Physico-chemical assessment, water body, Temperature, pH, Chemical Oxygen Demand (COD)*

Introduction:

The river Waldhuni, known to be heavily polluted, gets contaminated at its source itself. The river originates from the hills of Ambernath near kakola village in the district. Kakola Lake near Ambernath and unites with Ulhas River near Kalyan. It flows through thickly populated area of Ambernath, Ulhasnagar and Vithalwadi and is severely polluted due to domestic and industrial sewage.

The river banks are thickly populated and there are encroachments around the river. Effluents from industriesand residential area have been released in the river itself at several points that pollute the river water heavily. The appearance of river is like that of a gutter carrying liquid and solid waste. The Waldhuni river, which flows along the Ulhasnagar station, is popularly known as the Waldhuni Nallah for the heavy pollution it receives along its course. Though the industrial stretch of Ulhasnagar, and Ambernath and others townships like Vithalwadi flows contribute in

polluting it visibly, the river gets polluted at the source itself.

Water was primarily used for domestic needs such as drinking, cooking washing, bathing etc. But due to industrial and urban development, requirement of water is increased. Good quality of water with high Dissolved oxygen, low BOD and COD, minimum salts dissolved in it required for living beings. The quality of water is dependent on physical, chemical and biological parameters. Rapid release of municipal water, industrial water, agricultural water, sewage water, etc. degrades the water quality Polluted water may contain suspended solids, dissolved inorganic compounds, nitrogen and phosphorous compounds, animal wastes, toxic chemicals, insecticides, pesticides, medical waste, toxic heavy metals and biological pollutants such as pathogenic bacteria, fungi, protozoa, viruses, parasites, worms, etc. The increasing industrialization and urbanization all over the world has resulted in pollution of water and in deterioration of its quality.

Water is very vital for human beings and the health of its ecosystem. Thus quality of water is extremely important. The surface water quality is a very sensitive issue and is also a great environmental concern worldwide. Surface water pollution by chemical, physical, microbial and biological contaminants can cause epidemic problems, at times all over the world. Fish survival / growth and other biodiversity, conservation activities, recreational activities like swimming and boating, industrial / municipal water supply, agricultural uses such as irrigation and livestock watering, waste disposal and all other water uses are affected by the physical, chemical, microbial and biological conditions that exist in the water courses and also in subsurface aquifers.

Methodology:

Water samples were collected for physico-chemical analysis for period of two season i.e., rainy season and winter season. The samples were collected in plastic bottles. The water samples were collected from the four locations of Waldhuni River. These locations are origin at Kakola Lake at Kakolagaon, Bhaji Market at Ambernath, CHM College gate at Ulhasnagar and Kalyan. Water gets polluted as the water proceeds to flow as there are many industries located alongside the selected location i.e., CHM gate at Ulhasnagar and Kalyan whereas public toilet, hospital, vegetable shops are present along the site of bhaji market at Ambernath.

The pH is measured by using ph meter. The appropriate electrode was dipped into collected water in a sample container and the reading for unknown sample is taken.

The conductivity is measured by using conductivity meter. The solution is measured by dipping the electrode in sample container and taking its reading at 2 m and its accuracy was checked by rotating the knob at 20 m.

The TDS is measured by using Gravimetric analysis method. A well mixed measured portion of sample is filtered through wattman filter paper no.1 and the the filtrate in evaporated to dryness on heating mantle. The weight difference of empty evaporating dish and evaporating dish with TDS will give te total amount of TDS present in the sample.

COD was measured by titrimetric method. The organic matter and oxidized inorganic substances present in water gets completely oxidized by std. $K2Cr2O7$ in the presence of concentrated $H2SO4$ to reproduce $CO2$ and $H20$. The excess $K2Cr2O7$, remaining after the reaction is titrated with FAS. The dichromate consumed gives the oxygen required for oxidation.

Alkalinity of sample was estimated by titrating with 0.1 N HCL by using indicator

phenolphthalein and methyl orange which will indicate total alkalinity neutralization of OH, CO3 and HCO3.

Acidity of sample was estimated by titrating NaOH by using indicator phenolphthalein and methyl orange which will indicate sample acidity.

Hardness of sample was determined by EDTA titration method. 2ml of buffer solution is added to 50 ml sample in conical flask. EBT indicator turns the solution wine red in color then titrate it against 0.01 EDTA till the solution turns blue in colour.

Chloride was determined by titration method using 50ml sample with 2ml 5% K2Cr2O7 and titrating against 0.02N AgNO3. End point is indicated by color change from yellow to brick red.

Chromium VI was estimated using colorimeter by the reaction with diphenyl carbazide in acid solution. When reaction takes place a red violet colour complex of unknown composition is produced. The darker the colour the greater is the amount of chromium present. The reaction is measured colorimetrically at 540 nm.

The potassium value of the given water sample was determined by flame photometer. Solution containing cations of potassium is sprayed into flame; small fraction of the atoms is excited. Relaxation of the excited atoms to the lower energy level is accompanied by emission of light (photons) with characteristic wavelength. By adjusting the flame photometer by selecting the potassium filter and adjust it zero using distilled water. Unknown sample is measured by ploting graph.

Phosphorous was estimated colorimetrically by adding ammonium molybdate and therefore reducing molybdenum phosphate complex in acidic condition. The intensity of blue color on reduction provides a major half of the concentration of phosphate in the test solution. Unknown solutions are obtained by plotting graph.

Iron was estimated by colorimetrically, the iron ion reacts with phenolthroline solution to form red orange complex of tri-orthophenalthroline. This reddish-orange complex of iron is determined spectrophotometrically at 515nm. Potassium hydrogen phthalate is used to maintain the acidity as the entire reaction is pH dependent.

Turbidity was measured by using turbidity meter by adjusting blank and then taking reading for unknown sample by dipping electrode in container which contains sample.

Results and Discussion:

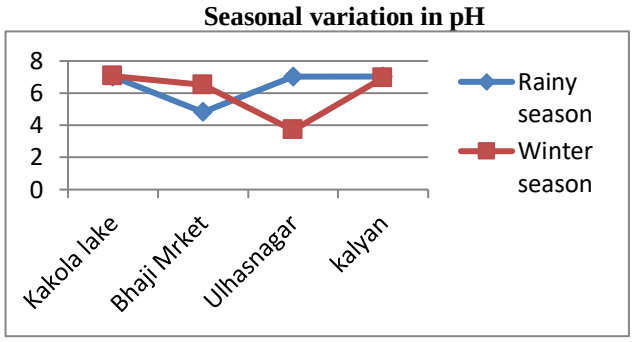
Standard Table:

Parameters	Permissible Limit Standards
Chloride(mg/l)	200
Total Hardness(mg/l)	600
Turbidity(NTU)	10
Alkalinity(mg/l)	600
Hexavalent chromium	0.1
Total Dissolved Salts(mg/l)	3000
Iron	2.0
p H	5.5 to 9.0
Chemical Oxygen Demand(mg/l)	250
Acidity(mg/l)	

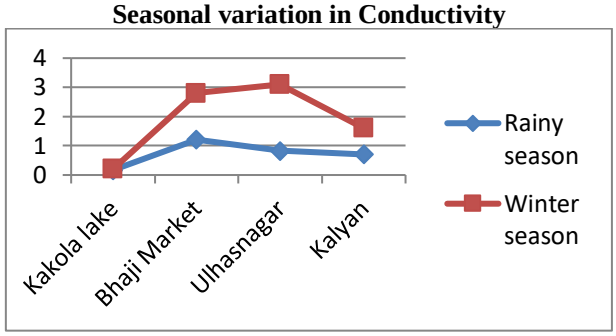
Phosphorus(mg/l)	1
Potassium(mg/l)	120
Conductivity	0.05

RAINY SEASON				
Parameters	**SITES**			
	Kakola lake (Ambernath)	**Bhaji market**	**CHM gate (Ulhasnagar)**	**Kalyan**
p H	7.03	4.38	7.03	7/02
Conductivity	0.17	1.21	0.83	0.71
Turbidity	2.2	8.2	0.9	1.6
Alkalinity(mg/l)	40	120	380	320
Acidity(mg/l)	28	42	8	9
Phosphorous	0.8	3.8	2.7	1.9
Potassium(ppm)	40	180	130	95
TDS(mg/l)	600	1200	6000	800
Hardness(mg/l)	42	107	112	108
Chloride(mg/l)	1.7	5.3	4.2	4.2
COD(mg/l)	20	540	960	620
Iron (mg/l)	0.45	0.65	0.3	0.4
Chromium (mg/l)	0.0	0.0	0.0	0.0
WINTER SEASON				
Parameters	**SITES**			
	Kakola lake (Ambernath)	**Bhaji market**	**CHM gate (Ulhasnagar)**	**Kalyan**
p H	7.06	6.5	3.69	6.94
Conductivity	0.2	2.8	3.1	1.61
Turbidity	13.6	226	227	25
Alkalinity(mg/l)	800	240	440	400
Acidity(mg/l)	8	40	44	20
Phosphorous	1.971	3.852	1.7678	3.852
Potassium	0.5	2.8	1	0.4
TDS(mg/l)	600	7000	1600	600
Hardness(mg/l)	48	125	123	128
Chloride(mg/l)	1.5	15.1	8.8	9.0
COD (mg/l)	420	980	940	900
Iron (mg/l)	0.3	0.7	1.2	0.95
Chromium (mg/l)	0.0	0.0	0.0	0.0

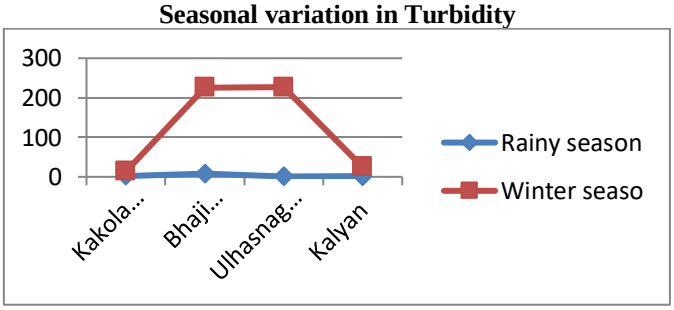
Graphs:



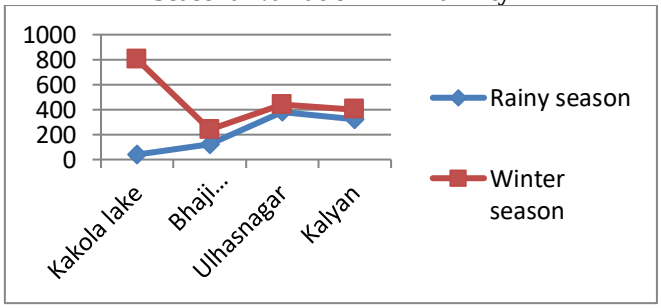
5.2.2Graph:
Seasonal variation in Conductivity



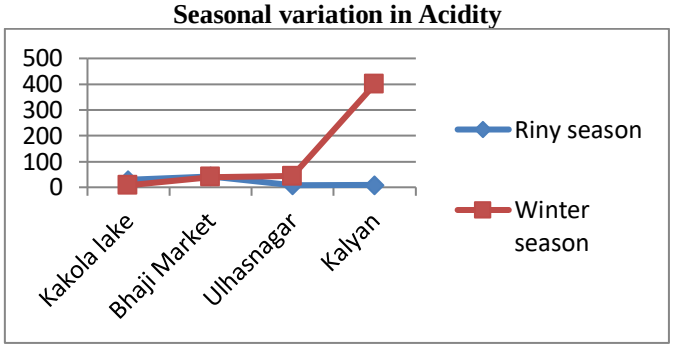
5.2.3 Graph:
Seasonal variation in Turbidity



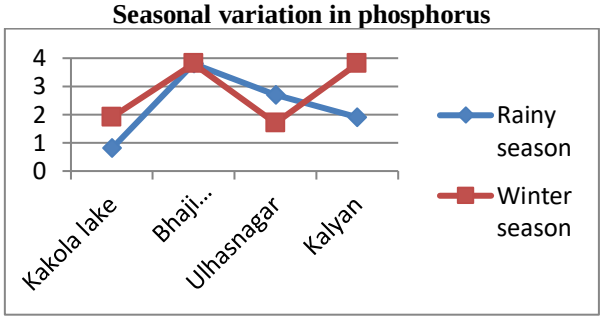
5.2.4 Graph:
Seasonal variation in Alkalinity



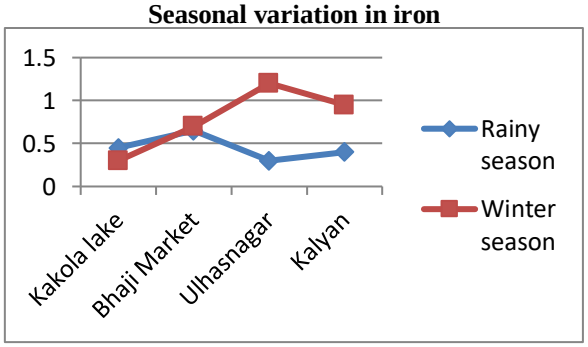
5.2.5Graph:
Seasonal variation in Acidity



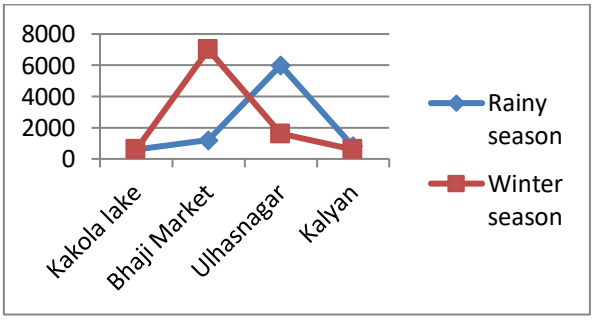
5.2.6 Graph:
Seasonal variation in phosphorus



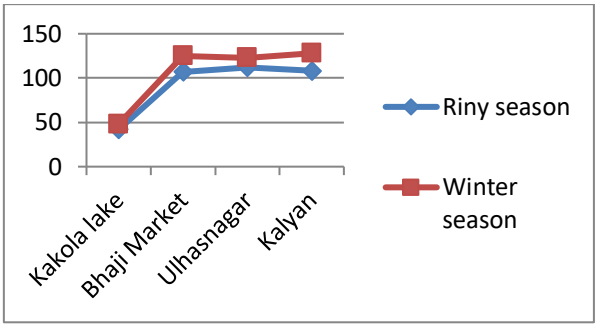
5.2.7Graph:
Seasonal variation in iron



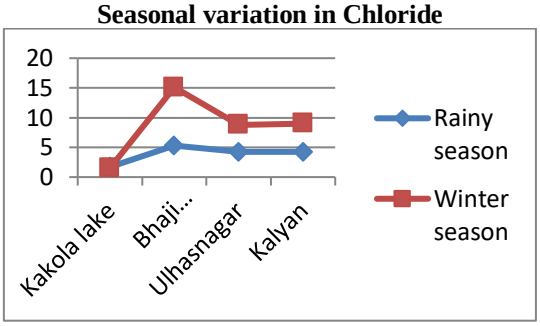
5.2.8Graph:
Seasonal variation in TDS



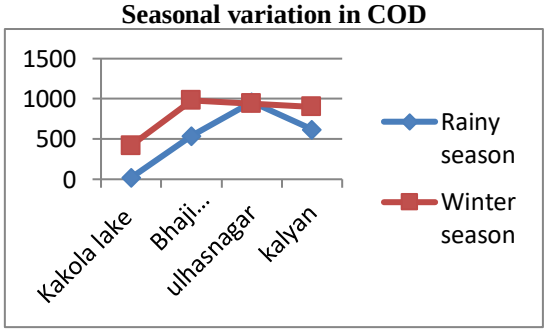
5.2.9 Graph:
Seasonal variation in hardness



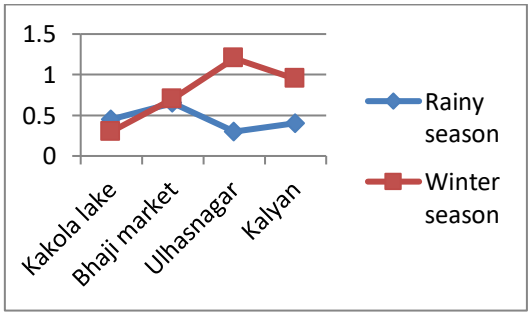
5.2.10Graph:
Seasonal variation in Chloride



5.2.11Graph:
Seasonal variation in COD



5.2.12Graph:
Seasonal variation in iron



The pH was observed in the range of 3.69 to 7.06. As there are dye and many other industries and also hospital along the banks of the rivers the effluents include dye stuffs, acids, bases, detergents at different times this results in fluctuations of pH value.pH of water is important for biotic component.

COD was received from 20 mg/l to 960 mg/l. The polluted water sample contains large quantities of some inorganic and/or organic pollutants in the sample due to heavy industrial inputs. At present time, during rainy season COD value is highest at CHM gate Ulhasnagar and during winter , COD value is highest at Bhaji market of Ambernath and CHM gate of Ulhasnagar.

At present rate Total hardness ranges from 42 mg/l to 128mg/l in different seasons. These values may be due to addition of calcium and magnesium salts through the industrial effluents. The result obtained in the present investigation shows presence of high values of total hardness during winter than during rainy season.

Chlorinity of the collected water sample was varied from 1.5 to 15.1mg/l. In any season chloride value is lowest at Kakola Lake.

Acidity of the river water sample was determined and was found to be in the range of 8 to 44 mg/l. Acidity interferes with the treatment of water. CO2 is of important consideration in determining whether removal by aeration or simple neutralization with lime/ lime soda ash or NaOH will be chosen as the water treatment method.

Alkalinity of water sample was determined to be in the range between 40mg/l to 320mg/l during rainy season and 240 to 800 mg/l during winter. Compound like calcium carbonate are responsible for high alkalinity.

Phosphorus level samples range was found to be between 0.8 to 3.8 mg/l. High level of phosphorus could be because of increase of mineral and organic nutrients.

The range of TDS sample was observed from 600 to 7000 mg/l , TDS is a measure of the combined content of all inorganic and organic substances.

The Potassium range was observed from 0.5 to 3.8 ppm. An abnormal increase or decrease of potassium can profoundly affect the aquatic life, and when extreme, can be fatal.

Chromium was found to be completely absent in any of the sample. This could be because of various technique like oxidation-reduction, sorption, precipitation, biologication transformations etc undertaken by industries to remove chromium from there effluent before discharge in river.

The amount of total iron from the sample range was observed from 0.3 to 1.2ppm.If iron exceeds its level it can cause staining, taste and odour problem.

The turbidity was obtained in the range of 1.6 to 227 NTU. Turbidity in the winter season is high compare to rainy season. Turbidity iscaused by a variety of suspended and collide material present in the water.

The conductivity value was observed from 0.7 to 3.1S/m. Conductivity is a measure of ability of water to carry electrical current. Poor water is poor conductorof electricity acids, bases and dissolved salts in water. The obtain value exceeds the permissible limit which indicate higher level of dissolved salts, acids and bases.

Conclusion:

From the result of the study we can conclude that Waldhuni River water quality was not good in winter season than rainy season. The physicochemical parameters such as alkalinity, acidity, hardness, chloride were within the permissible limit throughout the season. From the results two samples each from per season

was found to be below the average limit i.e.,4.83 and 3.69.Potassium value for two sample were also exceeded to above 120 mg/l which is toxic to aquatic organism.

Waldhuni River water quality is not acceptable from aquatic ecosystem perspectives for the parameter such as COD, TDS, turbidity, conductivity and phosphorus. There are various technique such as advanced oxidation process(AOP), Activated carbon, adsorption available for reducing the level of COD. Similarly for TDS, technique like highly-loaded activated sludge, alum, filtration process should be arrived out to obtain permissible limit. Whereas technology available for phosphorus removal include filtration, membrane technologies, precipitation, enhanced biological phosphorus removal.

Heavy metal such as Iron was found within the desirable limit ad chromium was completely absent in any of the samples. If iron level exceeds its permissible limit than techniques like chemical precipitation using zeolites, for removing excess of Fe. River water is highly polluted during winter compare to rainy season, these difference could be because of dilution of water during rainy season. The results obtained from present investigation indicates that the water is highly contaminated and and is totally unsafe for any type of use.

Acknowledgment:

I am thankful to my Guide Dr. Jyoti Koliyar, Professor, SIES College of Arts, Commmerce and Science (Nerul), for his valuable guidance, encouragement and cooperation during the course of this semester.

I am thankful to Lab Assistant, Mr. Rajesh Chavan and Nitin Mane, who went out of way to provide me every possible facility and support in presenting this research project smoothly and successfully.

Reference:

1. http://archive.indianexpress.com/news/waldhuni-river-polluted-at-its-source-study/388956/
2. https://www.ijcrar.com/vol-3-4/D.S.%20Pardeshi%20and%20ShardaVaidya.pdf
3. http://www.academia.edu/23154346/Conservation_of_Ulhas_and_Waldhuni_Rivers_in_Ulhasnagar
4. http://re.indiaenvironmentportal.org.in/files/Pollution%20Research%209_1.pdf

Mangroves for the Sustainable Future

Mrs. Priya Rajesh Parkar,
Associate Professor in Environmental Studies,
Maharshi Dayanand College,
Parel, Mumbai - 400012.

Abstract

Mangrove is group of fragile, sensitive tropical specialized trees growing in the saline and brackish water system (deltas, along major estuaries, fringe the estuarine banks and backwaters). Lack of knowledge of mangrove ecosystems, and their linkages to other ecosystems hampers efforts to conserve and manage mangroves. The unsustainable exploitation of these productive coastal resources has resulted in the overexploitation in many parts of the world. The paper points out that despite their strategic importance, mangroves are under threat worldwide. The paper therefore elaborates the role of mangroves to provide commercially important products and ecological significance of mangroves in the era of climate change and carbon trade and attempts to draw the attention of the academic fraternity towards the indiscriminate destruction of these valuable resources. The paper insists in providing financial incentives to the coastal indigenous community to make conservation of the mangroves economically viable by adopting community participatory approach.

The paper also provides new insight to consider the mangrove biodiversity as a gene bank to produce genetically modified crops and to earn patents in innovation of variety of medicines and other products. The paper concludes with expressing the pressing need to conserve the existing mangroves and also insists reforestation of degraded mangroves for sustainable future of the mankind.

Keywords - *Mangrove, economic significance, climate change, sustainable future*

Introduction

The term "mangrove" is being applied to the specific ecosystem consists of shrub, palm or ground fern generally grow in the intertidal zone which acts as a buffer between land and sea. Mangroves are the plants which grow in salt water hence are called as Halophytes i.e. salt tolerant plants. In different parts of the world, mangroves are called as 'mangals', 'coastal woodlands', 'tidal forests' etc.

Geographical distribution of Mangroves

Mangrove ecosystem is found in the inter-tidal zones of seashore, mud-flat, creek (a small inlet of sea or bay), and estuary (mouth or the wide part of a river at the place where it joins the sea. The largest percentage of mangroves is found between (see fig. No.-1) 5° N and 5° S latitudes. Mangroves occur worldwide in the tropics and subtropics, mainly between latitudes 30° N and 30° S. of the Equator.

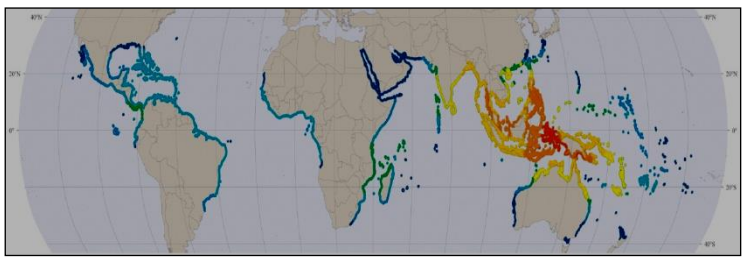


Figure 2: Global Distribution of Mangrove

Generally mangroves grow in the adverse and harsh environment where any other species of plant will not grow. Adaptation in each mangrove has allowed them to survive in the harsh environment such as limited fresh water and excess salt with deficiency of oxygen, exposure to the pressure of tides and winds due to their location in inter tidal zone and lack of firm foundation due to marshy soils. Unique adaptation properties among mangroves have made them economically and ecologically crucial plants on the earth.

Need for the research

Mangrove forests are one of the world's most threatened tropical ecosystems. According to WWF Report, More than 35 percent of the world's mangroves are already destroyed. In developing countries like India, the Philippines, and Vietnam, the figure is as high as 50 percent while in the Americas they are being cleared at a rate faster than tropical rain forests (WWF). Lack of knowledge of mangrove ecosystems and linkages to other ecosystems hampers efforts to conserve mangroves, leading to the unsustainable exploitation of these productive coastal resources.

The paper is descriptive in nature and based on the literature review to unfold the economic and ecological crucial role of mangroves. Thus aims at creating awareness about the significance of the most neglected mangrove ecosystem and their role in sustainable future development.

Economic Importance of Mangroves

Mangroves are the most important source of income generation and livelihood for the for shoreline communities like fisher folk. The livelihood of the people living near the vicinity of mangrove is greatly influenced by mangroves. It describes mangrove habitat linked with aquatic, inter tidal, terrestrial and avian habitat. Mangroves also serve the modern world by making available ready genetic pool for research.

Food

Due to high levels of tannins and other distasteful chemicals, generally mangrove plants are not directly consumed as a food source. But local tribal have traditional knowledge of using various parts of the mangroves to name a few the Fruits of Avicennia marina are used as vegetables. The fruits of Kandelia candel and Bruguiera gymnorrhiza contain starch. After removing tannin, it is used to make an excellent cakes or sweetened stuffing for pastry.

The leaves of (Acrostichum, the hypocotyls of Bruguiera) mangroves is a staple food of tribes from Papua New Guineans; some tribes consumes Salvadora persica -Meswak to survive during famine, leaves of Osbornia octodonata as a flavouring agents, and leaves of Suaeda and Acrostichum consumed as a vegetable.

Fisheries

Usually mangrove hosts algae, barnacles, oysters, sponges which require hard surface for anchoring while filtering their feed. They are the source of food for many fishes.The intricate mesh of mangrove roots offers a quiet and safe marine region for young organisms which serves as nurseries for many fish species. Thus mangrove forests are the breeding ground for large variety of marine organisms. Mangrove crabs are a commercially important crab and are trapped in special nets throughout the country fed on the leaves of mangroves (Skov, Martin W. & Hartnoll, Richard G., 2002). A study on the Mesoamerican reef had showed that about 25 times more fish of some species on reefs were found close to mangrove areas than in areas where mangroves have been cut down. This makes mangrove forests vitally important to coral reef and commercial fisheries as well.

Timber

Mangrove ecosystem is found in salty water, to avoid decaying of permanently submerged

roots, they developed the mechanism which makes their wood resistant to rot and insects. These properties of mangrove have made their timber commercially valuable. Heritiera fomes (Sundari) produces excellent quality expensive commercial timber. The trunk of Phoenix padulosa (Sea Date) is used for constructing traditional hutment. Mangrove timber is used for making fishing boats, furniture, fishing poles, tool handles and as wood for fences.

Fuel

Mangrove trees have been the source of firewood in India since ancient time. Phoenix padulosa (Sea Date) is used as a fuel. The Black and Red Mangroves are used for charcoal as the wood gives off an intense heat.

Tannin

The bark of red mangrove is peeled and tannin is extracted, which is used the leather industry and as a dye. Tannin is extracted from the bark of Red mangrove species like Rhizophora mucronata, Bruguiera gymnorrhiza and Ceriops tagal. Indian mangrove trees have higher tannin (35%) in their bark compared to other countries. Extracts from mangrove bark are used by Indian fishermen to dye their fishing net and enhance its durability.

Other Products

Wine

Nypa fruticans (Golpatta) is a characteristic palm species and resembles a shrunken coconut tree. It fruits throughout the year and the clustered fruits are similar to the Toddy fruits. Nypa fruticans is tapped for an alcoholic drink.

Honey

Honey collection is one of the major tribal activities in W. Bengal and Orissa. The nectar of Aegiceras corniculatum (River mangrove) produces fine quality honey. The blue flowers of Acanthus ilicifolius (Shore purslane) are source of nectar for honey bees. Honey collection from the mangrove forest is a promising business in India. It has been estimated that Sundarbans mangrove alone produce 111 tons of honey annually.

Gene Banks

Mangroves are specially adapted to withstand salinity, wave action, and can grow in poor soils. They can possibly provide a gene bank for cultivating salt tolerant species of crops which could be our future resource.

Medicines

The leaves of parviflora (orange mangrove) are supposed to be used for treating high blood pressure. Mangroves are known to be an astringent, expectorant, hemostat, styptic (to check bleeding by contracting the tissues or blood vessels) and tonic. Red mangrove has number of uses in traditional medicines for angina, asthma, backache, boils, constipation, convulsions, diarrhoea, dysentery, dyspepsia, elephantiasis, eye ailments, fever, fungal infections, headaches, haemorrhage, inflammation, jaundice, kidney stones, lesions, malaria, malignancies, rheumatism, snakebites, sores, sore throat, syphilis, toothache, tuberculosis, ulcers and wounds (Rahman et al., 2011). Miswak herb 'Salvadora Persica', is used for oral care. The astringent and anti-bacterial properties of Meswak maintain oral health.

Ecological Importance of Mangroves

Mangroves are important from environment point of view. They stock carbon to control climate change, prevent coastline erosion, acts as habitat for genetic biodiversity and aquatic, inter-tidal, terrestrial flora and fauna. They also help to stabilize climate by moderating temperature, humidity, wind and even waves.

Control Climate change

Mangroves control the release of Carbon -Di-Oxide which is one of the major Green House Gas (GHG's) gases responsible for the global warming. Mangrove forests absorb carbon dioxide; over half (55%) is captured by mangroves thus they are effective carbon sinks. Mangroves break play a large role in carbon sequestration (the capturing and storing of carbon). About one hectare of mangroves is capable of neutralizing 17 metric tonnes of carbon per year.

Global destruction of mangrove forests is estimated to emit about annually 150 million to 1 billion tonnes of CO_2. Thus, at the global scale, coastal wetland destruction could account for 1percent to 3 percent of industrial emissions. And the number would rise as more and more coastal wetlands are destroyed every year around the world.

Mangrove vegetations sequester carbon far more effectively (up to 100 times faster) and more permanently than terrestrial forests. Further, studies have shown that per hectare, mangrove forests store up to five times more carbon than most other tropical forests around the world.

Shelters Biodiversity

The mangrove forests have secured habitat aquatic, semi aquatic and terrestrial fauna. They are the home to bacteria, fungi, invertebrates (organisms without backbone) and macro algae. They protect the diminishing marine diversity by harbouring a variety of life forms.

Mangrove systems houses a wide range of biodiversity including crocodiles, Turtle, otter, birds, deer, tigers, monkeys, butterflies, Fish and honey bees (Saenger,2002).Many migratory species depend on mangroves for part of their seasonal migrations. Both aquatic as well as tree dwelling birds are commonly found in mangroves. Many animals (see fig.No.-2) find shelter either in the roots or branches of mangroves. Mangroves serve as rookeries, or nesting areas, for coastal birds such as Kingfishers, herons, storks, sea eagles, kites, sand pipers, Curlews, ducks etc. Flamingos flocks exposed mud flats, during the low tides. They use mangrove habitat as breeding and feeding grounds.

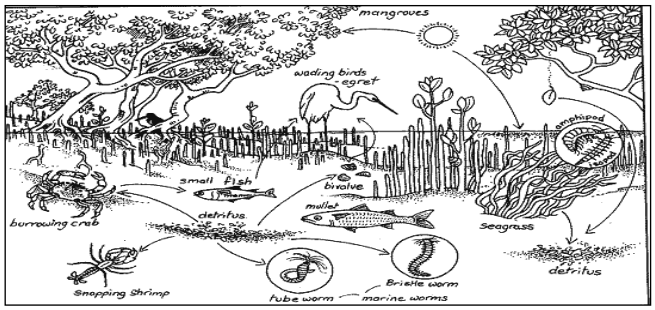


Figure 2: Biodiversity in Mangrove Habitat

Purify the Water

Purify the water by absorbing impurities and harmful heavy metals and help us to breathe a clean air by absorbing pollutants in the air. Avicennia marina species also tolerates pollution including heavy metals such as lead, mercury and chromium, all found in significant concentrations in the Mithi river of Mumbai suburb.

Stabilizes Coastal Areas by Preventing Coastal Erosion

The most important role of mangroves is that they protect vulnerable coastlines from wave action because they hold the soil together and prevent coastal erosion. Mangroves shield inland areas during storms and minimize damage. Mangrove forest plays a vital role in stabilizing these areas. Mangroves not only help in preventing soil erosion but also act as a catalyst in reclaiming land from seas.

Mangroves Protect Against Natural Disasters

Mangrove forest mitigates the effect of Tsunami by absorbing some of the wave's energy. They remain intact and serve as natural breakwaters. When the tsunami struck India's southern state of Tamil Nadu on 26 December, the area with dense mangroves suffered less damage compared to those areas without, which suffered massive causalities. Similarly, M. S. Swaminathan Research Foundation (MSSRF) in Chennai, India has reported that in 1999, mangrove forests reduced the impact of a 'super-cyclone' that struck Orissa on India's east coast. Mangroves will be the first terrestrial forests to face the encroaching tides occurred due to the threat of rising sea levels.

Conclusion

The paper provides new insight to consider the mangrove biodiversity as a gene bank to produce genetically modified crops and to earn patents in innovation of variety of medicines and other products. Despite their strategic importance, mangroves are under threat worldwide. Cutting down mangroves means releasing larger amounts of carbon into the atmosphere and depriving ourselves from their valuable services. Therefore financial incentives have to be offered to make conservation of the mangroves economically viable. Coastal indigenous community should be involved in conservation of mangrove by adopting community participatory approach. Mangroves should be recognized as carbon-storage assets that could radically alter the way these forests are valued. In carbon trading poor countries of the south will be able to exchange carbon credits to the rich industrialized countries of the North by reforestation of degraded coastal mangrove forest and conserving the existing mangrove forest. The paper pinpoints the need for more research to tap the properties of mangrove plants.

References

1. Medicinal Properties Of Mangrove Plants – An Overview Revathi P, T Jeyaseelan Senthinath, P Thirumalaikolundu subramanian and N Prabhu, International Journal of Bioassays ISSN: 2278-778X www.ijbio.com October 15,
2. "Mangal (Mangrove). "World Vegetation". Mildred E. Mathias Botanical Garden, University of California at Los Angeles". Botgard.ucla.edu. Retrieved 2016-08-06.
3. Anthony B. Rath, Mangrove importance, WWF, http://wwf.panda.org/about_our_earth/blue_planet/coasts/mangroves/mangrove_importance/
4. Bandaranayake WM. Traditional and medicinal uses of mangroves. Mangroves and Salt Marshes. 1998; 2:133–48.
5. Bos, A. R.; Gumanao, G. S.; van Katwijk, M. M.; Mueller, B.; Saceda, M. M. & Tejada, R. P. (2011). "Ontogenetic habitat shift, population growth, and burrowing behavior of the Indo-Pacific beach star Archaster typicus (Echinodermata: Asteroidea)
6. Encarta Encyclopedia 2005. Article — Seashore, by Heidi Nepf
7. Rahman MA, Haque E, Hasanuzzaman M, Shahid IZ, Antinociceptive, antiinflammatory and antibacterial properties of Tamarix indica roots, Inter J Pharmacol, 2011, 7, 527–31.
8. Saenger, 2002. Mangrove Ecology, Silviculture and Conservation. Kluwer Academic Publishers
9. Skov, Martin W. & Hartnoll, Richard G. (2002). "Paradoxical selective feeding on a low-nutrient diet: why do mangrove crabs eat leaves?". Oecologia. 131 (1): 1–
10. http://www.scidev.net/global/news/mangrove-forests-can-reduce-impact-of-tsunamis.html
11. http://www.mangrovesgy.org/home/index.php/2014-04-27-16-39-08/benefits-uses-of-mangroves#
12. http://www.aims.gov.au/docs/projectnet/mangroves-uses.html

The Socio Economic Impact of Tourism on Matheran

Priya Rajaram Gharge*[1], Pooja Desai[2]
1, 2- SIES (Nerul) College Of Arts, Commerce and Science
7350153194,*priyagharge16gmail.com

Abstract

Tourism in the form of activity influences the regions in which it is developed and received with economic, social, cultural, and environmental dimensions. Tourism at hill station plays a very important role in a Tourism industry. This project focuses on the the socio-economic impact of tourism development on the local community. Matheran is selected for the Project study. Matheran is a hill station in Raigad district. This is one of the hill stations declared eco-sensitive hill station by government. When tourists visit any tourist place they need various services like hotels, food, tourism infrastructures, and many other services. So, ultimately it contributes to the economic development of local people. The aim of the research is to investigate the socio-economic impacts of tourism in Matheran and to critically analyze the benefits, if any, of involvement of the local community in tourism. Data obtained from the questionnaire and interviewers .The main sources of inputs for analysis; detailed questionnaire was designed and developed. During the survey all together 100 effective face-to-face interviews were made from different categories including local people, shopkeeper, tour guides and tourist. The socio economic impact of tourism development refer to the changes in quality of resident of tourist destination is studied.

Keywords *- Socio cultural Impact, Tourism development, Matheran, Survey*

Introduction

Tourism is a rapidly growing phenomenon and has become one of the largest industries in the world. The impact of tourism varies differently. Tourism has stimulated the development of Varity in different infrastructure and facilities such as hotels, lodges, and campus. In recent times, tourism is one of the largest industries that have contributed to the socio-economic growth of many countries especially countries where tourism is the main source of income. The concept of socioeconomic modernization includes improvements in various indicators, including improvement in living conditions and the quality of life and well-being of populations.

Tourism quickly stimulates income growth, generate foreign exchange and contribute to domestic earnings of government through fees and taxes. The development of tourism in regions based positions, their resources, and financial situations. There is some consideration of economic effect of tourism which leads to increasing economic condition of that place. Such as tourism provides money and income flow to local people, it provides new vacancies for a local community, it supports small and medium size enterprises in regions, It attracts other sector of the economy.

Matheran is a hill station and a municipal council in the Raigad district in the Indian state of Maharashtra. It is a hill station in Karjat Tahsil and is also the smallest hill station in India. It is the leading tourist destinations in Mumbai Pune region mainly

because of the rich biodiversity resources it sustains and the scenic beauty, natural and manmade objective, like lake, hills, trees, wildlife, Eco Camping, Trek etc. Matheran provides employment opportunities to Local communities around. Therefore, this study focuses on the socio-economic impact of tourism case in Mather an.

Aim and Objectives

1) In the tourist to be aware of and understand how tourism development can affect the lives of people who live destination.
2) To determine the direct impact of tourist activities in the respective tourism areas.
3) To see the positive and negative impact of tourism on environment.

Methodology

This research study includes the Socio economic factors of selected place Matheran.

- For this study the quantitative approach had been used.
- For questionnaire simple open ended and closed ended questions was prepared.
- In this questionnaires were chosen as the main source of a research for collecting data.
- The questionnaire used in this study consist of 2 section

1) Environmental aspect 2) Economic aspect
Environmental aspect involved environmental issues like climate, soil land use, Forest etc. Second section includes the role of tourism as a tool for local socio-economic development including existing forms of tourism employment, tourist demand, and changing, standard of living.

- Sample Population was selected 100 Peoples
- The sample population for this research includes the residents, small business owners of hotels, restaurants, and shops from some areas of Matheran.
- Questionnaires were administered in locations such as hotels and restaurants, attraction sites and along the streets and residential areas include Bajar peth, Duster Naka, Kothval Nagar, and Monkey Point etc.
- Distribution of questionnaire was carried out on day time
- Analyzing data using proper Quantitative method

Result and Discussion

Table no:1

Climate	Increase%	Decrease%
Difference in Temperature	82	18
Monsoon condition	41	60
Summer condition	82	18

Table no: 2

Soil And Land	**Yes%**		**No%**	
Own Agricultural land	27		73	
Condition of the land	Fertile %		Non Fertile	
	25		75	
Reasons for change in fertility	Soil Erosion	Horse Excreta	Litter	Other
	68	05	10	17

Table No.3

	Yes %		No%	
Change in Quality of water	37		63	
Source of Water income	Pumping inside house	Village lake	Water tank	Other
	9	53	31	17

Table no.4

Forest	**Increase %**			**Decrease%**	
Change in forest or land cover	42			58	
Status of horse and Monkey	68			32	
	Yes%			No%	
Changes in Plants ,Animals	75			25	
Know the effect of Horse Excreta on Soil	39			61	
Reasons for forest Degradation	Deforestation	Construction	Climate change	Tourist Activity	Other
	24	22	35	15	4

Table no 5

Income	Yes%		No%	
No, of independent Travels Increased	87		13	
Average Monthly Income	Less than 25,000	25,000-49,000	75,000-99,999	100,000-149,000
	40	38	15	12

Table no.6

Improved, Declined or Stayed the same (%)	Yes%		No%
Quickly changing Matheran	75		25
To conserve the local natural Environment	62		38
Change in standard of living	88		7
No, of Tourist visited	Fewer than50,000	50.000-100,000	100,000-250.000
	18	54	28

Table no. 7

Effect of difference .in temperature	Increased heat level in summer, change in Rainfall pattern.
Monsoon condition effect	Soil erosion, loss of crop yield, Damages of houses, Plants, Landslides, disturbed transport and communication,
Summer condition effect on human life, Animals, Plant	Decreased water ground level, Skin related Problem
Main income sources of people	Tourism, Horse Riding, Small business(tea stall, Shops,)

Table no.1: Overview of climatic condition of Matheran.

Climatic condition includes the difference in temperature, Monsoon condition and summer condition. It was found that 82% people agree that there was increase in temperature as compared 5 years ago. 80% people say that there was decrease in monsoon condition and 82% people shows increased in summer condition.

Table no.2: Soil and land condition in matheran.73% of peoples do not have their own agricultural land and 75% land was non fertile .there were so many reasons for change in fertility of land. The main reasons were found to be soil erosion.68% people agree that soil erosion is reason for fertility of the soil.

Table 3: The water sources condition of Mathearn.-53% people say that the main water income is other (River).63% of people says that there was no change in water quality.

Table no.4 shows that forest and animals condition. It was found that 58% peoples agree that there was decrease in forest cover from last few years. Reasons for decreased forest cover was Deforestation, climate change, construction, tourist activity.etc.35% of people say that change in climatic condition is main reason for decrease forest land cover. Because of decrease forest cover pattern number of animals also decreased. It was found that no. of horse population is increased. It shows that 61% of peoples do not have any idea about the effect of horse's excreta on soil.

Table no.5 and table no 6 shows the information about Income ,no. of tourist, change in standard of living .87% of people

agree that there was increase in no. of tourist visited in Matheran. The monthly income range was 25,000-49,000.75% people agree that Matheran is changing rapidly.88% of people say that there was change in standard of living

Table No7: Effect on human animals, Plant life.it was found that difference in temperature shows effect on change in season's duration. example increase in heat level during summer condition, change in rainfall pattern. It was found that during high monsoon there were so many problems people are face .On human life such as Damages of houses, Plants, Landslides, distrust transport and communication. It was found that during summer condition people face some skin related problem, decrease ground water level. The tourism and tourism based income sources suchas Resultants, hotels, tea stall small shops etc. main income source.

Conclusion

Study of socio economic impact of tourism case of Matheran was carried out by using survey base method. The main focus of this study was include different environmental and economic aspects. Environmental aspects include climatic condition, monsoon, and summer condition. The study says that there was increase in Monsoon and summer condition. There were both positive and negative impact of climate on human, animals and plants. Positive effect includes increase in crop yield, increase ground water leveled while negative impact includes Soil erosion, loss of crop yield, Damages of houses, Plants, landslides, disturbed transport and communication. According to survey it was found that most people do not have own agricultural land. And most of land are in non-fertile state. The main reason for change in fertility of land was soil erosion, *Soil erosion* is a naturally occurring and slow process that refers to loss of field's top soil by water and wind.the main water source in Matheran Is Village Lake. People say that water quality is good for drinking and other purpose. Forest is the one of most consideration in Matheran; this forest ecosystem supports a variety of flora and fauna. The study says that the forest cover was decrease. Decrease forest cover shows impact on change in No.of animals and plant. Reasons for forest degradation include Deforestation, construction, climate change etc.

This case study shows that current forms of tourism development in Matheran contributed to the socio-economic empowerment of local people. It was found that main source of income is Tourism; the study says that number of travelers has increased rapidly and tourism base business shows improvement. Most of the community members have benefited from tourism in their social life and economic aspects in various ways. Mostly the benefits are counted in terms of empowerments to the communities. These empowerments are i.e. Economic empowerment which targets formal and informal empowerment as well as employment opportunities.

ACKNOWLEDGEMENT

It is a great privilege to express my deep sense of gratitude to all, who have helped me during the course of my research work. It is my prime duty to acknowledge my sincere gratitude to my guide Pooja Desai, Professor, SIES College of Arts, Commerce and Science (Nerul) for giving me guidance wherever required during the study.

Recommendation

1. Understanding local needs and providing ways to use natural resources in sustainable way.
2. For the sustainable development of tourism in the district, we can motivate the NCC and NSS students from schools and colleges in the district for enhancing the

awareness of environment and of tourist centers.

3. Activities and opportunities for awareness creation for tourists beyond enjoyment
4. Proposition of strategies alternative for conservation or development.
5. On the local level, proposed projects, that follows regional plans and regulations present detailed studies on the natural resources, land values, tourist demands and environmental impact assessment to update regional database

References

1. European Journal of Hospitality and Tourism Research Vol.2,No.1, pp.15-23, September 2014
2. American Journal of Environment, Energy and Power Research Vol. 1, No. 7, September 2013, PP: 117-130, ISSN: 2329-860X.
3. Journal of Sustainable Tourism Vol.15.N0 6.2007.
4. https://repository.cardiffmet.ac.uk/bitstream/handle/10369/2564/masadur%20final%20thesis%20version.pdf?sequence=1&isAllowed=y
5. Ofodile, C. C. (2004). Cultural tourism and national growth. *Journal of Environment 2(1) 26-44).*

Impacts of Ganesh Idol and Wastes Immersion Activities on Koparkhairane, Nerul and Juinagar Lakes

Nidhi Mhapralkar*[1], Pooja Desai[2]
1, 2-SIES (Nerul) college Of Arts, commerce and Science
*nidhi18uk@gmail.com

Abstract:

Contamination of water-bodies due to ever growing religious activities is a major concern in today's era. Decrease in water quality is also attributed to the fact that today most water bodies are been loaded with toxic material and chemicals, human and industrial waste, organic matter, and religious rituals of Idol immersions which is growing year on year basis. The under mentioned research work is mainly concerned about the water quality assessment to evaluate the qualitative nature and quantitative extent of pollution in water body before, during, and after of immersion idols in Ganesh festivals season last year.Water samples were collected from Three sites in Navi Mumbai city and were analyzed for various water quality parameters such as pH, Total Suspended Solids (TSS), Total Dissolved Solids (TDS), Total Solids (TS), Turbidity, Conductivity, Hardness, Chloride, Chemical Oxygen Demand (COD), Alkalinity and Acidity following standard. From studying and analyzing various parameters it was observed that water parameters increase during idol immersion period and decrease in some period of time. Generating awareness among the people and society about reducing pollution due to festival waste will help in conserving ecosystem of these water bodies as well as culture and environment can be preserved.

Keywords*: Physico-chemical Characteristics; Water Bodies; Pollutants, Contamination, Idol Immersion, Water Quality Assessment.*

Introduction:

Magnitude of growing water pollution is a major global problem and like other developing countries water pollution has reached to a level of no recovery and revival, causing alarming situation in India[3]. The issues related to water is becoming increasingly important to sustainable environment particularly with respect to human health and long term food security. Lakes and other heritage water bodies are the most fragile, fertile, diverse productive and interactive ecosystem in the world. These lakes water bodies are stagnant surface water bodies that receive, and stores fresh water received through rainfall. These stagnant water bodies have more complex and fragile ecosystem in comparison to running water bodies as they lack self cleaning ability.[1]This further cause accumulation of large quantities of toxic pollutants. Increased anthropogenic activities in and around these water bodies, damage the aquatic ecosystems and

ultimately affect the overall physiochemical properties of water [2].The idols of Lord Gnash, etc. are worshipped with all rituals by Hindu are immersed in water bodies between the months of August to October respectively every year. The time span of festival may vary from one and half day to ten days. Idols are immersed in logic or lactic water bodies based on the difference in the water residence time and the flow velocity. [4] However in present day scenario ever growing use of metals, ornaments, oily substances, and synthetic colors, chemical are used to make polish and decorate these idols for worship followed by large number of idols, immersion of these large idols in our surrounding aquatic environment severally affects the water body on its natural characteristics. [5]Growing religious activities have now become a threat to ecosystem, hence urgent need of idol immersion and its enforcement is necessary. I have carried out study at Koparkhairane Lake, Nerul Lake, and Juinagar Lake in Navi Mumbai where highly idol immersion activity has been take place for many years. This study finds the impact of these cultural and religious activities like idol immersion on the quality of the Lake water.

Methodology:

The water samples werecollected from selected location by random grab sampling method. Pre-immersion samples were collected 5 days prior to immersion activities, immersion samples will collected during the immersion period and post-immersion samples were collected one and two month later the completion of immersion activities of Ganesh. Well agitated collected water sample was filtered through a whatman filter paper. This unfilter water were evaporateted on heating mantle to obtained total solid (TS), while the filtrate obtained will evaporated to dryness till constant weight obtained in order to estimate Total Dissolved Solid (TDS). The subtraction of TDS from TS gives Total suspended Solid (TS) value. Turbidity was estimated using Turbidity meter and Conductivity was estimated by Conductivity meter. Total Hardness was analyzed by titrimetric EDTA method, Chloride was obtained by titrimetric silver nitrate method. Acidity and Alkalinity was obtained by titrate against hydrochloride and sodium hydroxide acids in presence of phenolphthalein and methyl orange indicators. COD was determined by open reflux method using potassium dichromate solution.

Result and Discussion:

pH: The pH ranged from 5.8 to 7.4.the minimum pH. was observed during immersion which indicated acidic ph. of water due to idol immersion. The post immersion ph was found to be 7.4, which were neutral.

Total dissolved Solids (TDS):.The amount of dissolved solids present in water determine sits suitability for domestic use. The recommended limit for the total dissolved solids present in water is 500 mg/lit.TDS in water are found

due to presence of carbonates, bicarbonates, chlorides, phosphates, calcium, magnesium, etc. it was seen that total dissolved solid are higher during immersion period and come back to normal in post immersion collection period.

Total suspended solids (TSS):.TSS in water was found due to immersion of idol made up of POP and other material. TSS can include a wide variety of material, such as silt, decaying flowers andorganicmatter, etc.Total suspended solids shows a remarkable increase during immersion period and then decreased toalmost original levels in the post immersion period.High concentrations of suspended solids can cause many problems for health of aquatic life.

Total solids (TS): Total solids, TS, are a measure of all the suspended, colloidal, and dissolved solids in a water sample.Total Solids increased during immersion, this then decreased slowly in all post immersion samples to nearly pre immersion value. The high TS value was found in Koparkhairane lake than other two lakes that are Nerul and Juinagar.

Turbidity: Turbidity of lake water sample is observed to be 4 to 7.4NTU.where maximum turbidity found in Nerul and minimum turbidity found in Juinagar lake. Turbidity is due to immersion of various organic and inorganic matter immersionsin water bodies.

Total hardness: Total hardness of all three lakes shows a remarkable increase during immersion period then decreased to almost original levels in the post immersion period. Water of koparkhairane was found to be very hard whereas water sample of Nerul and Koparkhairane was found to be moderately hard. Large scale of immersion of idol, detergents and large scale human use might be the cause ofelevation of hardness.

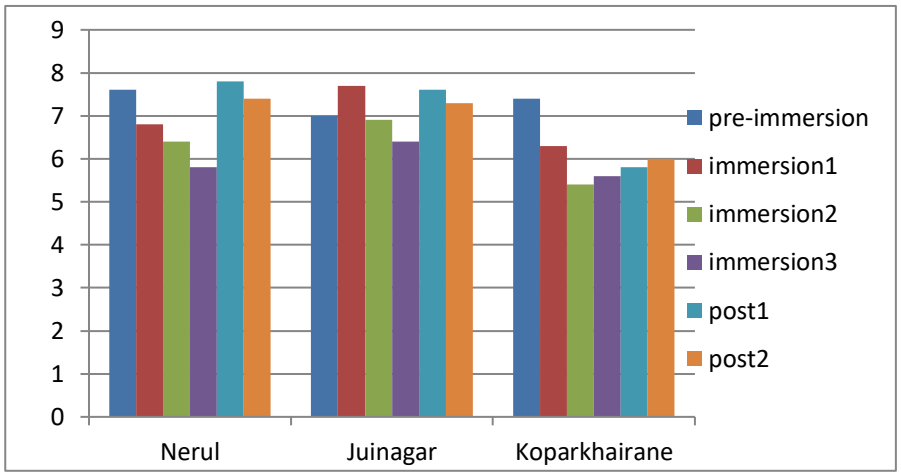
Chloride: It is formed when the element chlorine (a halogen) gains an electron or when a compound such as hydrogen chloride is dissolved in water or other polar solvents. Chloride of all three lakes water sample is less than the standard given by MOEF, 250mg/l.

Alkalinity: Alkalinity is the quantitative capacity of an aqueous solution to neutralize an acid. High alkalinity found in all three lakes during immersion period. This might be due to the presence of various types of chemicals during Gnash festival. Alkalinityincrease enormously high and exceeding the CBCP standards during immersion period but decrease slowly during post immersion period. The high alkalinity was found in Koparkhairane Lake than other two lakes that are Nerul and Juinagar.

Acidity: Acidity is the quantitative capacity of an aqueous solution to neutralize a base. High acidity is shown by

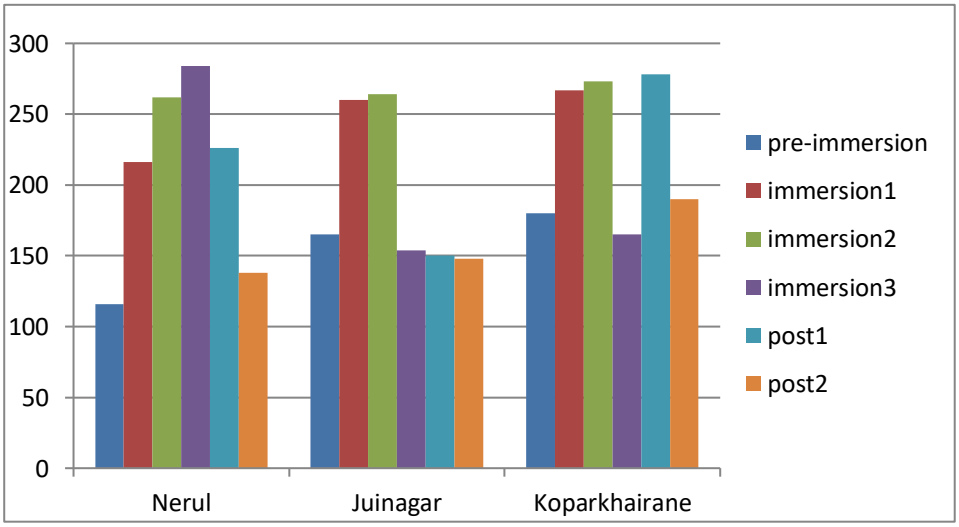
koparkhairane lake whereas low acidity shown by Nerul lake.

Chemical oxygen demand: The chemical oxygen demand (COD) test is commonly used to indirectly measure the amount of organic compounds in water. COD enormouslyincrease during immersion period.The high COD level was seen more after 1 month of festival but it decreases in next month.



	Pre Immersion (mg/lit)	During Immersion (mg/lit) (1/2 day)	During Immersion (mg/lit) (5 day)	During Immersion (mg/lit) (10 day)	Post Immersion (mg/lit) (1 month)	Post Immersion (mg/lit) (2 month)
Nerul	7.6	6.8	6.4	5.8	7.8	7.4
Juinagar	7.0	7.7	6.9	6.4	7.6	7.3
Koparkhairane	7.4	6.3	5.4	6.6	5.8	6.0

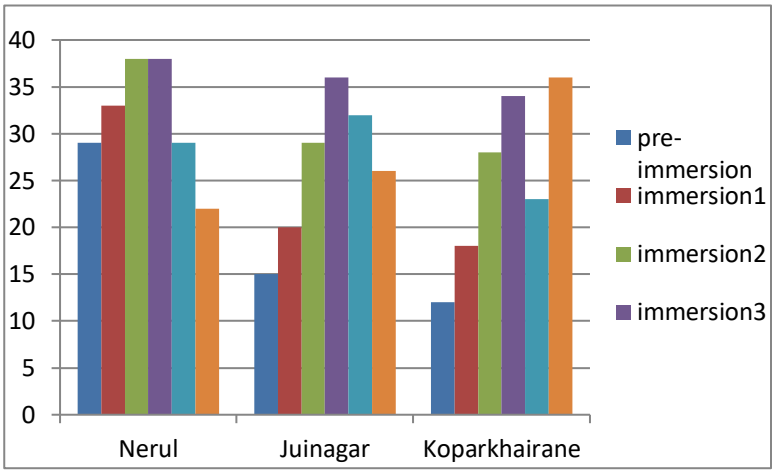
Table 1: PH Measurement



	Pre Immersion (mg/lit)	During Immersion (mg/lit)(1/ 2 day)	During Immersion (mg/lit) (5 day)	During Immersion (mg/lit) (5 day)	Post Immersion (mg/lit) (1month)	Post Immersion (mg/lit) (2 month)
Nerul	116	219	262	284	226	138

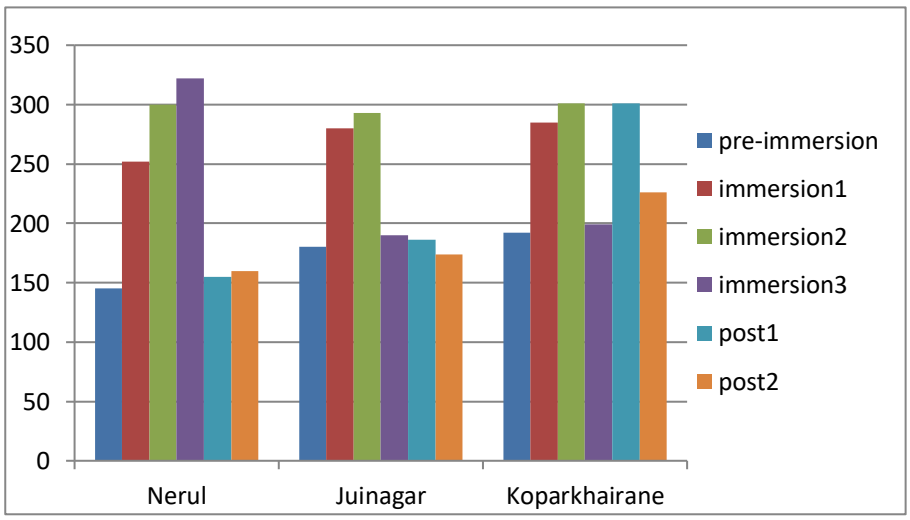
Juinagar	165	260	264	154	150	148
Koparkhairane	180	267	273	165	278	190

Table 2: Total dissolved solids



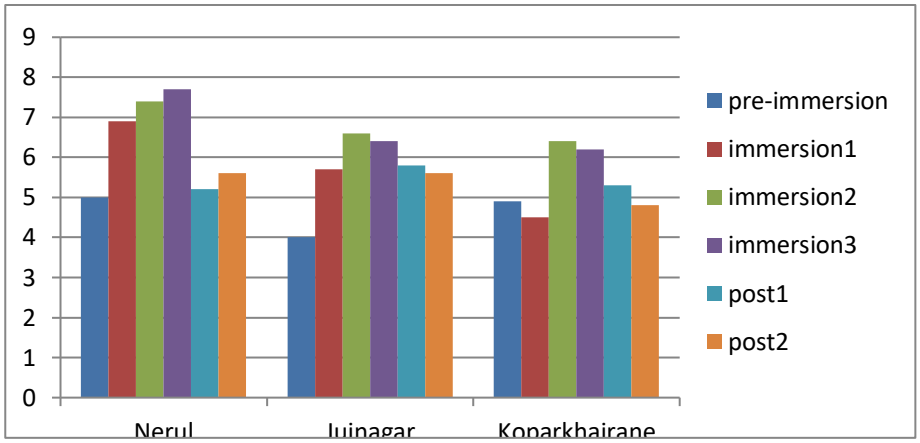
	Pre Immersion (mg/lit)	During Immersion (mg/lit)(1/2 day)	During Immersion (mg/lit) (5 day)	During Immersion (mg/lit) (10 day)	Post Immersion (mg/lit) (1month)	Post Immersion (mg/lit) (2 month)
Nerul	29	33	38	38	29	22
Juinagar	15	20	29	36	32	26
Koparkhairane	12	18	28	34	23	36

Table 3: Total suspended solids



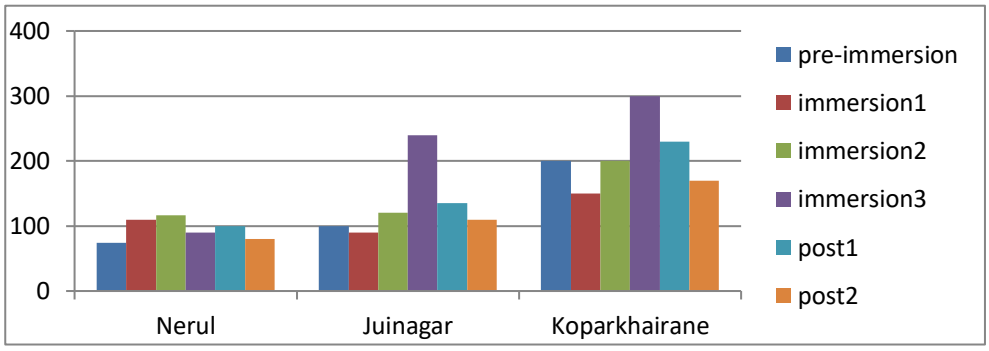
	Pre Immersion (mg/lit)	During Immersion (mg/lit)(1/2 day)	During Immersion (mg/lit)(5 day)	During Immersion (mg/lit)(10 day)	Post Immersion (mg/lit)(1 month)	Post Immersion (mg/lit)(2 month)
Nerul	145	252	300	322	155	160
Juinagar	180	280	293	190	186	174
Koparkhairane	192	285	301	199	301	226

Table 4: Total solids



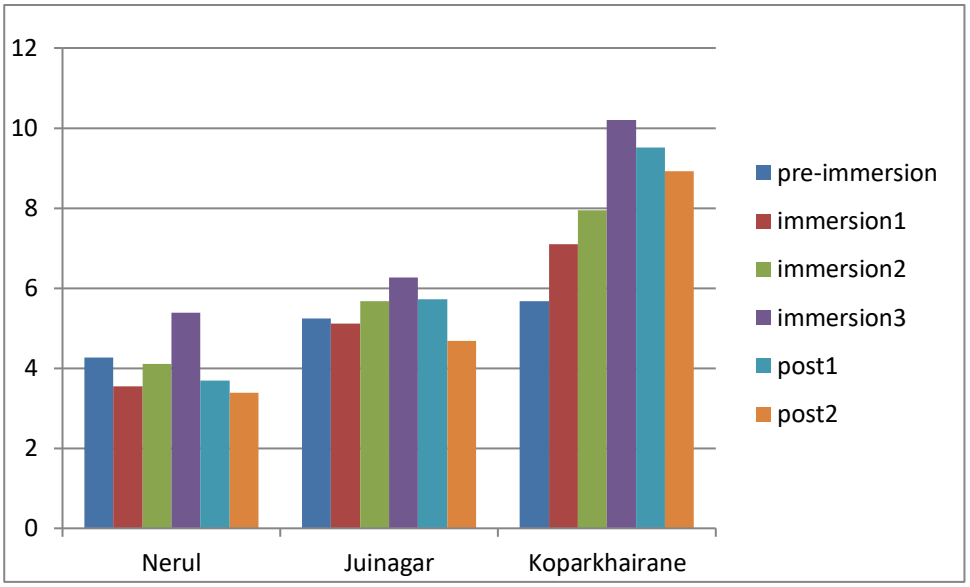
	Pre Immersion (NTU)	During Immersion (NTU) (1/2 day)	During Immersion (NTU) (5 day)	During Immersion (NTU) (10 day)	Post Immersion (NTU) (1 month)	post Immersion (mg/lit) (NTU)
Nerul	5	6.9	7.4	7.7	5.2	5.6
Juinagar	4	5.7	6.6	6.4	5.8	5.6
Koparkhairane	4.9	4.5	6.4	6.2	5.3	4.8

Table 5: Turbidity



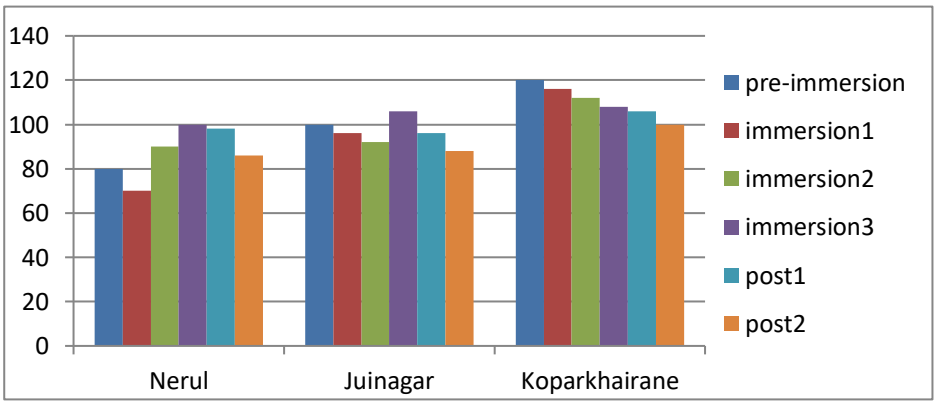
	Pre Immersion (mg/lit)	During Immersion (mg/lit)	During Immersion (mg/lit)	During Immersion (mg/lit)	Post Immersion (mg/lit)	Post Immersion (mg/lit)
Nerul	74	110	116	90	100	80
Juinagar	100	90	120	240	135	110
Koparkhairane	200	150	200	300	230	170

Table 7: Total hardness



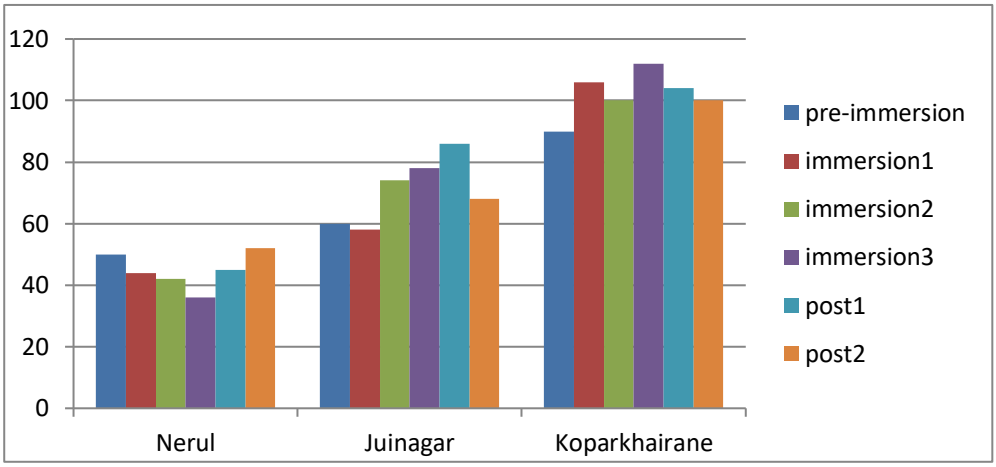
	Preimmersion (mg/lit)	During Immersion (mg/lit) (1/2 day)	During Immersion (mg/lit) (5 day)	During Immersion (mg/lit) (10 day)	Post Immersion (mg/lit) (1month)	Post Immersion (mg/lit)(2 month)
Nerul	4.26	3.55	4.11	5.39	3.69	3.39
Juinagar	5.25	5.11	5.26	5.68	5.73	4.68
Koparkhairane	5.68	7.1	7.95	10.2	9.51	8.92

Table 8: Chloride



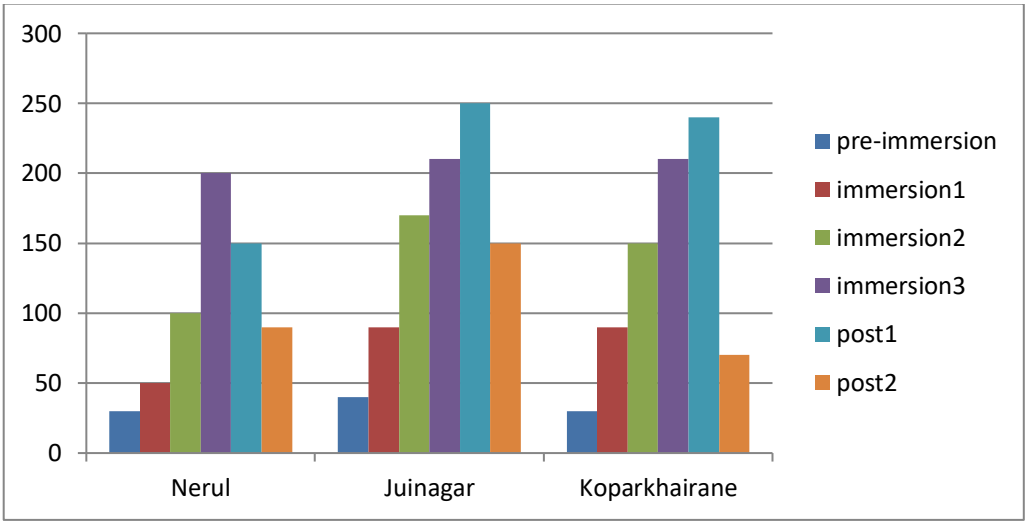
	Pre Immersion (mg/lit)	During Immersion (mg/lit) (1/2 day)	During Immersion (mg/lit) (5 day)	During Immersion (mg/lit) (10 day)	Post Immersion (mg/lit) (1 month)	Post Immersion (mg/lit) (2 month)
Nerul	80	70	90	100	98	86
Juinagar	100	96	92	106	86	68
Koparkhairane	120	116	112	108	106	100

Table 9: Alkalinity



	Pre Immersion (mg/lit)	During Immersion (mg/lit) (1/2 day)	During Immersion (mg/lit) (5 day)	During Immersion (mg/lit) (10 day)	Post Immersion (mg/lit) (1 month)	Post Immersion (mg/lit) (2 month)
Nerul	50	44	42	36	45	52
Juinagar	60	58	74	78	86	68
Koparkhairane	90	106	100	112	104	100

Table 10: Acidity



	Pre Immersion (mg/lit)	During Immersion (mg/lit) (1/2 day)	During Immersion (mg/lit) (5 day)	During Immersion (mg/lit) (10 day)	Post Immersion (mg/lit) (1 month)	Post Immersion (mg/lit) (2 month)
Nerul	30	50	100	200	150	90
Juinagar	40	90	170	210	250	150
Koparkhairane	30	90	150	210	240	70

Table 11: COD measurement

Conclusion:

Ganesh Chaturthi is a widely celebrated Hindu festival in India in honor of god Ganapati or Ganesha. It was introduced by Mr. Bhausaheb Laxman Javale in 1892 in Pune to unite people. This festival brings lots of joy and color but, it also harm environment to such extent that it become difficult to bring it to its original state.

The present study on assessment of idol immersion on physico-chemical characteristics of koparkhairane, Nerul and Juinagar lakes revealed that idol immersion activity has negative impact on water quality of the lakes. All of three lakes show. The water quality parameters like ph, TSS, TDS, TS, turbidity, hardness, chloride, alkalinity acidity and COD have shown significant increase during immersion of idols and then decrease slowly due to its self cleaning ability of water.The input of biodegradable and non biodegradable substances deteriorates the lake water quality and enhances silt load in the lake.The measured parameters of water quality standard show marked deviations from the established CPCB standards for water quality.The floating material released through idol in the lake, after decomposition result in eutrophication of the lakes. Governmental agencies are also need to be takenstrict measuresto avoid further deterioration of the water qualityand they need to put strict law and guideline on immersion of idols. A strong attempt to make the nearby people aware about the lake environment and its importance has to be done because they are one of the major stakeholders associated with the environment.[6]

Recommendation:

- We need to encourage people buy eco-friendly idol which cause lesser amount of pollution.
- After Ganesh festival, lakes need to be clean by removing all floating waste.

Acknowledgement:

The author is grateful to prof. Pooja Desai from SIES (Nerul) college of arts, commerce and science for her guidance andencouragement.

References:

1. Prashant Mehta (2013). Alteration in water quality parameters and consequential impacts due to festival waste in Jodhpur, The Experiment 17(1) 1166-1176.
2. Upadhyay K, Mishra P and Gupta AK (2010). Studies on the physico-chemical status of two ponds at Varanasi and Bhadohi under biotic stress, Plant Archives 10(2) 691-693.
3. Anju Vyas1*, D. D. Mishra2, A. Bajapai3, S. Dixit4 and N. Verma5Environment Impact of Idol Immersion Activity Lakes of Bhopal, India
4. *Prashant Mehta Comparative Analysis of Water Quality Parameters Due To Festival Wastes Immersion and Consequential Impacts in Jodhpur.
5. Dhote S, Varghese B and Mishrs SM (2001). Impact of idol immersion on water quality of Twin Lakes of Bhopal, Indian Journal Environmental Protection 21 998-1005.
6. Pooja Desai, Water Quality Assessment of Lakes in Vashi, Navi Mumbai, Maharashtra, India. IJSER, Vol 3, Issue 7, July 2015, pp.66-69

Systems Engineering Approach To Environmental Objects

Ms. Alpana Pandey

Lecturer, Computer Science Department

SIES (Nerul) College Of Arts, Science & Commerce

Research Scholar

alpanap2@rediffmail.com

Abstract:

Man's largely uncontrolled use and exploitation of the natural environment and the ever increasing needs of an overpopulated world have led to a situation in which only scientific assessment, planning and management can provide some measure of sustainability of the use of natural resources. Especially in the developing world with its limited access to technology, funds and expertise, excessive exploitation of natural resources has caused severe environmental degradation and there are communities which appear to be entirely dependent on an exploitative use of natural resources for their survival. Decision-makers and planners require reliable and current environmental information, to arrive at effective, realistic and sustainable management plans. Environmental Information Systems (EIS) provide a technology by which such environmental information can be combined, structured, managed and made available to planners and decision makers. Environmental informatics is a part of applied Informatics and supports methods and procedures of information technologies which contribute to environmental data analysis and environmental protection. It is a connection link between nature and engineering. Applying data sampling and data analysis methods statistics simulation models and decision support systems on environmental problems and tasks one gets simulation results and prognoses to explain and to solve environmental problems. Methods of environmental informatics form a basis of decision making processes for environmental problems using state-of-the-art computer technology.More and more challenging tasks of environmental management and protection have forced the conceptualization and development of models of environment objects based on systems engineering approaches with the natural and social sciences background. Advanced information technologies like simulation, networking and monitoring help to understand the behavior of complex environmental systems and their parts and to forecast the influence of human activities on the environment.

Key Words: *Environmental information, Environmental Information Systems, Environmental Informatics, Systems Engineering*

Introduction

Environmental Information Systems (EIS) in the Context of Environmental Management

Mankind must attempt to find the delicate balance between its developmental needs on the one hand and the complete preservation of the status quo, or preferably the reversal of environmental damage, on the other. While it is highly unlikely, if not entirely unrealistic to assume, that environmental management models will provide for full sustainability, every effort must be made to

minimise negative human impact on the environment. It is well known that increased population and socio-economic developments, such as urbanisation, apply tremendous pressure on agriculture, biodiversity, climate, vegetation, wildlife, and water resources, among others. Man's exploitation of these resources inevitably leads to environmental degradation in the form of soil erosion, deforestation, increased urbanization and irregular settlements. Environmental information includes information relating to topography, soil, geology, minerals, vegetation, land cover, wildlife, land use, land use controls and restrictions, jurisdictional boundaries, historic and prehistoric sites, economic projections, etc. Environmental practitioners can use EIS as a management technology to determine, organise and manage and the optimal utilisation of environmental resources. Environmental Information Systems should therefore, include strategies, procedures and institutional frameworks, together with data management tools, that ensure access to environmentally relevant data and allow for their analysis. Users of EIS should be able to query these systems and derive information on fauna and flora locations, migration routes, sources of pollution, land ownership, archaeological sites, protected areas, location of endangered species, demographics, etc .

Environmental objects (EO)

The first step of data processing concerns the mapping of environmental objects(real world objects) to entities that are more abstract and can be handled by computers or directly by decision makers. Environmental objects can be natural entities (e.g. animals, plants, lakes, hills, landscapes) or man-made structures (e.g. houses, towns, factories). Each environmental object is mapped to a collection of environmental data objects. For instance, a typical environmental data object would be a time series of water quality measurements which describe the time varying behaviour of a certain chemical substance in a lake or river (the corresponding environmental objects).

Environmental System Conception

The conception of systems is very general. In system science it is used to analyze complexity, to bring a greater amount of transparency into the interaction of parts. It maps the flow of information or energy or material etc. through the complex system. It is based on the decomposition of the complex system into subsystems. The chosen subsystems should be simple to handle. Mostly, they are object-orientated. The topology of the real object determines the structure of the mapped system. Systems are characterized by inputs and outputs. They can be controlled via the inputs and observed via the outputs. The difficulty of analyzing and especially forecasting the environment consists in the fact that man as an actor is himself part of the complex environmental system/complex ecosystem – the biosphere (Figure 1). The concept of systems builds a bridge between the world of real objects and mathematics. Systems analysis requires to design a conceptual model consisting of submodels. The conceptual model is a plan for mathematical modeling. Mathematical modeling is based on measurement before or during the control process. Modeling is not a purpose for itself. Its focus is to solve problems and according to the problems, selected models are developed. Generally, the systems approach provides models for control, decision and planning processes

.

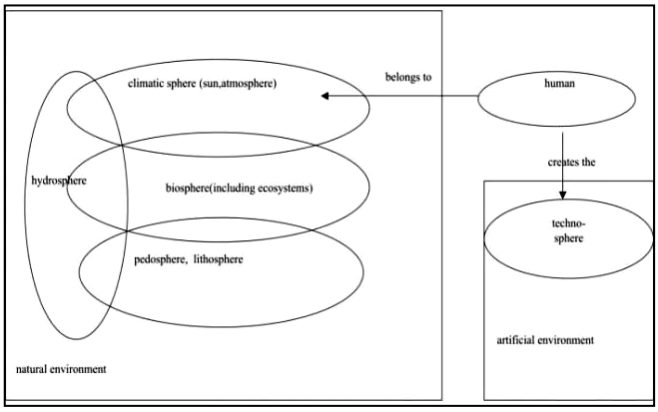


Figure 1: Human environment

Complexity of Environmental Systems

The complexity of environmental systems is known to all who need to make decisions in the management of plants, in environmental politics or in the study of global change, etc. (Figure 2). The complexity is inherent in the nonlinearity of mathematical models, the dynamic and stochastic nature of natural resource problems, the multipurpose, multiobjective attributes of decision problems. The complexity is also caused by the natural coupling and interaction of parts of the biosphere. The complexity depends also on problems of measuring, transmitting, processing and analyzing data and the decision-making process under environmental, technical, economic and political aspects. Systems methodology provides theoretical and computational tools for modeling, analyzing, understanding and controlling, optimizing or planning complex, environmental systems. The systems approach brings transparency into the interactions of the system's parts. Simulation tools support numerical insights into the system behavior.

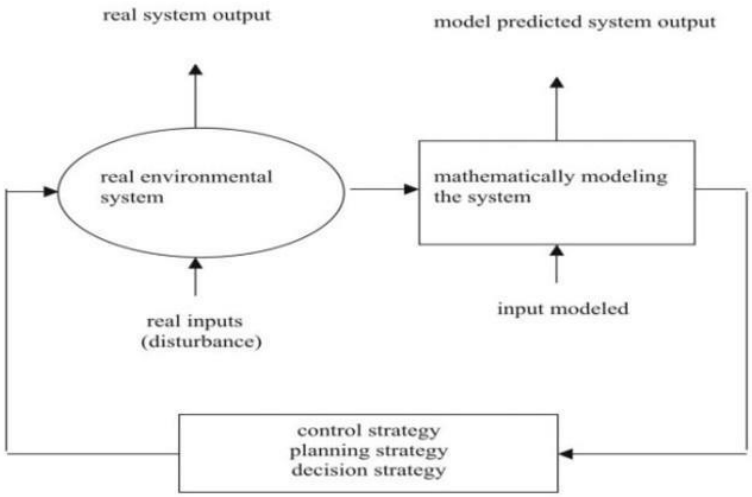


Figure 2: Modeling and decision making

Challenges of Environmental Systems Modeling

The first challenge is the characterization of uncertainties that exist in many intertwined system parameters that could make the environmental systems extremely complicated. Applicability of modeling techniques to environmental management is affected by many factors. Firstly, environmental systems are complicated, where a number of factors and interrelationships are hard to be expressed as mathematical formulas; also, nonlinearity that exists in system can hardly be effectively reflected. Secondly, information for a number of system parameters is often unavailable, such that rough estimations have to be made. Also, a large portion of information that is available may not be quantifiable; instead, this type of information could be simply the implicit knowledge from decision makers. Thus, inputs for a modeling system may only be a small part of the entire information in a study system; consequently, the modeling outputs may only be useful for providing part of decision support, while another part should be from solid investigations of the ambiguous and unquantifiable information through innovative information technologies. Thirdly, for information that is quantifiable, a significant part of it may not exist as deterministic data. A second challenge is the quantitative description of how is the risk involved in decision-making related to the uncertainty in modeling process. While risk involved in environmental assessment might become another source of uncertainty, uncertainties in environmental systems may cause a certain level of risk that might affect the final decision in environmental management. Consequently, risks and uncertainties associated with a variety of system behaviors, objectives identification, and their interrelationships have received significant attention from both environmental manage-ment and information science. An associated challenge is to develop the capability to minimize the uncertainties and risks using advanced information and communication technologies. To ease the challenges and to enhance model feasibility and applicability, there is need for scientists to incorporate these advanced information and communication technologies along with up-to-date monitoring and measurement devices to aid in environmental systems modeling.

Systems Analysis

Systems analysis consists of various steps. Basically, these are described in the following outline:

1. Analyzing the decision problem (goals, decision or control variables).
2. Formulating a model which is adequate in quality and accuracy for the complex problem (structure, parameter, interconnections).
3. Testing the model (usually by computer simulation) (validity, sensitivity).
4. Solving the decision problems by scenario analysis, optimization (control, decision strategies, planning)

Computer simulation and optimization tools provide essential aids as regards most of the steps. Modeling on the systems level is based on the input-output analysis and needs mathematics, natural life and economic sciences as a background. System identification and parameter estimation are the main steps of modeling.

Example: water quality. As an example of the systems approach a control problem of water resources is considered (Figure 3):

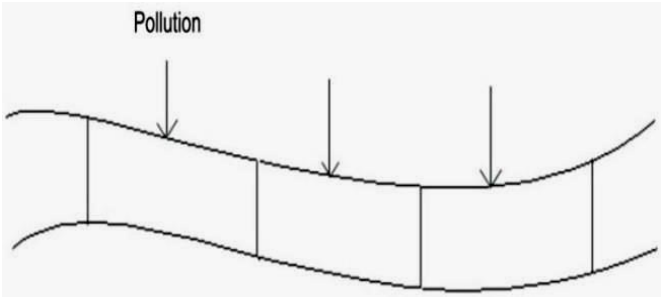


Figure 3: The water quality of a river

What variable should be measured and controlled?

How to control and by which variables?

According to the wastewater inflow the river is decomposed into subsystems (Figure 4).

The pollution is directly discharged into the river or over a wastewater plant. The control problem for water quality consists in the fulfillment of certain conditions (biological oxygen demand, dissolved oxygen) and optimization of the overall costs, including the costs for the wastewater treatment.

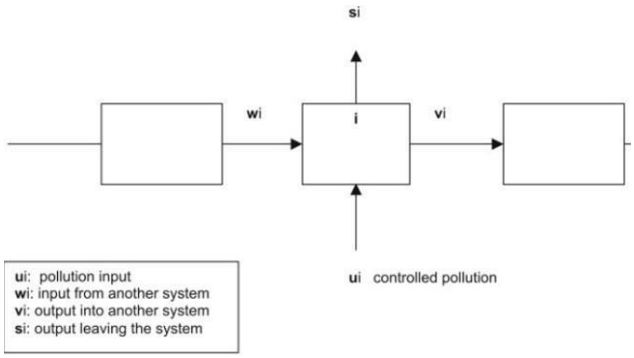


Figure 4: Systems approach description

Measurements: Data Capture, Validation, Interpretation

Environmental object classification leads to the taxonomy distinguishing between atmosphere (all objects above the surface of the Earth), hydrosphere (water-related objects), lithosphere (relating to soil and rocks), biosphere (all living matters) and technosphere (human-made objects), cf. Figure 5.

Figure 5 shows a comprehensive classification for databases. Because the environment is a complex object some parts could be allocated to different classes. Analyzing environmental objects and data are the basis for information systems and monitoring of the state of environment. Furthermore, they are needed for modeling (systems identification and parameter estimation). After systems analysis the conceptual model (model design) requires input and output data of the systems or subsystems. In general, measurement and validation are the bottleneck and a great challenge for the further development and realization of the environment.

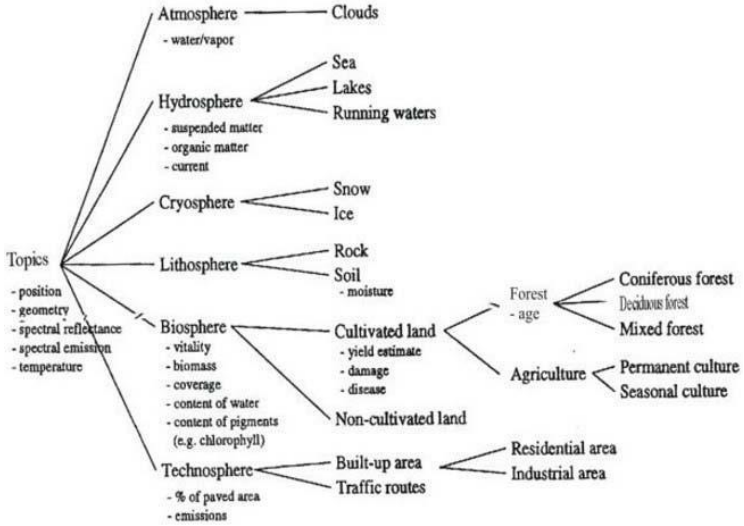


Figure 5: Taxonomy of environmental objects

Conclusion

Information technologies are becoming more and more important for environmental management, due to the increasing needs for large-scale computational capability in order to meet the goals of sophisticated environmental decision-making. To explore the ultimate limitation of nature, an analysis of the environment in terms of the physical, chemical, and biological processes and the relationship of these processes and their interactions are becoming critical. Significant efforts are required to analyze the relevant information, simulate the related processes, evaluate the resulting impacts, and generate sound decision alternatives. The system-based approach developed within the last two decades enables us to investigate the complex interactions fundamental to the co-evolution of engineered and natural systems. Re-cent advances in information technology lean toward making effective search for the sustainable development strategy via integrative efforts between multi–dimensional, multi-scale data analysis and environmental system modeling. This could facilitate decision-maker to intimately link the domain knowledge with the envisioned social, economic, ecological, and environmental objectives leading to foster a new interdisciplinary field, environmental informatics.

References

1. Alcamo J., Shaw R., and Hordijk L., eds. (1990). *The RAINS Model of Acidification. Science and Strategies in Europe*. Dordrecht, Netherlands: Kluwer Academic Publishers.
2. Amann M., Bertok I., Cofala J., Gyarfas F., Heyes C., Klimont Z., and Schöpp W. (1996). *Cost-effective Control of Acidifiaction and Ground-Level Ozone*, International Institute for Applied Systems Analysis, Laxenburg, Austria. [An example of an systematic-analytical environmental work.]
3. Balzer K. (1989). *Weather Forecasts*, 160 pp., Leipzig: Urania-Verlag (in German). [An introduction discussing possibilities and limits of weather forecast.]

4. Cellier F. E. (1991). *Continuous System Modelling*, Berlin, New York, Tokyo: Springer-Verlag.
5. Grützner R., ed. (1997) . *Modelling and Simulation in the Sector of Environment*, 350 pp., Braunschweig/Wiesbaden: Vieweg-Verlag (in German). [Proceedings of a simulation conference with some good survey papers.]
6. Günther O. (1998). *Environmental Information Systems*, 244 pp. Berlin, New York, Tokyo: Springer-Verlag. [A book describing techniques of data capture and information technology.]
7. Haimes Y. Y. (1977). *Hierarchical Analysis of Water Resources Systems*, 478 pp., New York: McGraw-Hill International Book Comp. [A book presenting an excellent overview on modeling and optimization of large-scale systems applied to water resources systems.]
8. Haken H. (1978). *Synergetics: An Introduction*, 382 pp. Berlin, New York, Tokyo: Springer-Verlag, German edition 1982. [A pioneer book on principles of self-organization.]
9. Kocak H. (1989). *Differential and Difference Equations through Computer Experiments*, 224 pp. Berlin, New York, Tokyo: Springer-Verlag. [A university text book including a disk with a simulator and a library of fundamental dynamic models.]
10. Mesarovic M. D., Macko D., and Takahara Y. (1970). *Theory of Hierarchical Multilevel Systems*, New York: Academic Press. [A pioneer work reflecting decomposition and hierarchical structures in a broad area of sciences.]
11. Achim Sydow. Environmental Systems Vol, I

Network Security with Comparative Analysis of Cryptographic Techniques

Priyanka K Matekar & Neethu N Panicker
SIES(Nerul) College of Arts, Science & Commerce
MSc-IT (Part-1)(PG Students)
priyamatekar.96@gmail.com, neethupanicker9@gmail.com

Abstract:

Network Security is the most vital component in information security because it is responsible for securing all information passed through networked computers.The hackers and virus writers try to attack the internet and computers connected to the Internet. With the growth in business use of the Internet, network security is rapidly becoming crucial to the development of the Internet. Cryptography is an emerging technology, which is important for network security. Cryptography is a method of storing and transmitting data in a particular form so that only those for whom it is intended can read and process it.In this paper we also perform comparative analysis of various cryptographic techniques.

Introduction:

Cryptography is a word with Greek origins, means
"secret writing".Cryptography a Modern encryption technology, comprising of different mathematical processes involving the application of formulas (or algorithms) was conventionally designed to secure communications. With the Rapid growth of information technology and science of encryption, an innovative area for cryptographic products has stimulated. Cryptography is defined as "the subdivision of cryptology in which encryption /decryption algorithms are designed, to guarantee the security and authentication of data". Cryptography can be classified as Symmetric key algorithm and Asymmetric key algorithm.

Symmetric Key Algorithms:

Symmetric algorithm is also called shared key cryptography [1],[2]. During data transmission, the sender and the receiver share the same key for encryption and decryption. To maintain confidentiality, this key needs to be kept secured. If the key for communication is leaked out the data can be stolen by the attacker. There are different types of symmetric algorithms like Data Encryption Standard (DES), Triple Data Encryption Standard (3DES), Advanced Encryption Standard (AES) and Blowfish.

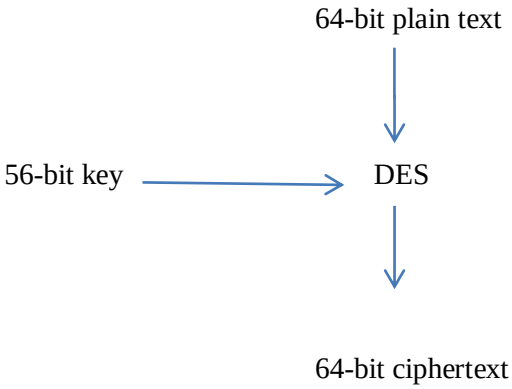
Asymmetric Key Algorithm:

Asymmetric Algorithm is also called public key cryptography. It uses two keys 'Private key' and 'Public key'. During data transmission, the sender encrypts the plain text with the help of public key known as the cipher text and the receiver decrypts this cipher text with the help
of its private key. The different types of asymmetric algorithms are Rivest Shamir Adlemen (RSA), Diffie-

Hellman and Digital Signature Algorithm.

Data Encryption Standard (DES) Algorithm

Data Encryption Standard (DES) is a symmetric key block cipher algorithm which was developed by IBM in 1977. It uses a block size of 64-bits and a key size of 56-bits (where 8bits are the parity bits) to encrypt the plain text which is 64bit in size.



Algorithm:

1. DES takes an input of 64-bit long plaintext and 56-bit key (8 bits of parity) and generates output of 64bit block.
2. The plaintext block is subject to and shift the bits around.
3. The 8 parity bits are removed from the key by subjectingthe key to its Key Permutation.
4. The plaintext and key are processed in 16 rounds consisting of:
   a) The key is split into two 28-bit halves.
   b) Each half of the key is shifted (rotated) byone or two bits, depending on the round.
   c) The halves are recombined and subject toa compression permutation to reduce the keyfrom 56 bits to 48 bits. This compressed keyis used to encrypt this round's plaintextblock.
   d) The rotated key halves from step 2 are usedin next round.
   e) The data block is split into two 32-bithalves.
   f) One half is subject to an ExpansionPermutation to increase its size to 48 bits.
   g) Output of step 6 is exclusive-OR'ed withthe 48-it compressed key from step3.
   h) Output of step 7 is fed into an S-box, whichsubstitutes key bits and reduces the48-bit block back down to 32-bit.
   i) Output of step 8 is subject to a P-box topermute the bits.
   j) The output from the P-box is exclusive-OR'ed with other half of the data block.
   k) The two data halves are swapped andbecome the next round's input.

2DES:

It performs twice same as DES normally do once. Ituses two different key k1 and k2.It firstly performs the DESon the original plain text by k1 key. And then again performencryption on encrypted text with the other key K2.

3DES:

It is enhancement version of DES. And used to remove the meet-in-the-middle attack occurred in 2-DES. In this 3 times iterations of DES encryption on each block isperformed. In 3-DES the 3-times iteration is applied to increase the encryption level and average time.

Rivest Shamir Adlemen (RSA):

The algorithm was developed by Rivest, Shamir and Adlemen in 1977. It is a public key algorithm because it uses two keys pairs to encrypt and decrypt the message. Public key is used by the sender to encrypt the text and is known to all. However, to decrypt the encrypted text
private key of the receiver is used. This private key, as the name suggests is known only to the receiver.
The RSA consists of some mathematical operations through which one can calculate the encryption and decryption keys (e and d), after that one can easily calculate the cipher text
and the plain text by the following formulae
C=M^e mod(n)….(1)
P=M^d mod(n) ….(2)
Where in (1) and (2) M is the original message, e and d are public and private keys and n is a value obtained from mathematical operations in RSA.Although RSA is a secure algorithm,
but in an experiment was done in the application of low private exponent attack in RSA where the author found out that there can be some new weak keys in RSA.Therefore, digital signature concept was introduced in combination with RSA .

Impact of Cryptography on Various Fields:

Technology:

Cryptography provides a variety of powerful cybersecurity tools. It enables more inter product communications,centralized data collection, and remote access, which result in increased workforce efficiency. Cryptography began as the science of hiding information.

Economy:

The tech industry, however, argues that consumers want better security and privacy and that a weaker encryption standard would be a huge economic hit to companies, because consumers would shift to apps and services with strong encryption made overseas.

Comparative Analysis:

This section shows the comparison between DES and RSA algorithm:

Table1: Distinction between DES and RSA algorithm

Features	DES	RSA
Key used	Same key is used forencryption anddecryption Purpose.	Different keys areused for Encryption and decryption purposes.
Scalability	It is scalable algorithm due to varying key size and block size.	No scalability occurs.
Avalanche effect	No more affected.	More affected.

Power Consumption	Low	High
Throughput	Very High	Low
Confidentiality	High	Low

Table2: Execution Time (Milliseconds) of Encryption of Different data packet size:

Input Size(KB)	3 DES	DES	RSA
45	50	25	55
55	44	29	46
96	76	45	89
236	113	39	119
319	155	89	157
560	171	131	169
899	299	240	309
5345.28	1166	1296	1441
Throughput (MB/Sec.)	2.08	3.01	1.67

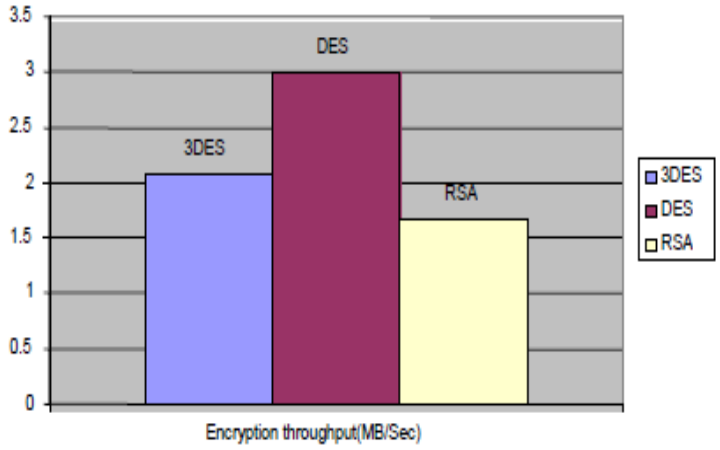
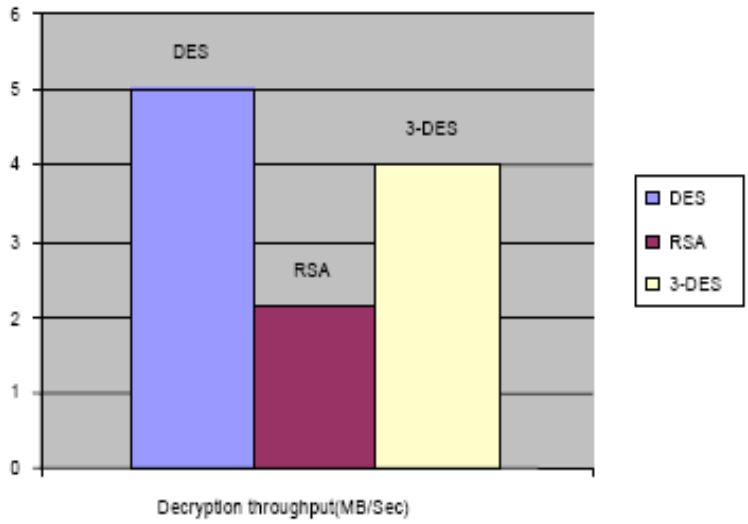


Table3: Execution Time (Milliseconds) of Decryption of Different data packet size

Input Size	3 DES	DES	RSA
45	49	34	61
55	47	22	59
96	63	53	57
236	67	62	64
319	85	98	154
560	161	125	163
899	171	152	183
5345.28	835	783	827
Throughput (MB/Sec.)	4.03	5.012	2.147



Conclusion:

The selected algorithms DES and RSA are discussed with their working mechanisms. As DES is secret key based algorithm suffers from key distribution and key agreement problems .But RSA consumes large amount of time to perform encryption and decryption operation.Results showed that DES has better performance than RSA. From the result, I evaluated that throughput of DES algorithm is much better than the throughput of RSA algorithm. And, I also state that 3DES has more power consumption and less throughput than the DES due to its triple phase characteristics. It had been also observed that decryption of DES algorithm is better than other algorithms in throughput and less power consumption.

Bibliography:

1. 1.International Journal of Advanced Research in Computer Science and Software Engineering-
2. By Dr. Sudesh Jakhar and Mr. Sunil Makkar.
3. 2.International Journal of Emerging Trends & Technology in Computer Science (IJETTCS)
4. 3.Cryptography and network security-By Atul Kahate.

Secured Authentication Technique-3D Password

Namrata Thakur[1], Vinita Mhatre[2], Vrushali Thakur[3]
SIES (Nerul) College of Arts, Science & Commerce
namratathakur544@gmail.com[1], vinitamhatre1213@gmail.com[2],
vrushalithakur111@gmail.com[3]

Abstract

Authentication is a process that ensures and confirms a user's identity. It is mainly provided to secure a system from different type of threats and to ensure authorized user can handle that system. Authentication is an important security service provided to the system by the different authentication schemes or algorithms. And this algorithm includes Text password, Graphical password, Biometric password, Token authentication etc. Text password mostly includes simple text (clear text) which may include names, any dictionary word, car name etc. And nowadays, text password can be easily cracked. Biometric identifiers are simply physiological versus behavioral characteristics which include fingerprint, palm veins, face recognition, DNA, retina etc. In Graphical password, user selects images in a specific order, presented in a graphical user interface. And tokens are smart cards like credit card etc. But cards can be stolen, and some people don't want to carry their cards, some refuse to undergo strong IR exposure to their retinas. Therefore the secure authentication scheme introduced called '3D PASSWORD'. It is combination of all this scheme that is Recognition + Recall + Token + Biometric. 3D password is multi-factor authentication technique which has virtual environment containing the user interface which looks like a real time environment, but it is actually not a real time environment. It is more secure than other schemes of authentication.

Introduction

Authentication is a process that ensures and confirms a user's identity. To improve authentication and avoid password hacking with management policies that enforce password expiration, length and complexity requirements. User ID and password systems are among the oldest forms of digital authentication. To protect any system authentication must be provided, so that only authorized persons can have right to use or handle that system & data related to that system securely. There are many authentication algorithms are available some are effective & secure but There are some authentication techniques are as follows.

Types of authentication:

Fig: Types of authentication

1. **Simple Password**: Password Protection is security process that protects information accessible via computers that needs to be protected from certain users. Password protection allows only those with an authorized password to gain access to certain information.
2. **Token Based:** A token is a piece of data created by server, and contains information to identify a particular user and token validity. The token will contain the user's information, as well as a special token code that user can pass to the server with every method that supports authentication, instead of passing a username and password directly. Examples Credit Cards, ATM Cards, Master Card etc.
3. **Biometric Authentication:** Biometric Authentication is any process that validates the identity of a user who wishes to sign into a system by measuring some intrinsic characteristic of that user. Biometric Authentication depends on measurement of some unique attribute of the user. They presume that these user characteristics are unique, that they may not be recorded and reproductions provided later, and that the sampling device is tamper-proof. Biometric samples include finger prints, retinal scans, face recognition, voice prints and even typing patterns.
4. **Graphical password:** In this user need to identify, recognize password created be-fore. Recognition based authentication can be used in graphical password. Generally this technique is not use much more as Recall based is used. Still both recall based & recognition based authentication techniques having some drawbacks & limitations when they are used separately or used single authentication scheme at a time.

But to improve the security we are introducing 3D password as current schemes have many of the flows. 3D password has a virtual environment which looks as a real. A virtual 3D password provides means to the user or programmer to combine all the permutations & combinations of existing system into 3D virtual environment. 3D password technique is very flexible gives user to create infinite number of password possible. It is easy to remember and difficult to hack.

Existing System

The authentication schemes we are using nowadays suffer from many weaknesses. Existing System includes techniques like text password, graphical password, and biometric, token based authentication. As the text password is simple text it can be easily hacked with the help of brute force attacks. Graphical password have a space that is less than or equal to the textual password space. Tokens including different kind of smart cards can be stolen. Therefore, biometric authentications have been proposed. However, users tend to resist using biometrics because of their intrusiveness and the effect on their privacy. Moreover, biometrics cannot be revoked. Therefore 3D password technique has been proposed. It is multifactor authentication scheme. It combines multiple authentication techniques in one 3D virtual environment. It is combination of recall, recognition, token and biometric.3D password provides extremely high degree of security to the user.

Proposed System

The proposed 3D password is a multi-factor authentication technique which has virtual environment containing the user interface which looks like a real time environment, but it is actually not a real time environment. This system utilizes all the positive aspects of the existing authentication systems. Users are provided the flexibility to choose between application of 3D password by being just recall based, recognition based, and token based, biometric based. It can also combine

two or more of the above schemes as a 3D password. Therefore it ensures higher acceptability by the user with such a system he can mould in his way of convenience. The secure authentication technique called 3D password is combination of all this scheme that is Recognition + Recall + Token + Biometric. This can be done by designing a 3D virtual environment that contains objects that request information to be recalled, information to be recognized, tokens to be presented, and biometric data to be verified.

The 3D password is therefore nothing else but the sequence of interactions with the virtual objects that is

1) Pre created
2) Pre stored
3) Verified by the user.

This kind of interaction in a 3D environment projected on a 2D environment is termed a pass action.

Fig: 3D password system

Objectives:

Flexibility: In 3D password technology, a 3D password provides multifactor authentication such as biometric and textual passwords can be embedded in it.

Strength: It provides almost unlimited password possibility.

Easy to Remember: it can be remembered easily as a short story.

Privacy: organizers have option. Organizers can choose authentication designs that respect user's privacy.

Therefore this system constitutes interaction with only those objects that perform acquisition of information from the user that he is comfortable to provide. It ignores interaction with the rest of the objects that might demand the information which the user might not want to provide to the system.

Fig: Interface of 3D password

We can have the following objects:

1. A computer with which the user can type;
2. A fingerprint reader that requires the user's fingerprint;
3. A biometric recognition device;
4. A paper or a white board that a user can write, sign, or draw on;
5. An automated teller machine (ATM) that requests a token;
6. A light that can be switched on/off;
7. A television or radio where channels can be selected
8. A staple that can be punched;
9. A car that can be driven;
10. A book that can be moved from one place to another;
11. Any graphical password scheme;
12. Any real life object;
13. Any upcoming authentication scheme.

Working

Consider a three dimensional virtual atmosphere space that is of the size G×G×G. Each point in the

three dimensional atmosphere space represented by the coordinates. (x, y, z)∈ [1…G] × [1...G] ×[1…G].The entities are distributed in the three-dimensional virtual atmosphere. Every entity has its own (x, y, z) coordinates. Assume the user can navigate and walk through the three-dimensional virtual atmosphere and can see the entities and interact with the entities. The input device for interactions with entities can be a mouse, a keyboard, stylus, a card reader, a microphone…etc.

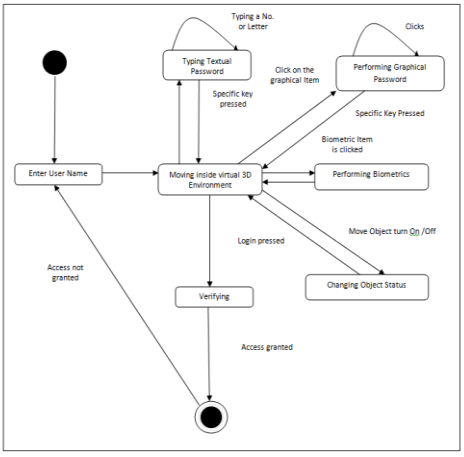


Fig: State diagram of 3D password

For example, consider a user who navigates through the 3D virtual atmosphere that consists of a temple area. Let us assume that the user is in the virtual area and the user turns around to the bell located in (9,16, 80) and rings it. Then the user touch deity feet. The user types "KRISHNA" into a computer that exists in the position of (10, 5, 25). The user then walks over and turns off the light located in (15, 6, 20), and then goes to a white board located in (55, 3, 30) and draws just one dot in the (x, y) coordinate of the white board at the specific point of (420,170). The user then presses the login button. The initial representation of user actions in the 3Dvirtual atmosphere can be recorded as follows:

(9, 16, 80) Action = Ring the bell;

(9, 16, 80) Action = touch deity feet;

(10, 5, 25) Action = Typing, "K";

(10, 5, 25) Action = Typing, "R";

(10, 5, 25) Action = Typing, "I";

(10, 5, 25) Action = Typing, "S";

(10, 5, 25) Action = Typing, "H";

(10, 5, 25) Action = Typing, "N";

(10, 5, 25) Action = Typing, "A";

(15, 6, 20) Action = Turning the Light Off;

(55, 3, 30) Action = drawing, point = (420,170);

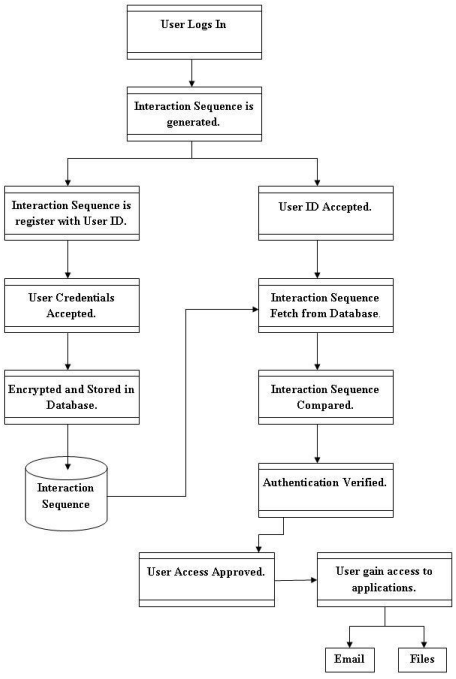


Fig: 3D password Technique

Security Analysis

It is necessary to consider all possible attack methods to realize and understand how far an authentication scheme is secure. It is important to understand if authentication scheme proposed is

immune against such attacks or not. Moreover, if the proposed authentication scheme is not immune, we then have to find the countermeasures that prevent such attacks. The countermeasures to such attacks are detailed in this section.

1. Brute Force Attack
2. Well-Studied Attack
3. Shoulder Surfing Attack
4. Timing Attack

Advantages

1. Provides security.

2. This 3D password can't take by any other person.

3. 3D graphical password has no limit.

4. Password can change easily.

5. Implementation of the system is easy.

6. Password can remember easily.

7. This password helps to keep lot of personal details.

Disadvantages

1. Difficult for blind people to use this technology.

2. Requires sophisticated computer technology.

3. Expensive.

4. A lot of program coding is required.

Future Scope

As 3D password scheme uses a combination of Recognition + Recall + Token + Biometric, it mainly focuses on critical systems and resources. Critical System such as military facilities, critical servers and highly classified areas can be protected by 3D password system with large three dimensional virtual atmospheres. Moreover, airplanes and jet fighters, ATM's and operating system's logins can also make use of 3D passwords to provide more secure authentication.

Conclusion

The 3D password is a multi factor authentication scheme that combines the various authentication schemes into a single 3D virtual environment. Design of the 3D virtual environment is the selection of objects inside the environment and the object's type reflect the resulted password space. Its password space is very large compared to any existing authentication scheme. It is a task of system administrator to design the environment and to select the appropriate object that reflects the protected system requirements. Its design is simple and easy to use 3D virtual environment is a factor that leads to a higher user acceptability of 3D password system.

References

1. Fawaz A. Alsulaiman and Abdulmotaleb El Saddik, "A Novel 3D Graphical Password Schema, IEEE International Conference on Vir-tual Environments, Human-Computer Interfaces, and Measurement Systems, July 2006.
2. https://www.uniassignment.com/eassy-samples/information-technology/secured- authentication-3d-password-information technology-essay.php
3. https://www.slideshare.net/mobile/Gowsayasn/3d-password.ppt
4. www.seminarsonly.com/Labels/3D-password- technology.php

Third Party Attacks in Ecommerce Websites

Padmaleela Damaraju[1*] and Dr.Sudarson Jena[2]

[1]Dept of Computer Science-IT, SIES College of Arts, Science & Commerce, Nerul, Navi Mumbai

[2]Gitam University, Vishakapatnam

*padmaleela1970@gmail.com

Abstract

With the tremendous increase in the Ecommerce sector in India, more and more retailers are turning to the internet for increasing their sales. These small retailers use third party plugins to manage their business. According to a study conducted by the Internet and Mobile Association of India, the e-commerce sector is estimated to reach Rs. 211,005 crores by December 2016. The study also stated that online travel accounts for 61% of the e-commerce market. Owing to security threats, there is a large section of people who are scared of online payment, which ultimately affects the business of retailers. Any attack on these websites not only leads to loss of revenue but also decrease in consumer faith is doing online transactions. Hackers are increasingly using these plugins to launch attacks on websites. Knowledge of the types of attacks will help in preventing these attacks and help companies in taking preventive measures. This paper surveys some of the common third party attacks launched on ecommerce websites and how to prevent them.

Keywords *— E-Commerce Third party attacks, Security measures, Online Shopping third party attacks, Security Threats, Secure online shopping guidelines*

Introduction

There are a number of reasons why Ecommerce web sites are prone to attacks. One of the main reasons is that in a rush to add functionality to a web site, programmers often integrate third party tools with their web site to offer their customers the best of their online shopping experience. The second reason is that for many small retailers it involves integrating third party Ecommerce platforms to boost their revenues. As a result safety is not given much importance and keeping these sites safe from hacking and fraud becomes much more difficult. And as small business owners know all too well, one major breach could mean the end of their business.

This paper examines some of the threats to E-Commerce web sites through third party platform plug-in and how they can be addressed.

The first section of the paper examines the possible security threats and the second section looks at some of the possible solutions to these threats.

I. TYPES OF ECOMMERCE PLUG-INS

Every Ecommerce web site today involves integrating 3rd party plug-ins for adding the latest must-have consumer features, the appropriate site analytics and marketing metrics, or integrating business process applications into your website. The ecosystem of ecommerce and business applications has evolved: highly specialized vendors now offer every kind of specialty tool, plug-in feature and business operations application

imaginable and still new applications are appearing every day. Plugins or extensions are separate software components that add addition functions and power to an existing software or application.

ECommerce Partners can help integrate a host of these plug-ins to augment the core website with applications that help meet business goals and can transform the website into a dynamic and sophisticated consumer experience. The end result will be an engaging, seamless, and unified experience for the consumer and internal staff.

The following are some of the applications plug-ins which can be integrated into Ecommerce websites:

1. Consumer Experience Applications: These are applications that enhance the consumer's experience on website by offering additional features, tools or services. Examples include:

Alternative payment processing: Various solutions enable consumers to pay for ecommerce transactions via debit cards, ATM cards, phone cards, in foreign currencies, or through Amazon, PayPal, Google Checkout, etc.

2. Sophisticated Site Search and Recommendations: Several vendors provide specialty feature-based and dynamic filter search engines, support auto-complete and type-ahead search, and offer product recommendations systems, predictive recommendations, customizable product finders or step-by-step diagnostic "wizards", as well as various options to enable the dynamic reordering of product listings in the catalog to help increase conversion, the number of sales and the value of each sale.

3. Online Merchandising & Product Catalog Tools: Specialty catalog viewers can show your traditional product catalog in engaging ways. Online merchandising tools will optimize which products are featured at what price and in what order and ensure the listings are always fresh and compelling. Product customization tools and step-by-step wizards can guide the consumer through customizing their own specialty products.

4. Imaging & 3D Visualization Tools: Possibilities range from 3D rendering, animation, dynamic customized views of products, immersive virtual product environments, 360-degree product views and pans, customizable virtual mannequins, photo albums etc.

5. Business Intelligence & Website Analytics: These help to determine what the customers are doing online so one can optimize site performance and sales. These analytics answer key questions like, what offers drive consumer response, how consumers navigate the site, how many actions or clicks it took for the user to make a transaction, how much time consumers are spending on the site, how frequently they visit, how much they spend per transaction, where they enter and exit the site etc.

6. Email Marketing Solutions, which allow the retailers to reach out to established customer base through integrated email campaigns that direct them to customized website landing pages, product offers with special pricing and more.

7. Innovative Point of Sale (POS) solutions: These enable to track sales and inventory

over multiple stores and locations and integrate offline sales with your Internet sales for an aggregate analysis of all

8. Business Operations Management Applications: These are back-office applications that require integration with ecommerce website for the most smooth-running, efficient business operations and supply chain management.

9. Inventory Management, Warehousing & Fulfillment: Just like supply-side supply chain efficiently has to be managed, one may have a complex fulfillment chain that is initiated by an ecommerce transaction, or costly overhead for warehousing product, or a need for sophisticated, just-in-time inventory management and delivery systems. The ecommerce transaction sets off a highly coordinated and often global chain of events that is critical to business; so one must ensure that the integration of online orders is seamless.

10. Customer Relationship Management (CRM): These applications help to track, group, target, and monitor customer relations, be it for sales, service or support. On-site support is often the first avenue for customer complaints making sure customer have a positive experience.

II. TYPES OF ATTACKS

All these third party applications have some vulnerability which are exploited by the attackers to cause security and privacy breaches like identity theft and financial fraud. Some of these attacks have utilized vulnerabilities in reusable third-party components utilized by CMS content management systems) , such as the plugins described above . Other attacks have used vulnerabilities that are common in any web application, such as SQL back ends or scripts. Ransomware is one of the less known attacks but is becoming increasingly popular among hackers.

The following are some of the common attacks launched on ecommerce web sites and some ways to prevent these attacks.

SQL Injection : SQL injection refers to the insertion of SQL meta-characters in user input, such that the attacker's queries are executed by the back-end database. Typically, attackers will first determine if a site is vulnerable to such an attack by sending in the single-quote (') character. The results from an SQL injection attack on a vulnerable site may range from a detailed error message, which discloses the back-end technology being used, or allowing the attacker to access restricted areas of the site because he manipulated the query to an always-true Boolean value, or it may even allow the execution of operating system commands.

SQL injection techniques differ depending on the type of database being used. For example, on an Oracle database it is done primarily using the UNION keyword which is much more difficult than on the MS SQL Server, where multiple queries can be executed by separating them with the semi-colon . In its default configuration, MS SQL server runs with Local System privileges and has the 'xp_cmdshell' extended procedure, which allows execution of operating system commands.

To prevent SQL injections, the following measures need to be adopted:

- Constrain and sanitize input data. Check for known good data by validating for type, length, format, and range.
- Use type-safe SQL parameters for data access. ...
- Use an account that has restricted permissions in the database. ...
- Avoid disclosing database error information..

Unpachted vulnerabilities in CMS

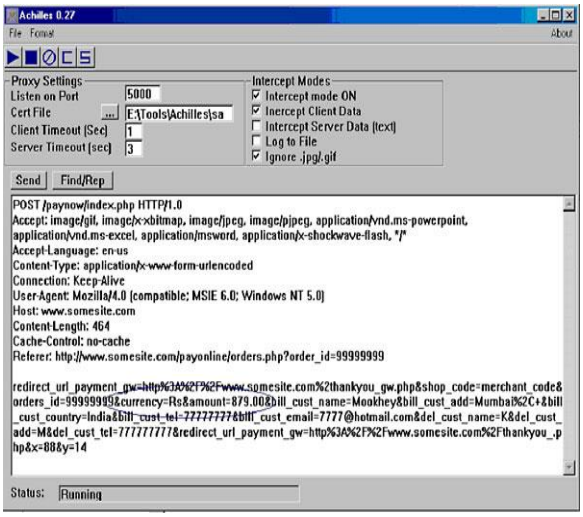
CMS(content management systms) provide a wide variety of functionality like publishing, modifying content, organizing data and managing users. Vulnerabilities in these systems, that are left unpatched are often targeted and used as a foothold to install backdoor programs. A backdoor attack can lay in wait for days, months or even years and wait for the appropriate moment for the underlying actors to return to use it to gain access again.

These attacks can be prevented by having regular vulnerability scans of websites and web applications. Implementing a formal patch management process also can prevent these attacks.

Price Manipulation

Price manipulation is a type of attack that occurs only in online shopping sites. When the customer checks out after completing his shopping the total payable price of the purchased goods in the cart is stored in a hidden HTML field of a dynamically generated web page. An attacker can use a web application proxy such as Achilles to simply modify the amount that is payable, when this information flows from the user's browser to the web server. The following image shows one such manipulation of the payable amount using Achilles

.



F*igure 1*. **Achilles web proxy**

The attacker can then manipulate the final payable amount (currency=Rs&amount=879.00) to a value of his choice. This final amount is sent to a payment gateway with whom the online merchant has partnered. This kind of attacks may go unnoticed and or sometimes discovered too late for any counter measures to be implemented.This eventually can lead to a heavy loss of business for the merchant.

The only way to prevent this attack is to remove the price variable from the HTTP headers and cookies entirely and having just the item number in the HTTP headers. Also the price should be pulled from the database and double-checked through some mechanism so the price is validated back by the server making sure that the price user paid was actually the price of the item.

Buffer overflows

Buffer overflow vulnerabilities are very common in shopping cart or other web applications which use common scripting languages like Perl, PHP, ASP, etc. In this kind of attacks the attacker inputs a large number of bytes to an input field in an web application which is not geared to deal to with such large amounts of data .This leads to unexpected consequences like error messages being thrown which disclose the path of the functions being used in the script . For example the image below shows the PHP error that was

thrown when 6000 or more bytes were fed into a particular field .This error revealed the location of these PHP functions

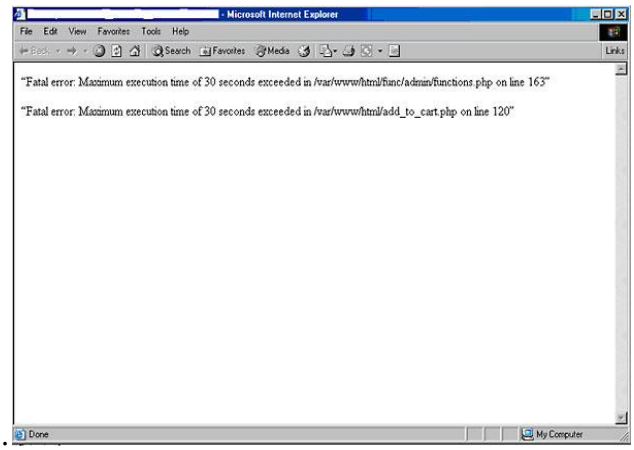
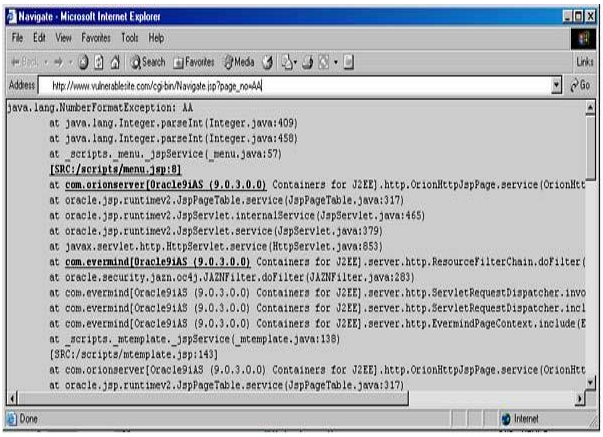


figure 2 .PHP Timeout error

Using this error information it was possible to access the restricted 'admin' folder in $DocumentRoot.

Error pages can serve as a valuable source for critical information. These errors can be induced in web applications that do not follow strict input validation principles. For instance, the application may expect numeric values and would fail when alphabets or punctuation characters are supplied to it. In the following example , a e-commerce website used numbers for its various pages. Users would navigate using a link such as http://www.vulnerablesite.com/jsp/Navigate.jsp ?pageid=123. By manipulating the URL and supplying the value 'AA' as the pageid, an error was induced.



F*igure 3: Discovering information through navigation errors*

Cross-site scripting

The Cross-site Scripting (XSS) attack is primarily targeted against the end user and leverages two factors:The lack of input and output validation being done by the web application

- The trust placed by the end-user in a URL that carries the vulnerable web site's name.

The XSS attack requires a web form that takes in user input, processes it, and prints out the results on a web page, which also contains the user's original input. It is most commonly found in 'search' features, where the search logic will print out the results along with a line such as 'Results for <user_supplied_input>'. In this case, if the user input is printed out without being parsed, then an attacker can embed JavaScript by supplying it as part of the input. By creating a URL, which contains this JavaScript, a victim can be social engineered into clicking on it, and the script executes on the victim's system.

A typical XSS attack URL would look like this: http://www.vulnerablesite.com/cgi-bin/search.php?keywords=<script>alert("OK")<script>. In this case, when the victim clicks on this link, a message box with the text "OK" will open up on his system.

These can of attacks are used in order to try and steal the user's cookie, which might probably contain the session ID and other sensitive information. The JavaScript could also be coded to redirect the user to the attacker's website where malicious code could be launched using ActiveX controls .

A bigger threat can be posed when the JavaScript can also be used to redirect the user to a site that looks similar to the original web site. This web site can then be used to ask the visitor to enter sensitive information such as his authentication details for that web site, or his credit card details The image below shows one such attack where the visitor has been tricked into supplying his credit card details into an pop up window . When the submit button on this window is hit ,the information wassubmitted to the hacker's server.

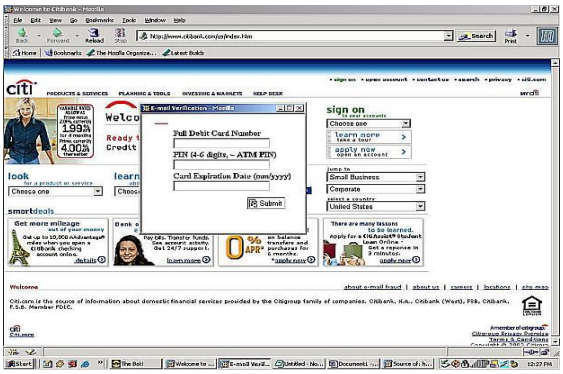


Figure 4: Phishing scam (Source: Article on SecurityFocus http://www.securityfocus.com/infocus/1745)

Called a 'phishing' attack , it was done by sending a spoofed email that claimed to originate from Citibank and asked users to verify their details.

The link in the spoofed email had an url like this: http://www.citibank.com:ac=piUq3027qcHw003nfuJ2@sd96V.pIsEm.NeT/3/?3X6CMW2I2uPOVQW.

Novice users would be unable to figure out that this link would actually go to sd96v.pisem.net and not www.citibank.com.

The following are some of the ways to prevent a session hijacking:

- ✓ Validating input for type, length, format and range whenever data passes through a trust boundary, say from a Web form to an application script, and then encoding it prior to redisplay in a dynamic page
- ✓ user input can be forced down to a minimal alphanumeric set with server-side processing before being used by Web application in any way.
- ✓ Using the meta tag to reduce the number of possible forms a script injection can take place –restrict to English and most european languages

e.g. <META http-equiv="Content-Type" content="text/html; charset= ISO-8859-1">

Weak Authentication and Authorization

Authentication mechanisms that do not prohibit multiple failed logins can be attacked using tools such as Brutus. Similarly, if the web site uses HTTP Basic Authentication or does not pass session IDs over SSL (Secure Sockets Layer), an attacker can sniff the traffic to discover user's authentication and/or authorization credentials.

Since HTTP is a stateless protocol, web applications commonly maintain state using session IDs or transaction IDs stored in a cookie on the user's system. Thus this session ID becomes the only way that the web must be designed and if necessary the architecture itself may be modified.

Some Countermeasures should also include:

1. Using strict input validation routines
2. A 3-tier modular architecture

application can determine the online identity of the user.

If the session ID is stolen say through XSS, or it can be predicted, then an attacker can take over a genuine user's online identity vis-à-vis the vulnerable web site.

Ransomware:

Ransomware is characterized by malware that prevents users, typically through encryption, from accessing their system, file shares or files. After gaining access and control, threat actors hold the data for "ransom" until the user agrees to pay money to regain access to their data.

The only reliable way to defend against this threat is to ensure that the website is secure. It is recommended to run a daily automated scanning and for the website administrators to deploy file integrity monitoring systems. These types of operations can also be quickly spotted on regularly updated Web applications.

Counter measures

'Prevention is better than cure'. Going by this old adage it is better to have a security features incorporated into the applications at design stage itself and to have a risk assessment exercise to identify the key information assets that the web application will be dealing with. These could include configuration information, user transaction details, session IDs, credit card numbers, etc. Each of these information assets needs to be classified in terms of sensitivity. Depending upon the tentative architecture chosen, the developers along with security experts must analyze the threats, impact, vulnerabilities and threat probabilities for the system. Once these risks are listed out, system countermeasures

3. Use of open-source cryptographic standards, and other secure coding practices.
4. Use of HTTP with SSL that is HTTPS

5. Making sure the site is PCI DSS compliant
6. Keeping the site updated

IV.CONCLUSION

The vulnerabilities discussed in this article are now just limited to shopping cart applications. They can be exploited in any web site which uses third party plug–ins. However they attacks launched on Ecommerce web sites have huge implications not only for the merchants but also for the customers because of the nature of the information that is exchanged. They lead to enorrmous loss of revenue for the merchant and pose great financial risks for the customers when sensitive information like their credit card numbers are revealed to fraudsters. In such a scenario it is highly recommended that companies have regular security audits and invest in security measures to mitigate these attacks and make the Online shopping market pace a safe and fun experience for their customers

.

V. References

1. P.S.Lokhande,B.B.Meshram,*EcommerceApplications:Vulnerabilities,Attacksand Countermeasures,* Volume 2, Issue 2, February 2013, International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) ISSN: 2278 –*4.* 1323
2.
3. Niranjanamurthy M , DR. Dharmendra Chahar , *The study of E-Commerce Security Issues and Solutions* ,Vol. 2, Issue 7, July 2013, International Journal of Advanced Research in Computer and Communication Engineering ISSN (Print) : 2319-5940, ISSN (Online) : 2278-1021
www.symantec.com/connect/.../common-security-vulnerabilities-e-commerce-systems

Cyber Attacks and the Applicability of Existing International Law

Micheal Rosepreethi[1], Singh Alark[2], Yadav Seema[3]

[1, 2, 3]SIES (Nerul) College of Arts, Science & Commerce

rosepreethimic@gmail.com , alarksingh77@gmail.com seemay162@gmail.com

Abstract:

The ever increasing technology of the information age has led to unprecedented access to information, increases in capabilities and the evolution of cyberspace. However, the great advances come with a danger. Information stored on both government and private networks. The purpose of this paper to provide an overview: (a) of the potential restraints imposed on cyber warfare by existing international law, (b) of the most important difficulties and controversies raised in the interpretation and application of international law to cyberwarfare, and (c) of the potential humanitarian impacts of cyberwarfare. In view of the constraints in terms of time and space, the envisaged overview cannot be exhaustive but will have to remain selective, focusing on providing a general understanding of the issues most relevant to contemporary state practice. Moreover, in view of the technical and legal complexity of the matter and the still rudimentary state of legal research, the ambition of this paper must remain limited to identifying issues and putting them into context, but cannot be to authoritatively resolve them. Said, this paper will focus on examining the following areas of international law

1. *Under the law governing the resort to force between states*
2. *Under the law of neutrality*
3. *Under the law of armed conflict*

Introduction:

Under the law governing the resort to force between states, it will

have to be determined in what circumstances, if any, cyber operations can amount to (a) an internationally wrongful threat or use of "force", (b) an "armed attack" justifying the resort to necessary and proportionate force in self-defence, or (c) a "threat to international peace and security" or "breach of the peace" subject to UN Security Council intervention.

Under the law of neutrality, the questions arise as to whether belligerents can lawfully use the telecommunications infrastructure of neutral states for the purpose of cyber attacks, and what the responsibilities of "neutral" states are with regard to non-state belligerents conducting attacks from within or through its territory or infrastructure.

Under the law of armed conflict (*jus in bello*), here referred to as international humanitarian law (IHL), "cyber warfare" must be distinguished from phenomena that are not necessarily governed by IHL, such as "cyber criminality" and "cyber terrorism". Where IHL does apply, it must be clarified to what extent its rules and principles, designed to govern traditional means and methods of warfare, can be

transposed to cyber warfare. In doing so, the focus will be on the rules and principles of IHL governing the conduct of hostilities rather than those governing the protection and treatment of persons in the hands of a party to an armed conflict, which is an area less relevant for cyber warfare.

The Importance of the Law of Armed Conflict in Cyber Operations Security

When a cyber weapon is deployed or implanted, is this something that is quite distinct from a kinetic weapon? Lawyers have struggled with concepts such as „armed conflict" and „armed attack" over the years.

There is however general consensus that we need to look at the consequences, or in the cyber context, indirect consequences of deploying malware which is regulated by international law.

As we have not yet witnessed cyber warfare of that kind, we are still in the process of understanding how the law applies; it will develop in time, and the law on this issue will become clearer. These two bodies of law (IHL and jus ad bellum) are there to prevent conflict and in the event of armed conflict, to restrain parties to that conflict. If we understand how the law applies to potential cyber warfare, we can apply it. It is important for international lawyers to be clear on how the rules constrain all the parties and the need for international lawyers to engage with this question.

One of the main problems is one of attribution. A state is entitled to act in self-defence with regard to an armed attack (kinetic or otherwise). However, cyber presents a particular challenge: to identify who was responsible for the attack.

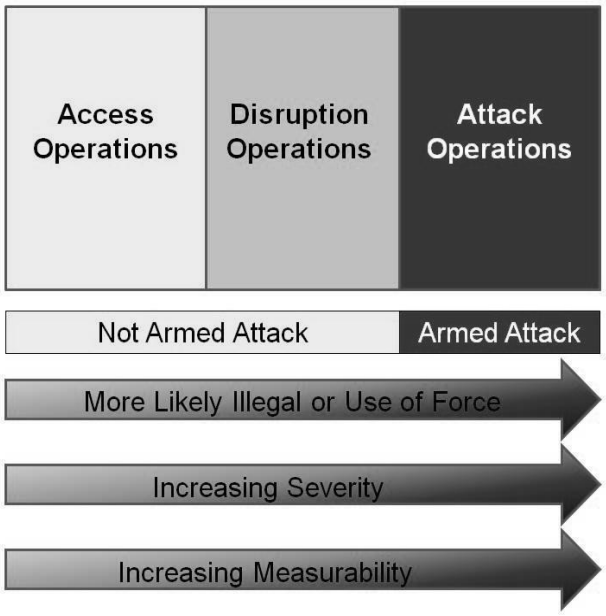
This problem of attribution, which is not witnessed in other types of warfare, causes difficulties. There are several questions:

1) Who is attacking and on what basis?
2) If the attack is by non-state actors, are they getting any state support?
3) If so, what degree of involvement is there?

These questions are important so that we can develop robust rules and are prepared if it does happen in some point in the future. Although the majority of „attacks" to date are thought to be by non-state actors – (hackers, criminal networks, etc.)

– clearly, some will be by states (primarily espionage-related). Non-state actors currently do not have the same capabilities as states. However we need to go beyond the state-state paradigm and think about how the law constrains the use of force by states in the event that non-state actors develop the capability of causing equivalent harm and destruction as states. Turning to the rules governing armed conflict, cyber capabilities may in fact result in conclusions that are different from what might be expected. For example, in the context of attacks, there is an obligation to attempt to minimise civilian causalities. This raises the question as to whether there is an onus or obligation on technologically sophisticated states to use cyber weapons that will cause less civilian damage than a bomb? Such questions are important and warrant careful consideration.

Cyber access operations:



The DOD Strategy for Operating in Cyberspace focuses on five strategic initiatives:

- Treat cyberspace as an operational domain to organize, train, and equip so that DoD
- can take full advantage of cyberspace‟s potential.
- Employ new defense operating concepts to protect DoD networks and systems.
- Partner with other U.S. government departments and agencies and the private sector to enable a whole-of-government cyber security strategy.
- Build robust relationships with U.S. allies and international partners to strengthen collective cyber security.
- Leverage the nation‟s ingenuity through an
- exceptional cyber workforce and rapid technological innovation.20

The Effects of Cybercrime on the Global Economy

Within the past few weeks, news of the cyber-hack into Sony Pictures' confidential files has demonstrated once again the undeniable influence that individuals can hold over a major corporation due to the empowerment of the globalization of modern technology. Unlike any other time in human history, the rise of the "Information Age," which has led largely to positive global effects like easing barriers to trade.

Regarding the international system as a whole, cyber-attacks cause a major stumbling block for global economic growth due to its detrimental effects on innovation and the theft of ideas. Many small businesses without adequate protection are hacked without any knowledge of the act until their sales greatly suffer years later due to competitors gaining knowledge of the company's logistics, target markets, or personal information. As shown by the Sony attack, even some of the largest companies involved in software development can still fall victim to these attacks, but fortunately international collaboration has begun

to show signs of reducing the rate of cyber crime. Therefore, as technological advances continue to spur on the efficiency in global commerce, firms must focus on protecting their personal and corporate information from information traders involved in the illicit markets of cybercrime.

Annual reports

Systematically imply that cybercrime expenses will continue to skyrocket to the point where it may be too late to ask questions and derive conclusions (but truth needs dialogue and dialogue needs questions):

a. Targeted attacks wouldn't be nearly as access often granted to users without a second thought. An industry analyst report by Force point and Ponemon Institute recently proved that privileged users are the riskiest in an organization.
b. A recent report by Cyber security Ventures predicts that annual computer crime costs will jump to $6 trillion by 2021.
c. According to a 2014 report by McAfee (PDF), the annual cost to the global economy from cybercrime is more than $400 billion.
d. According to a 2015 report by British, insurance businesses lose some $400 billion a year due to cyber-attacks. Losses include direct damages and post-attack disruptions, which both affect the course of normal internal processes.

Ransomware alone, such as the currently active Zepto virus, make millions out of cyber extortion. The FBI says that ransomware operators collected $209 million in the first quarter of 2016.On one hand, these losses may even be bigger when related costs from the same attacks are added to the loss equation. On the other, some victims prefer not to report the crime and deal with it on their own (meaning the number could be even bigger).Shortly said, cyber crime is profitable, and all these ghastly numbers serve to depict its increasing effect on the world economy.

The Effects of Cybercrime on the Money

In cybercrime, truth is in the eye of the beholder. And if in any other research or business field it is somehow easy to define cause and consequence, in cybercrime it is not.

Perhaps it is due to its complexity and multi-layered character that cybercrime has become a business more Profitable than the drug trade. According to the 2013 Europol Serious and Organized Threat Assessment, the total global impact of cybercrime has jumped to $3 trillion, making it more lucrative than the global trade in marijuana, cocaine and heroin combined.

In that sense, a financial loss to one is profit to another. On the other hand profits these are criminal's "businesses" l malware attacks, data breaches and IT security-related incidents that all help shape cybercrimes platinum status. In man single maliciously crafted email. Cybercrime is indeed the biggest threat to companies and organizations –be it commercial or bureaucratic. Its unprecedented success proves that classical cyber-protection approaches fail more often than not, and that threat actors and attack initiators are frequently found where least expected (i.e. within the organization).

Real Life Example:

Bank informs RBI of security breach: Axis suffers cyber attack, hires EY to probe damage MUMBAI: A month ago, an official of Axis BankBSE 1.95 % - - India's third largest private sector lender -- received an unexpected telephone call. The caller, an engineer at Kaspersky Lab, the well-known Moscow-headquartered cyber security firm, rattled off the names of several Axis computers which, he claimed, have been breached. The Kaspersky man said his firm had stumbled on the information in the course of a separate probe. When an Axis team looked into the bank‟s servers, it found out that there was indeed an unauthorized login by an unnamed, offshore hacker.Last week; Axis filed a preliminary report about the breach to RBI. The bank has hired EY, the audit and advisory firm, to carry out an investigation. Till now there are no reports of any fund transfers but the bank and EY are trying to figure out the extent of damage, data loss if any, and most importantly whether the virus is still crawling in the institution‟s server zone, said a banker who is aware of the breach.

Conclusion:

As has been shown, as far as international law is concerned, the phenomenon of cyber warfare does not exist in a legal vacuum, but is subject to well established rules and principles. That being said, transposing these pre-existing rules and principles to the new domain of cyberspace encounters certain difficulties and raises a number of important questions. Some of these questions can be resolved through classic treaty interpretation in conjunction with a good measure of common sense, whereas others require a unanimous policy decision by the international legislator, the international community of states. It has been attempted in this paper to identify the most important of these questions and to make suggestions as to possible avenues for their resolution. For the time being, cyber warfare has not had dramatic humanitarian consequences, and it is to be hoped that this state of affairs will not change in the future. The potential for human tragedy, however, is already enormous, and it is likely to increase with our growing dependence on computer-controlled systems to sustain our daily lives. It is all the more important; therefore, that states be aware not only of their legal duty to examine whether new weapons and methods employed in cyber warfare would be compatible

With their obligations under existing IHL, 176 but also of their moral responsibility towards generations to come

References

Barrett, Devlin (5 June 2015). "U.S. Suspects Hackers in China Breached About four (4) Million People's Records, Officials Say". Wall Street Journal. Retrieved 5 June 2015.

1. **Jump up^** *"U.S. gov't hack may be four (4) times larger than first reported".*
2. **Jump up^** *Sanders, Sam (4 June 2015). "Massive Data Breach Puts 4 Million Federal Employees' Records At Risk". NPR.*
3. 22Harold Koh, “International Law in Cyberspace,” scripted commentary, Ft. Meade, MD USCYBERCOM, September 18, 2012.
4. 23Leon Panetta, “Remarks by Secretary Panetta on Cybersecurity to the Executives for Nation Security,” scripted commentary, New York, NY, October 11, 2012.
5. 24George Franz, “The Cyber Domain Operations in Cyber Battlespace,” briefing slides, Carlisle Barracks, PA,

U.S. Army War College, December 14, 2012.
6. 25Ibid.
7. 26Ibid.
8. 27Aram Roston, "DOJ Plans to Indict State-Sponsored Cyber Attackers," December 18, 2012, http://www.defensenews.com/article/20121218/ C4ISR01/312180009/DOJ-Plans-Indict-State-Sponsored-Cyber-Attackers?odyssey=tab|topnews|text|FRONTPA GE (accessed December 19, 2012).
9. 28Department of Defense, *Fact Sheet: Defense Industrial Base (DIB) Cybersecurity Activities* (Washington, DC: The Department of Defense, May, 2012).
10. 29U.S. Senate Committee on Armed Services, *Senate Armed Services Committee Completes Conference of National Defense Authorization Act for Fiscal year 2013* (Washington, DC: U.S. Senate Committee on Armed Services, December 2012), 25.

Yogita Y. Sawant[1] and Sagar Karkhanis[2]

[1, 2] JVM's Mehta College, Airoli, Navi Mumbai

yogita.y.sawant@gmail.com, karkhanissagar@yahoo.in

Abstract:

With the popularity of computer advance technology and internet the word cyber has become more familiar to the people. The evolution of IT has created cyber space which provides opportunities to the people to access any data or information in a minute's time. Everyone is engaged with internet through Whatsapp,Twitter,Facebook ,Netbanking &lots of other platforms. This increase in the number of netizens has given rise to cyber crime which is an unlawful act wherein computer is either a tool or target or both. With Cyber crime being so easy and rampant it is essential to ensure adequate cyber security measures and hence the cyber laws came into existence both at national and international level. The objectives of our paper are to provide a general awareness of cyber crime, to know the evolution and importance of cyber laws and to learn how to keep away from being a victim.

Keywords*:-Evolution, netizens, unlawful, cyber security*

Introduction

When internet was developed, the founding fathers of internet hardly had any inclination that Internet could also be misused for criminal activities. Today there are many disturbing things happening in cyberspace. Cybercrime refers to all the activities done with criminal intent in cyberspace. Eradicating cyber is one of the biggest challenges of digital media. More and more criminals are exploiting the speed, convenience and anonymity of the internet to commit a diverse range of criminal activities that know no borders, either physical or virtual, cause serious harm and pose very real threats to victim worldwide.

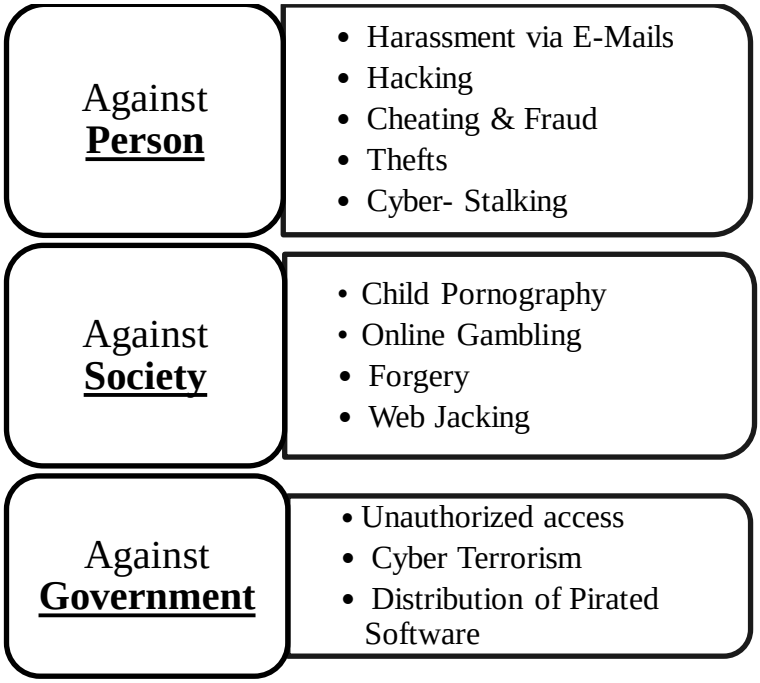
Definition of Cyber Crime

Cyber crime is not specifically defined. It refers to any crime that involves a computer / mobile and a network. The computer may have been used in the commission of a crime, or it may be the target.

In other word, Cyber crime is an illegal activity committed on the internet.

Types Of Cyber Crime

Cyber crime may be basically divided into **Three** categories:-



1. Hacking :

Hacking in simple terms means an illegal intrusion into a computer system and/or network. It is also known as CRACKING. Hackers write or use ready - made computer programs to attack the target computer. They possess the desire to destruct and they get the kick out of such destruction. Government websites are the hot target of the hackers. Some hackers hack for personal monetary gains, such as to stealing the credit card information, transferring money from various bank accounts to their own account followed by withdrawal of money. By hacking web server taking control on another person's website called as web hijacking.

2. Virus Attack:

Virus is a program that attaches itself to a computer or a file and then circulates to other files and to other computers on a network. They usually affect the data on a computer, either by altering or deleting it. Worms, unlike viruses do not need the host to attach themselves to. They merely make functional copies of themselves and do this repeatedly till they eat up all the available space on a computer's memory.

3. Data Theft:

If any person without permission of the owner or any other person, who is in charge of a computer, computer system of computer network-downloads computer database or including information or data held or stored in any removable storage medium, then it is data theft.

4. Identity Theft:

Identity Theft is a form of fraud or cheating of another person's identity in which someone pretends to be someone else by assuming that person's identity, typically in order to access resources or obtain credit and other benefits in that person's name.

5. E-Mail Spoofing:

It is a kind of e-mail that appears to originate from one source although it has actually been sent from another source. Such kind of crime can be done for reasons like defaming a person or for monetary gain etc. E.g. if A sends email to B's friend containing ill about him by spoofing B's email address, this could result in ending of relations between B and his friends.

6. Cyber Terrorism:

Targeted attacks on military installations, power plants, air traffic control, banks, trail traffic control, telecommunication network are the most likely target. Others like police, medical, fire and rescue system etc.

7. Online Gambling:

There are millions of website hosted on severs abroad, that offer online gambling. In fact it is believed that many of these websites are actually fronts for money laundering.

8. Child-Pornography:

According to crime research child pornography involves disturbing, trafficking, dissemination and posting any child-related obscene material. When executing this cyber crime, offenders will post obscene photos and videos of children and underage teenagers. They will provide these for free or charge a subscription free to those who sign up for their website.

9. Forgery:

Counterfeit currency notes, postage and revenue stamps, mark sheets etc can be forged using sophisticated computers, printers and scanners. It is very difficult to control such attacks. For e.g. across the country students buy forged mark sheets for heavy sums to deposit in college.

Legal & Technological Measure's To Combat Cyber Crime

Many countries like US, Russia, UK, France, Australia, Germany, New Zealand, South Korea, China, Brazil, South Africa, Denmark, Sweden, EU, Singapore, Malaysia etc. are seriously engaged in attending to their cyber security doctrines and strategies to provide safe and secure environment for their citizens. The international community is also engaged in a variety of discussions. NATO has taken the task of creating cyber security institutions in member countries. A group of governmental experts (GGE), set up by the UN Secretary General, gave a report in 2010 on '"developments in the field of ICT in the context of international security". The report noted that there was increasing evidence that states were developing ICTs as "instruments of warfare and intelligence, and for political purposes". To confront challenges in cyberspace, the GGE recommended cooperation among Likeminded partners, among states, between states, and between states and civil society and the private sectors.

To meet the challenges posed by new kinds of crime made possible by computer technology including telecommunication, many of the countries largely industrialized and some of those which are moving towards industrialization have in part few years reviews their respective domestic criminal laws from the point of adaptation, further development and supplementation so as to prevent

computer related crime. A number of countries have already introduced more or less extensive amendments by adding new statutes in their substantive criminal law.

According to McConnell Internationally some counties laws are substantially or particularly updated laws, while some others have no updated laws.

Updated Law	No Updated Laws
Australia	Albania
Canada	Bulgaria
Estonia	Burundi
India	Cuba
Japan	Dominican Republic
Mauritius	Egypt
Peru	Ethiopia
Philippines	Fiji
Turkey	France
United States	Gambia
Brazil	Hungry
Chile	Iceland
China	Iran
Czech Republic	Italy
Denmark	Jordan
Malaysia	Kazakhstan
Poland	Latina
Spain	Lebanon
United Kingdom	Lesotho
	Malta
	Moldova
	Morocco
	Nigeria
	Norway
	Romania
	South Africa
	Sudan
	Vietnam
	Yugoslavia
	Zambia
	Zimbabwe

The above table, which listed the countries, which are updated their legislation for combating Cyber Crime. The list of countries as mentioned in the above table is the initiative of McConnell International who surveyed its global network of information technology, Cyber Security Laws around the world. McConnell International asked the countries to send their respective legislation is respect of the Cyber Crime. Over fifty countries responded through sending their piece of legislation. On that basis the table is divided into two column i.e. (1) updated laws and (2) No updated laws

There is no uniformity in the legislation among the nations. Different countries have made different legislations. For example,

1. **Australia**: Has included offence related to computers in the Australian crime Act. The penalty for damaging data in computers is imprisonment up to 10 yrs and for unlawful data in computers imprisonment from 6 months to 3 years.
2. **Canada:** Has named three Computer Crimes (a) Possession of devices to obtain unauthorized telephone facilities; (b) unauthorized access to computer; (c) Committing mischief with data. The
6. Child Online Protection Act 1998, The Internet Tax Freedom Act 1998, The U.S. Trademark Copyright prevention Act, in Global and National Commerce Act (E-Sigh) 2000, The Uniform Computer Information Transaction Act 2000, and The Children Internet Protection Act 2001 .

imprisonment varies from 2 years to up to 10 years depending the nature of the crime.

3. **Singapore:** Computer Misuse Act refers to unauthorized access to computer system with intent to commit or facilitate commission of offence, unauthorized modification of computer material etc. Punishra.ent is Imprisonment from 2 years to up to 5 years with fine.
4. **United Kingdom:** Computer Misuse Act included unauthorized access to computer material or system and unauthorized access with intent to commit or facilitate commission of further offences as the computer crimes. The punishment is imprisonment from 6 months to up to 5 yrs with five.
5. **United States:** US has created a for dose legal framework to deal with the peril of computer crime, following are some of the top internet - related laws that have been framed for this purpose; The federal fraud Abuse Act - 1986. The computer Misuse Act 1991, The Data collection Improvement Act 1996, the Digital Signature legislation 1996, The Electronic Fund Transfer Act 1996, the Federal Trade Marks Dilation Act 1996, The Intellectual property protection Act 1996, The National Information infrastructure protection Act 1996, the Telecommunication Act 1996. The Electronic Communication privacy Act 1997, The Electronic Theft Act 1997, The

How to Tackle Such Activities

- Invest in Anti-virus, firewall and SPAM blocking software for your PC.
- Detect secure websites when conducting transactions online
- Do not respond or act on emails sent from unknown sources
- Always use latest and update antivirus software to guard against virus attacks
- Always keep back up volume so that one may not suffer data loss
- Awareness is the first step in protecting yourself, your family and your business.
- Never send your credit card number to any site which is not secured to guard against fraud
- One should frequently change his/her passwords

Conclusion:

These days cybercrime is tremendously advanced and countries are constantly at threat, hackers are continuing to develop and upgrade themselves to stay ahead of law. It has been very difficult to be 100% sure of preventing an attack, since new types of attacks are being developed .There has been a changed focus however in countries in response to an evolving cyber threat. The emphasis is now more related to how countries can prepare for and respond to incidents that occur. Handling them effectively can help a nation to demonstrate how resilient it is. Nations need to have in place systems, processes and procedures so that people know what to do when facing a cyber attack. It might be argued that a disaster recovery plan is also needed to help businesses recover from such situations. The key message to make sure we have efficient cyber security and strong cyber laws.

References:

1. Dudeja, V.D, *Cyber Crimes and Law.* Vol.1, Commonwealth publisher, Ed. 1st
2. Sutar Prafull, *Social Media- Digital Media,* Multiversity Publication, Pune, 2015
3. Gurjeet Singh & Vidhy Sandher, 'Emerging of Cybercrime A challenge for new millennium' *Aligarh Law Journal.* Vol. XIV & XV, year 1999-2000
4. Verma, S.K. & Mittal, *Legal Dimensions of Cyberspace.* New Delhi, ILI Publisher, 2004
5. www.wikipedia.org

Hydroponics and Aquaponics - A Sustainable Approach for Rurban India

Meghana Vyas & Charlotte Braganza

S.K.Somaiya College of Arts, Science and Commerce, Vidyavihar, Mumbai

charlottecalypso@gmail.com

Abstract:

The threat of climate change has heightened the importance of urban –rural partnerships in making sustainable use of natural resources. Considering the projected severe impacts of climate change on habitats and bio-diversity, the role of rural areas and specifically of farmers as providers of environmental and ecosystem services will increase in importance.

In India the practice of sustainable agriculture is important as it accelerates the productivity, efficiency, employment, and provides guidance to reduce the practices which affect the quality of soil, water resources and degradation of other natural resources. Shyama Prasad Mukherji Rurban Mission (SPMRM) was launched by the honorary Prime Minister on 21st September 2016 at Kurubhata, Murmunda Rurban Cluster, Rajnandgaon, Chhattisgarh

The Mission aims at development of rural growth clusters which have latent potential for growth, in all States and Union Territories (UTs), which would trigger overall development in the region.. ***The Rurban Mission will thus develop a cluster of Smart Villages.***

In the Indian context, rurban setting is seen commonly in states like Kerala, Goa and the mountainous regions, unlike in other larger states where the rural-urban divide is more pronounced.

The paper highlights the importance and relevance of Hydroponics and Aquaponics as an alternative agricultural practice towards procuring a Sustainable India. The study relates to the significance of Mobile agriculture for sustenance. A cost analysis has been calculated to project how economically viable the use of Hydroponics and Aquaponics is for developing a egalitarian India. The study is a systematic approach towards understanding the practicality of sustainable farming to achieve Food security, Economic security, Food safety Social responsibility and Environmental responsibility.

Introduction:

The threat of climate change has heightened the importance of urban –rural partnerships in making sustainable use of natural resources. Preserving rural areas and the resources they contain from urban sprawl matters more now that rural areas are seen as actual or potential suppliers of renewable energy, whether in terms of bio-mass and bio-fuels. Taking into account the severe impacts of global warming on habitats and bio-diversity, the role of rural areas and specifically of farmers as providers of environmental and ecosystem services will increase in importance .Urban and rural areas should act as partners, not competitors, and that they should realize that both exist in a state of mutual inter-dependence which is significant for the use of sustainable development of resources. It is important for one to understand the nature of rural-urban linkages, the approaches that are being developed and particularly whether there are unaddressed policy needs

In India the practice of sustainable agriculture is increasing in importance as it accelerates the productivity, efficiency, employment, and providing guidance to reduce the practices which affect the quality of soil, water resources and degradation of other natural resources. It basically aims at adopting specialization and using environment friendly tools to protect and preserve the environment as well as to enhance the level of production without harming to the environment.

The paper is a reflection of the importance and relevance of Hydroponics and Aquaponics as an alternative agricultural practice towards achieving a sustainable India. The study relates to the significance of mobile agriculture for sustenance.

Agriculture is a part of our national and cultural heritage, which face various challenges namely urban growth and competition for agricultural land; dynamics of land conversion, planning to protect farmland, agricultural land resources for the future, land resources for food and agricultural land conversion.

On 22 February 2016, Prime Minister Narendra Modi launched the National Rurban Mission (NRM) from Kurubhat in Rajnandga on district of Chhattisgarh. The mission also dubbed as "Shyama Prasad Mukherjee Rurban Mission" (SPMRM) aims to spur social, economic and infrastructure development in rural areas by developing a cluster of 300 Smart Villages over the next 3 years across the country in the first phase. More clusters will be identified depending upon the progress of the scheme. This mission was announced in the Union Budget 2014-15. NRUM is to be implemented by Ministry of Rural Development.

The objective of this mission is to stimulate local economic development, improve basic services and create well planned Rurban clusters and enable cluster based development with a "rural soul and urban amenities" along with focus on equity and inclusiveness.

As per 2011 Census data, India's rural population is 833 million, which is almost 68% of the total population. Various data show that there are inequalities in basic amenities between rural and urban India. For example, while 93% of urban households have electricity, the number stands only at 55% for rural households. Similarly, the percentage of households which has access to piped water connections is 71% in urban areas and 35% in rural areas. The recently launched mission is a pilot project to bring parity in the amenities provided in rural and urban areas.

Further, many villages in India are part of clusters of settlements and not stand-alone settlements. The relative proximity to each other portrays economic drivers and potential for growth and has locational and competitive advantages. Hence, if there is a proper policy directive for the development of these clusters, it can change the fate of rural areas in India. This Rurban mission has been launched as per this rationale. The major outcomes envisaged are as follows:

- Bridge the rural urban divide- economic, technological and those related to facilities and services.
- Spreading development in the region.
- Attracting investment in the rural areas.
- Stimulating local economic development with emphasis on reduction of poverty and unemployment in rural areas.

A Rurban cluster comprises of geographically contiguous villages with a population of around 25000 to 50000 in

plain and coastal areas and a population of around 5000 to 15000 in desert, hilly or tribal areas. As far as possible, the clusters of village will be in a single block/tehsil for administrative convenience. The mission outlines 14 desirable components linked to developing skills and local entrepreneurship, economic activities and providing necessary infrastructural facilities.

Components of Rurban Mission

The 14 components which are envisaged as desirable in each cluster under this mission are Skill development training linked to economic activities, Agro Processing, Agri-Services, Storage and Warehousing, Fully equipped mobile health unit, Upgrading school /higher education facilities, Sanitation, Provision of piped water supply, Solid and liquid waste management, Village streets and drains, Street lights, Inter-village road connectivity, Public transport., LPG gas connections Digital Literacy and Citizen Service Centers- for electronic delivery of citizen centric services/e-gram connectivity.

In the Indian context, Rurban setting may be seen commonly in states like Kerala, Goa and the mountainous regions, unlike in other larger states where the rural-urban divide is more pronounced.

Hydroponics is a method of growing plants using mineral nutrient solutions, in water, without soil. The method can be implemented in places where the soil type is not ideal for the desired crop. In addition, the technique can be used in roof top farming and therefore is very useful in areas with limited space such as urban areas.

Advantages

- No soil is needed so there is no crop limitation due to soil type, eroded or diseased soils.
- Water can be recycled so it is advantageous in drought prone areas or deserts.
- No nutrition waste due to water run-off which in turn can lead to eutrophication.
- Higher and stable yields because the plants does not expand too much energy in finding nutrients in the soil thus this energy is invested into the growth of the plant. Also in soil plants compete with weed for food and water but in hydroponics the adequate nutrients are delivered straight to the roots.
- Less frequent occurrence of diseases because of the absence of soil which a bacteria growth media.
- Due to container mobility hydroponics enables the farmer to grow crops near the area of use thus reducing transportation costs.
- Labour intensive work such as tilling, cultivating, fumigation, and watering is not required for hydroponic farming (Jones, 1997). And as for advanced hydroponics the system is usually automated using pumps or even computers, labour costs will decrease dramatically.

Disadvantages

- The hydroponic conditions (presence of fertilizer and high humidity) create an environment that stimulates salmonella growth.
- Although the use of advanced hydroponics is cheaper in the long run, its initial start up cost is rather high as it is expensive to procure the equipment required
- Requires the use of uncontaminated water

Cost analysis of Hydroponics

Revenue flow (when land is owned)

Capital Costs: Assuming land is currently owned by the owner the capital costs per acre required would include

Cost of Land	₹. 0 Lakhs
Cost of Green house	₹. 9 Lakhs
Drip irrigation	₹. 2 Lakhs
Soil preparation	₹. 20,000
Mulching Sheet	₹. 10,000

Grand Total (Every 5 Years) = ₹ 11 Lakhs (Approx.)

Operational Costs: The Operational costs of a hydroponic farm growing tomatoes for 1 acre per year would include

Polybags	₹. 12,000
Coco pear	₹. 67,000
Trellising thread and clips	₹. 12,000
Nutrients per cropping cycle	₹. 50,000
Organic pesticides per cycle	₹. 15,000
Seeds	₹. 72,000
Salary for 2 employees	₹. 2,40,000
Electricity	₹. 30,000

Grand Total (Per Year) = ₹ 5 Lakhs (Approx.)

Revenues: Assuming tomato growth for 1 year per acre assumptions include

No. of kgs. Yield per plant	5 kg.

No. of plants per yield	12,000 plants
No. of yields per year	2 yields
Price per Kg. sold in market	₹.20 per Kg.
Total Calculation	5*12000*2*20

Grand Total (per year) = ₹ 24 lakhs (Approx)

Equated profit about 17 lakh per year

Aquaponics is a sustainable method of combining aquaculture (raising fish) and hydroponics (growing plants using mineral nutrient solutions in water) to produce organic food year round. This process dates back to 1,000 A.D when the Aztec Indians used rafts floating on the surface of lakes to raise plants. It creates a sustainable closed system. The water from the raising of fish is normally a waste product but is actually filled with nutrients that provide what plants need for growing. Rather than having to feed the plants with inorganic nutrients, which is the normal practice in hydroponics, the plants utilize the "waste" from the fish.

Low-tech aquaponics involve the simultaneous cultivation of an aquatic species and plants in a system. There is a reduced need for fertilizer because the waste of the aquatic organisms is used by the plants as nutrients. This type of aquaponics has been historically implemented for thousands of years in China and other places that have large swampy tracts of land. The most commonly implemented one is a Tilapia-Azolla-Rice culture. Tilapia are one of the most efficient species of fish and can put on close to one pound of fish flesh per pound of fish food they eat; the Azolla is a floating aquatic macrophyte that acts as supplemental food to the fish. The rice can be harvested directly for human consumption. This solution requires investment in education; training the local farmers is the key to its successful implementation. The method holds particular promise where conventional agriculture is not viable due to the excess of swampland and lack of soil.

Dynamics of aquaponics

- Waist-high aquaponic gardening eliminates weeds, back strain and animal access to your garden.
- Reuse resources currently considered "waste". There is no more toxic run-off from either hydroponics or aquaculture.
- Uses only 1/10th of the water of soil-based gardening, and even less water than recirculating aquaculture.
- Watering is integral to the system. The amount of water used is of utmost importance
- Fertilizing is also integral to the system.
- The aquaponic grower does the tasks of feeding the fish and tending and harvesting the plants.

Major Strengths of Aquaponics;

1. Saving water: Water is an incredibly precious resource. Water availability

and water quality are two very limiting factors for growing food around the world. Luckily since aquaponics requires significantly less water by recirculating it through the fish and plant system, it can help grow food in places that would otherwise struggle.

needs, nutrients, oxygen and water in perfect combination and totally sustainable. So plant roots in aquaponics don't have to bore through the soil to find what it needs and can spend all of its energy growing up into edible plant material.

3. Growing in places that otherwise don't grow: Aquaponics allows food to be produced in many places that would not otherwise be able to grow. The infrastructure can be setup inside greenhouse, warehouse or outdoors where weather permits.

4. Natural and constant fertilizer: Aquaponics gets its nutrients from the water source, the by-products of the fish system, and possibly from the media materials as well. Since aquaponics mimics a natural ecosystem, it produces many nutrients that plants need without chemicals.

5. Producing no waste: Any solids collected from the fish system can be added to compost or applied to tree lines or berry bushes. Any unharvested plant material from the system can be fed to animals or composted and very little if any water needs to be discharged. Nature doesn't produce waste, and neither should methods for growing food.

2. Overcoming the challenges of soil: Aquaponics removes soil from the equation completely, and that often throws off traditional gardeners. However, aquaponics provides the plant everything it

6. Reducing "food miles": Long distance transport for our food means more hands touching it, more refrigeration needed in multiple locations, more packaging, more food safety concerns, and less nutritious food since it has left the field many days or weeks before consuming. Aquaponics allows us to grow more food at home, for our schools and in our communities. This means more nutrition since its fresh and much less of all the negatives associated with long distance transportation.

7. Financial sustainability: Many people find that initial investment well worth its value in nutrition, health, piece of mind, and food security. Home and hobby scale systems can usually pay for themselves in produce and fish within 1 – 2 years. Farm scale systems can be profitable in a similar amount of time if growing the right products, having the right market place, selling at the right price and keep expenses under control. Financial sustainability is just as important as environmental sustainability. If aquaponics makes as much sense financially as it does in mimicking the natural environment, then more people will make the choice to grow with aquaponics.

Cost analysis of Aquaponics:

The growing beds in an aquaponic farm that support plants are made by using different types of material like thermocol sheets or gravel. The approximate cost of setting up an aquaponics farm ranges between ₹. 5 lakh to ₹.15 lakh.While the cost of setting up such a farm is higher than conventional farming. The operational cost is much less because there is no need for fertilizers. An aquaponic farm also uses 90% less water than a conventional farm.

Aquaponics and Hydroponics –Future for Rurban India

Raising fish and plants together can be done and can be accomplished successfully and sustainably. Aquaponics and hydroponics systems are quickly moving from the realm of experimental to commercial as researchers and growers alike have turned the systems into working models of sustainable food production

Decreased water use: 70-90% of the water used in these systems is saved through recirculation.

Decrease dependence on crop inputs: aquaponics produces its own nutrients through recirculation of fish waste through the system. . Additionally, if an indoor, controlled system is used, the fish and plants aren't exposed as much to disease or pest pressures.

Flexible land use: both hydroponics and aquaponics have the capacity to grow 10 times more produce in the same footprint as terrestrial farming. Compared to soil farming they can deliver 30 percent faster time to harvest. These systems can be employed anywhere with suitable light, including rooftops and parking lots, as well on non-arable land and indoors.

Waste reduction: Aquaponics systems have zero discharge, as all the waste is recycled into the system.

Locally produced: since these systems can be set up almost anywhere with suitable light, including indoors, produce can be raised in geographies where growing outside would be a challenge during winter months. Room for improvement: like all farming systems, there is always room to grow and improve.

Two main disadvantages of Hydroponic and Aquaponics systems are ;

1) The high amount of electricity needed to keep the systems running

2) The difficulty in maintaining a balanced system between fish and plants (different fish require different water temperatures and pH, so some species are incompatible).

Continued research is needed on alternative energy solutions for running these systems (like solar energy) and on poly cultured systems that can grow more than one type of fish.

Sustainable Agricultural practices in India-Smart India Initiatives

The sustainable development of the planet and the way we feed and clothe the population are major issues confronting the world today. As a global community, we need to advance our expertise in plant production, food technology, sustainable management of natural resources, as well as how we use the natural environment for recreational activities. The main challenge will be to

supply safe products that are needed for a quality of life while maintaining a healthy planet.

Hydroponic and greenhouse technology, aquaculture and aquaponics, organic and urban farming technologies are intensive plant production systems that are all well placed to meet the challenges ahead.

Scientists and researchers in India are striving for creating alternative ways of developing agricultural and horticultural products. A major challenge ahead for the industry will be to grow crops with a minimal use of safe pesticides. This means developing more disease-resistant plant varieties, discovering a wider range of beneficial insects and other biological control agents, and developing management protocols to control pest and disease problems.

Biotechnology will play an important role in developing disease-resistant plant varieties. Gene technology is also being increasingly used to develop fresh food products high in beneficial nutrients that slow or prevent disease. Biotechnology will be used to develop other food crops loaded with beneficial nutrients that promote good human health.

In the 21st century, biotechnology will play an increasing role to produce what is known as 'functional' foods. Genetically modified foods may also carry other useful components such as genes to vaccinate consumers against important diseases.

Aeroponics and fogponics are alternatives method, India can perceive for achieving growth insustainable agriculture.

Understanding the practicality of sustainable farming to achieve Food security, Economic security, Food safety, Social responsibility and Environmental responsibility should be the sole responsibility of every individual. Adopting a rurban approach can help a long way in finding solutions for an egalitarian India.

References

1. Keith Roberto, Dec.2011, How–To Hydroponics Retrieved from www.howtohydroponics.com
2. Howard M. Resh , July 2003, Hobby Hydroponics Retrieved from http://www.crcpress.com/Hobby-Hydroponics.
3. Andy Jacobson, March 2016, Aquaponics; The Essential aquaponics guide.
4. B. K. Desai, B.T. Pujari, October 2007, Sustainable agriculture; A Vision for Future
5. Segun R. Bello, Balaogun R. Babatunde, November 2012, Sustainable Agriculute; Challenges and Prospects

'Mangroves and Money'- Economic Importance of Mangroves

Ms. Maithili Vijay Sawant,
Assistant Professor, Department of History
NES Ratnam College, Mumbai
Email ID: balshree.91@gmail.com

Abstract

Mangroves are the buffers between the land and the sea. Coastlines throughout the world are facing serious problems of coastal erosion and threat of rising sea levels due to global warming. To control such assault of the sea on land the nature has provided Mangroves.
Apart from protecting and guarding the coasts mangroves also contain high commercial values. Mangroves provide timber, firewood, medicinal plants etc. Mangroves also pose as the hotbeds for fishing activity as it provides a habitat for a number of species. This paper aims at tracking the various commercial uses of mangroves and its contribution to the economy and finding the potential areas for the commercial development in future.

Key words*- Mangroves, economy, commercial uses, development*

Introduction

Man and environment share a timeless bond. From birth to death, in his entire lifetime man has to remain dependent on the Mother Naturefor his survival. Once upon a time when man was in his primeval stage of evolution, he feared the nature and its mighty forces. But as the man started stepping ahead in the journey of evolution, he learned the art of extracting benefits from the surrounding environment.

In present era with the help of advanced technology man has discovered every possible way to pull advantages from the nature. We are using almost all natural resources to obtain monetary benefits. Products and goods made from 'natural' raw materials have a huge market share both nationally and internationally.

India is blessed with the 7,516.6 kilometers of coastline. On western and eastern coasts of India presence of mangroves is significant. Sunderbans in Bay of Bengal, Bhitarkanika in Odisha, Pichavaram in Tamilnadu are the major mangrove forests in India. The coastline of Mumbai also has some sprawling green patches of Mangrove forest. These marshy lands are indeed the guardians of coasts. But apart from protecting the shorelines they also carve a share in the economy by providing various commercial uses.

Mangroves

Mangroves are the buffers between the land and the sea. Coastlines throughout the world are facing serious problems of coastal erosion and threat of rising sea levels due to global warming. To control such assault of the sea on land the nature has provided Mangroves.

What is Mangrove?

Mangrove ecosystem is one of the most productive natural ecosystems on the earth with great ecological and economic significance. It is widely believed that mangrove forests developed first in the Indo-Malaysian region and then got spread to other regions of the tropics. This region is, therefore, considered as the cradle of evolution for mangrove vegetation [1]

Mangrove ecosystem is a peculiar habitat found at the interface between land and sea. The term "mangrove" is being applied to the specific ecosystem of the intertidal world in the tropics and subtropics and the plant community of this ecosystem is termed as "mangrove vegetation". They have been variously described as 'woodland, 'tidal forest' and 'mangrove forest'. Generally, mangroves are trees and bushes growing below the high-water level of spring tides. Their root systems are thus regularly inundated with saline water, even though it may be diluted due to freshwater surface run-offs. [2]

Following are some of the definitions which will give us the clear picture of mangroves.

Davies described "Mangrove" as a general term applied to plants, which live in muddy, loose, wet soil of tropical tidal waters.[3]According to Clough mangroves are the only trees amongst a relatively small group of higher plants that have been remarkably successful in colonizing the intertidal zone at the interface between land and the sea.[4]

Environmental and ecological significance of mangrove eco system.

Throughout the world, there is general awareness about the ecological and economic importance of forests. Mangroves being intertidal forests, are no exception, and are equal to tropical forests. Moreover, the importance of mangroves is not merely in its forest value, but due to its strategic location between the land and the sea. Mangroves are the lifeline for any coastal area. We can summarize their importance in the following points.

1. Mangroves are buffers between the land and the sea. All shorelines are under a constant threat of erosion due to wave action and tidal motion. Mangroves stabilizes shorelines and the banks of rivers and estuaries, providing them with protection from tidal action, ocean currents and storm surges.
2. Mangroves help in preventing soil erosion, but also reclaim land from the sea.
3. Mangroves play role as breeding grounds for many marine organisms like crab and shrimps.
4. Calorie value of mangrove timber is very high, it absorbs 5 times more carbon dioxide and produces 3 times more oxygen than other plants.
5. Mangroves provide a habitat for a large number species.

Economic importance of mangroves.

A. Mangroves as a source of energy.
B. In both developed and developing countries mangroves are used by the coastal population for their forest products. Mangroves are used as an important source of energy in the form of wood and charcoal. The commercial demand for mangrove products have largely been for energy purpose in the form of fuel wood, charcoal and fodder by the coastal communities.
C. Firewood : practically all mangrove species are used as firewood. Species like *Rhizophora, brugruiera* etc. are widely used as firewood by the coastal communities.

Especially *Rhizophora* is very popular because of its hard tough and dense wood.

D. major kind of exploitation which has degraded the mangroves the most. The gulf of Kutch , Bombay and Cochin are the three classic examples of over exploitation of the mangroves due to excessive population pressure.[5]

E. Charcoal : Wood from mangrove forests is used widely throughout the tropic and sub tropic for charcoal production. *Rhizophora* make charcoal of excellent quality. Other mangrove species of *Bruguiera, Ceriops* and *Heritiera* are also used but are quantitatively less important.

F. Fodder: The foliage of some species is used as fodder for cattle, camels and goats. *Avicennia* marina is largely used as fodder for camels and cattles as it grows in very arid areas e.g. Gujarat coast in India as well as Konkan, Goa regions.[6]

G. Food: Various parts of mangrove plants are edible but most of these foods do not seem to represent much more than mere starvation diets and few presumably enter the market in significant quantities. The fruits of *Avicennia spp, Sonneratia spp* and *Heritiera spp* are edible.

H. Alcohol: The Nypa palm is a very useful mangrove leaves for thatching, edible fruits and the sap of the inflorescence is used for sugar, alcohol or vinegar productions. This was once a major industry in the Philippines. From Nypa alcohol production is about 15,000 litres/ha/yr, while the Sugar is about 20 tonnes/ha/yr.[7]

Major uses of mangroves in some countries

1. India arid Zone - Firewood, fodder
2. Sunderbans (Indian and Bangladesh) - Timber, firewood
3. Thailand - Charcoal
4. Vietnam - Charcoal, firewood,
5. Malaysia- Charcoal,
6. Indonesia- firewood, Charcoal, poles, chips

Perhaps this is the

7. Phillipines - Firewood
8. Papua New Guinea - Firewood, poles, posts
9. Pacific - Firewood, poles, posts

B) Source of Tannin

Due to high content of tannin mangrove trees are a traditional source tanbarks. Mangrove trees contain commercially valuable tannin material. . *Rhizophora* barks produces a very fine quality of tannin required for leather work. Tannin obtained from mangrove species is also used for the dying of fishing nets made from natural fibers.

C) Source of Wax and Honey

Mangrove forests are the hotbeds of wax and honey production. Honeybees build honeycombs on the branches of mangrove trees and collect the nectar from the nearby areas. In India, a trend of collection of honey from mangrove forests is increasing. It has been observed that in Sunderban forests on average, the fishermen earn around $70 to $80 (£42 to £49) each during the season [8] The activity of honey and wax collection has a huge scope for employment as it requires more human labour. Honey collected from mangroves also has a good market demand.

D) Source of Medicine

Mangroves possess medicinal Properties. Tribals of Andaman and Nicobar Islands have been using Mangrove species to heal various disease.*Salvadora persica* , a mangrove specie commonly known as Meswak, or Peelu or toothbrush tree, is a species Used for centuries as a natural toothbrush, its fibrous branches have been promoted by the World Health Organization for

oral hygiene use. Research suggests that it contains a number of medically beneficial properties including abrasives, antiseptics, astringent, detergents, enzyme inhibitors, and fluoride.The therapeutic applications of the blackmangrove like *Aegiceras corniculatum* (Linn.) distributed in coastal and estuarine areas of India are studied well.Mangrove plants are traditionally used for the treatment of rheumatism, painful arthritis, inflammation, asthma antioxidant, anti-inflammatory, and diabetes. [9]

E) Mangroves and fishing activity.

Marine fish production in India was 3,443 thousand tonnes in 2013-14, which accounted for 36 percent of total fish production in the country[10]. Commercially relevant fish species that are commonly found in mangroves in the coastal regions of India are prawns and crabs, mollusks, and finfish such as snappers, catfishes, pomfrets and croakers. Mangrove forests in India are largely located in the deltas of the rivers Ganges, Mahanadi, Godavari, Krishna and Cauvery as well as on the Andaman and Nicobar group of islands. In India 11.55 lakh hectare area is under the mangrove fishing activities.[11]

Potential use of mangroves for commercial activities.

Mangroves hold a very good commercial value as they provide a wide range of materials to be extracted for commercial use. From fishing to medicine, it encompasses an extensive array of products.Since rapid commercialization is becoming the feature of every developing economy, no area can be ignored if it has a potential scope for recreational purposes. This will also provide an employment to the coastal communities further boosting to the development, irrespective of its spectrum.

Mangroves also have moderate chances for commercialization, of course with keeping its safety in the forefront.

Mangroves for fish farming

Fishes like shrimps, lobsters have a huge market demand in India. Taking this into consideration, increasing the supply of such fishes is the need of the time. Hence the concept of integrated mangrove fish farming was implemented by M S Swaminathan Research Foundation in Tamilnadu which benefitted the 260 rural families. This concept is developed by 'Mangroves for the Future (MFF)' a unique partner-led initiative which promotes investment in coastal ecosystem conservation for sustainable development. MFF is Co-chaired by IUCN and UNDP. In this project The IMFFS farms worked on the principles of ecological and environmental sustainability. They were fed by tidal water. Tidal flows also brought in natural feeds and new fish and prawn seed, and flush away wastes.IMFFS models had a very high mangrove survival rate (92%). Also encouraging were survival rates for introduced tiger prawn seed and mullet and sea bass fingerlings (60%). If such projects are implemented in the other parts of the country, then we can witness more of such success stories and an increased fish production.

Mangrove eco-tourism

Mangrove forests have a rich variety of animals, birds, insects and reptiles. They can be converted into the wildlife sanctuaries. Mangroves comprise a high potential to become an eco-tourism destination for educational and economy. Sunderbans is earning popularity as it provides mangrove tours. Mangroves in the other parts of the

country can follow the footprints of the Sunderbans and develop into the tourist destination. A state of the art infrastructure, well furbished planning and aggressive marketing is the key to make the mangrove forest an eco-tourism spot. Mangroves of Konkan, Thane, Kutch region can be considered as the places having potentials for eco-tourism.

Conclusion

Mangroves play multiple roles.They protect the shorelines, provide the habitat for a large number species, they provide livelihood for coastal communities and also supply materials for various commercial uses. Though it offers traditional and future ways of making money, we should always keep in mind that safe guarding and conserving mangroves is our prime priority. Changing climatic conditions are posing a major threat to the mangroves, in such circumstances conservation of the mangroves should be focused. We cannot afford to exploit mangroves for commercial gains hence a balance between environment and economic activities must be maintained. Safe mangroves will ensure the safety of our future.

References

1. Krishnamoorthy, R., A. Bhattacharya, and T. Natarajan, Mangroves and coral reef mapping of South Andaman Islands through Remote Sensing Sustainable Management of Coastal Ecosystems. (eds.) Swaminathan, M.S. and R. Ramesh, 143-151. **(1993).**
2. Kumar rajiv, Conservation and management of mangroves, Goa University, 5-6,(**2000)**
3. Davies, J.H.Jr., The Ecology and Geologic role of mangroves in Florida,Tortugas Lab,32, 303-412 **(1940).**
4. Clough, B.F., Growth and salt balance of the mangroves, Avicennia marina (Forsk) Vierh and Rhizophora stylosa Gra in relation to salinity. Aust. J. Plant Physiol., 11: 419-430. **(1982).**
5. Untawale A.G. , 'Management of Mangroves for energy needs' ,Anthology of Indian Mangroves, ENVIS Centre, Annamalai University, Chidambram, 54, **(1998)**
6. Untawale A.G. , 'Management of Mangroves for energy needs' ,Anthology of Indian Mangroves, ENVIS Centre, Annamalai University, Chidambram, 55, **(1998)**
7. Untawale A.G. , 'Management of Mangroves for energy needs' ,Anthology of Indian Mangroves, ENVIS Centre, Annamalai University, Chidambram, 55, **(1998)**
8. http://www.bbc.com/news/13556336
9. Revathi P, T Jeyaseelan Senthinath, P Thirumalaikolundusubramanian and N Prabhu , 'Medicinal properties of mangrove plants – An overview', International Journal of Bioassays,
10. Handbook on Fisheries Statistics 2014, Department of Animal Husbandry, Dairying and Fisheries, Government of India.(http://www.dahd.nic.in/)
11. Handbook on Fisheries Statistics 2014, Department of Animal Husbandry, Dairying and Fisheries, Government of India.(http://www.dahd.nic.in/)

- 'Mysterious mangroves' , DNA, August 8, 2010
- 'Understanding wetlands', The Times Of India, 3rd February 2008
- 'Kill the mangroves, Loose the city' , The Economic Times, 5th June 2008

Interview with

- Mr. Hemant Karkhanis.
  Soonabai Pirojshah Godrej Marine Ecology Centre, Mumbai, 4th April 2016
- Mr. Laxmikant Deshpande.
  Soonabai Pirojshah Godrej Marine Ecology Centre, Mumbai, 4th April 2016

Green Business is Green Business & Clean Technologies: An Emerging Trend in India

Dr.Vandana N. Purav

P.D. Karkhanis College of Arts and Commerce, Ambarnath

vnpurav63@gmail.com

Abstract

The concept of Green Business started at the end of 20th century. Green Business is the one which follows sustainable industrial practices. It includes general practices, technical practices to reduce pollution and some legal and institutional practices that create environment for practicing such measures. Thus Green Business is concerned with not only natural environmental quality but also human environmental quality. It talks about sustainability of environment, economy and human rights.

Clean Technology refers to any process, product or service that reduces negative environmental impacts through significant energy efficiency improvement, sustainable use of resources and environmental protection activities

In this paper we discuss the concept of Green Business and Clean Technology. Also we focus on various features of Green Business and 10 startups programmers in India regarding Clean Technologies.

Key Words: *Green Business, Clean Technology, sustainability*

Introduction:

The concept of Green Business is started at the end of 20th century. Green Business can be defined as

i) An establishment that produces Green output,
ii) The business that requires a balance commitment to profitability, sustainability and humanity.
iii) The business functioning in a capacity where no negative impact is made on the local or global environment, the community or the economy.
iv) An organization that uses renewable resources and holds itself accountable for the human resource aspect of their activities.

In general Green Business is concerned about not only natural environmental quality but also human environmental quality.It talks about sustainability of environment, economy and human rights.

Green Business is a part of Green Consumption. Green Consumption is the practice of using envoi mentally ecofriendly products. These products do not cause risk to human health and do not threaten the function and diversity of natural ecosystem. Green Consumption is the most cost effective approach for implementing cleaner production efforts. In general Green consumption can help countries progress towards sustainable development.

Following are the features of Green Business as sustainable industrial practices:

1) **Product Stewardship: I**t means that manufacturer is responsible for waste reduction, recycling and the use of renewable material.

2) **Eco-labeling :** It is the process where the goods are marked as ecofriendly.This system has been adopted by many countries like Canada, Japan, India, Germany, USA, etc.

3) **Green packaging**: Companies can minimize the volume and weight of packaging and also to reduce the packaging waste.

4) **Green Marketing**: Consumers willing to pay more for a Green product. A Green brand should be effectively marketed.

5) **Environmental Audit:** This is to understand the type and amount of resources used by the company, product line or facility and the types of waste and emissions generated.

6) **Cost saving Practices:** It includes practices like heat generating by waste incineration, cutting down the paper use in exchange for electronic communication, turning off electronic appliances when they are not in use.

7) **Other practices**: Companies encourage their employees to use public transportation instead of their own cars in order to reduce air pollution.

Examples of Green Business:

Orchid Hotel is the Asia's first hotel to win Ecotel Certification.

LG company LED, E60, and E90 series monitor consumes 40% less energy.

Tata Consultancy services have practice sustainability.

i) Oil and Natural Gas Company is the India's largest oil producer uses the invention of green cremenatoiums
ii) Induslnd bank is the first bank to discourage the use of paper.
iii) Wipro used the technology in saving the energy and preventing waste.
iv) MRF tires has launched the ZSLK series of ecofriendly tubeless tires.
v) ITC has adopted a Low Carbon Growth path and a cleaner environmental approach

Clean Technology

A Technology was invented with the sole aim of providing a helping hand to the human kind. But, somewhere during the whole process, human beings became so much self-involved that they lost track of other important things like the environment that the technology could help them with. Fortunately, some percentage of human race did take note of the situation and decided to change it by coming up with idea of **clean technology** or **cleantech.**

Clean technology, sometimes referred to as Cleantech, is a term generally used to define a set of technologies that either reduces or optimizes the use of natural resources, whilst at the same time reducing the negative effect that technology has on the planet and its ecosystems.

Clean technology refers to any process, product, or service that reduces negative environmental impacts through significant energy efficiency improvements, the sustainable use of resources, or environmental protection activities.

Clean technology includes a broad range of technology related to recycling, renewable energy (wind power, solar power, biomass, hydropower, biofuels, etc.), information technology, green transportation, electric motors, green chemistry, lighting, Greywater, and more.

Examples of such technologies are relatively new sustainable energy sources, such as wind and wave power,

or improved conventional energy production processes, such as clean coal technology.

Clean Technology Sectors:

Sustainable Energy:

There are various technologies which make use of sustainable sources of energy. Listed below are some of the most common which are being used across the globe:

Wind power – this sustainable resource is typically exploited in the form of vast wind farms, often found offshore. A wind farm contains a large group of individual wind turbines connected to one another, which generate electricity without producing any greenhouse gas emissions.

Hydroelectric power – this refers to the use of the gravitational force of water falling or flowing to produce electricity. Once constructed, a hydroelectric power plant will produce extremely low levels of greenhouse gases when compared to fossil fuel based techniques.

Solar energy – two techniques are used to generate electricity from solar energy; Photovoltaic (PV) or concentrated solar power systems (CSPs). The former uses the photovoltaic effect to directly convert light into an electrical current, whilst the CSP uses lenses or mirrors to focus a beam of light directly onto a small area which is converted into heat which subsequently drives a heat engine to generate electricity.

Geothermal energy – this is simply the heat from the Earth itself. This heat can be used in a similar fashion to the directed light beams for CSPs to heat up water to drive heat engines thus generating electricity.

Polluted Water can be made clean by the following treatments.

Clean Water -Clean Water treatment – this refers to the treatment of raw water to ensure that it is safe for human consumption.

Wastewater treatment is the conversion of wastewater into water that can then be entered into the water cycle or reused, is referred to as waste water treatment.

Pollution Reduction can be done by adopting the following ways.

Emission control – there are several methods to reduce global emissions. The adoption of clean technologies, such as the sustainable energy sources listed above, as well as a transition from petrol based vehicles to biofuels and electric vehicles are just a few of the suggested ways to control emissions

Pollutant monitoring/sensing – air monitoring stations are used throughout the United States of America in a system called *State Local Air Monitoring Stations* (SLAMS) which provide annual reports on the volume of pollutants in each American state. Similar techniques of monitoring the levels of air pollutants are employed across the world

Remediation of polluted sites – when a request for environmental remediation of a location is made by government or land remdiation authorities, immediate action must be taken by the landowners to ensure the location is made safe for humans and animals. This can involve cleaning soil, groundwater, surface water or sediment, by removing pollutants and contaminants.

Recycling and Waste Treatment

Recycling of consumer products – the majority of consumer products nowadays has large numbers of parts or components which can be recycled. Once a product reaches its "postconsumer" stage, it should be

sorted correctly to ensure it does not end up in landfills.

Reduction and treatment of toxic waste – often in the form of dangerous chemicals or products, toxic or hazardous waste should be treated very carefully.

Most governments across the world have plans in place for the reduction, collection, treatment and regulation of toxic and hazardous waste. Under planning the development of clean technologies are the developments in information and communication technology, materials science and nanotechnology, semiconductors and electronics.

We now discuss **10 startups programmers in India for Clean Technology**

1) Gram Power –Gram Power was founded in 2010 by Yashraj Khaitan (an Indian), and Jacob Dickinson (an American), engineering graduates of University of California, Berkeley, who are being mentored by Eric Brewer, a vice-president of infrastructure at Google and a professor at Berkeley. The startup provides cutting edge Smart Grid technologies to address the electrification challenges in developing nations. In March 2012, the startup set up India's first Solar Powered Smart Microgrid in the Rajasthan hamlet of Khareda Lakshmipura, providing energy for lights, buttermilk machines, televisions and fans.

2) Mera Gao Power (MGP) – Mera Gao Power, which means "my village" in Hindi language, builds, owns, and operates micro grids in Uttar Pradesh serving off-grid villages with high quality, dependable lighting and mobile phone charging services. MGP's unique model is able to provide service to a typical hamlet for $1,000, making its lowest cost design the first commercially viable micro grid targeted at the rural poor.

The U.S. Agency for International Development is MGP's first investor. USAID, through its Development Innovation Ventures, has awarded MGP a grant of $300,000 to build and operate micro grids in 40 off-grid villages of Sitapur district, in the state of Uttar Pradesh and evaluate the impact of MGP's services on health, income, and education.

3) **Barrix Agro Sciences** - Founded in the year 2011, this particular startup realized it real soon that in order to transform and provide an eco-friendly touch to the pest control measures being currently employed in agriculture, they will have to initially focus on doing extensive research. The company's future plans include developing a pest control methodology with dedicated personnel and a strong supply chain, so as to have a positive impact on ecology and society.

4) **Avant Garde Innovations** -Avant Garde is a Trivandrum, Kerala based cleantech startup that claims to be India's first & only startup with 100% renewable energy commitment. It aim is to introduce innovative, affordable and sustainable solutions that take renewable energy self sufficiency and energy empowerment to the next level through a distributed and decentralized approach using pioneering strategies the world has not witnessed yet.

5.) **Ecolibrium Energy** – India is a land rich with natural resources but at the rate at which we're consuming, something needs to be done in order to conserve these natural resources for the future brigade. Started in the year 2010 by

Chintan and Harit Soni, this innovative startup, which already has over 450 companies in its kitty, is working towards provide energy management solutions to the energy rich land that is India.

6.) **Husk Power Systems** – Husk Power Systems –. Bihar based Husk Power Systems' aim is to provide power to India's rural population by making use of company developed proprietary technology.

The startup programmer uses a biomass gasifier to generate electricity. Each of the company's plant is currently serving over 400 rural households, thus saving 18,000 liters of diesel and 42,000 liters of kerosene every year. This further helps in improving the health conditions in rural along with reducing the alarming indoor air pollution levels.

7) Oenrgy - The company founded in the year 2009 in West Bengal. The model Solar Hut by Switch ON-ONergy - in Bagnan, West Bengal. .It provides decentralized energy solutions. This also includes various range of solar products like solar home systems, solar water heating systems, solar inverters, solar lanterns, solar TV, solar micro grids and solar irrigation systems, KW installations for households and institutions and cook stoves etc.

8) Karma Recycling- Founded in January 2012, Karma Recycling provides a platform for trade-in of used electronics particularly mobile phones, tablets and laptops. The customers can get paid cash or coupons against trade-in of old devices. The services are offered through its proprietary platform called XchangeHub that provides efficient pricing and certainty of fulfillment.

Using recycling trade model, the New Delhi based startup focuses on conserving earth's precious resources through systematic collection, reuse, re-commerce, and recycling of smartphones, tablets, and laptops, thus reducing e-waste.

9) Green India Building Systems and Services (GIBSS) –

Incubated at the Indian School of Business, Hyderabad, this 2010 founded startup offers geothermal cooling technology, LED indoor lightning and hot water co-generation solution. Initially having begin as a three-member team has now matured into a company with 80 staff with offices in Mumbai, Bangalore, Delhi and Singapore. The startup plans to touch Rs.250-300 cores in revenue by the year 2016-2017.

10) Tessol Thermal Energy Solutions – Mumbai-based TESSOL is mainly into logistics and intends to transform the way thermal energy is being produced and consumed in the world at present. The startup focus on technologies that have tremendous potential to impact current thermal applications in Agricultural, Commercial and Industrial facilities. Tessol is currently focusing on the cold chain sector – transportation as well as stationary storages using the cold plates technology. It uses the brand name 'PlugnChill' for this solution.

PlugnChill eliminates the use of diesel for refrigeration operations reducing its operating costs by more than 60% while ensuring temperature stability of the container. The system charges within 6 hours using any power source and thereafter maintains the required temperature range in the container for up to 24 hours for a point to point transportation.

Besides this Government of India has launched the Clean Technology week -

Exhibition, Conference from 18 Jan 2017 to 20 Jan 2017 in Hyderabad.

Conclusion:

Green Business is a part of Green Consumption. Green Consumption is the practice of using environmentally, ecofriendly products. Green Business is concerned with not only natural environmental quality but also human environmental quality. It talks about sustainability of environment, economy and human rights.

Whereas **Clean Technologies** are related to recycling, renewable energy i.e. -wind power, solar power, biomass, hydropower, biofuels, etc. Information technology, green transportation, electric motors, green chemistry, lighting, Greywater, and more. There is a Global drive to adopt Clean Technology clean technology solutions have a positive benefit in relation to climate change and sustainable development. Thus Green Business and Clean Technogies is .an emerging Trend in India.

References

1. Bharucha Erach, Enviornmental Studies
2. Clean Technology, Wikipedia
3. Kumar Vaibha, Environmental Studies II
4. Prolini Alessandro, What is Clean Technology?
5. Shinde P.G., Environmental Studies I
6. 10 Promising Cleantech Startups In India Right Now website.

Green Building: A Strive for Sustainable Future

Sneha Chavan, Ar. Shamani Tendulkar
ARDRA Green Building Studio

Abstract :

Construction sector in India is the major contributor of GDP, it promotes inclusive growth by creating equal opportunity during the economical growth which benefits every section of the society. It employs millions of people, creating favorable conditions to the associated industries such as steel, cement, technology etc. This accounts major development in the social and economic sector, however one needs to understand the potential of our country in building Green economy and sustainable future. Green Building, a concept that is imperative for our better tomorrow that needs a major boost to promote and catch hold in every professional's mindset while designing and planning the same. Green Building is simply defined as "One which uses less water, optimizes energy efficiency, conserves natural resources, generates less waste and provides healthier spaces for occupants, as compared to a conventional building." As compared to any conventional building it mainly focuses on design, utility, durability and comfort. While designing a Green Building all the environmental parameters are taken into account and thus creates energy security, water security, material and resources management, improved indoor air quality, healthy lifestyle etc. In longer run, it reduces the operation and maintenance cost, enhances assets value and profit, optimizes life cycle performances. The expenses and the cost involved while constructing a green building can be managed by using appropriate strategy and methodology. Cost escalation for any Green Building is around 2%, but that too will depend if all the parameters are taken into consideration during planning level to build a high performance building.

Green Building is a necessity tool to build a brighter and better tomorrow, it is a path that will help in develop and progress our country towards sustainable development. It is a major positive contributing factor that will increase our economical strength without compromising on the natural resources.

Introduction: -

Construction sector in India is the major contributor of GDP. It promotes inclusive growth by creating equal opportunity during the economic growth which benefits every section of the society. It employs millions of people, creating favorable conditions to the associated industries such as steel, cement, technology etc. This accounts major development in the social and economic sector, however one needs to understand the potential of our country in building Green economy and sustainable future. Green Building, a concept that is imperative for our future that needs a major boost to promote and catch hold in every professional's mindset while designing and planning the same.

Green Building is simply defined as "One which uses less water, optimizes energy efficiency, conserves natural resources, generates less waste and provides healthier spaces for occupants. As compared to any conventional building it mainly focuses on design, utility, durability and comfort. While designing a Green Building all the environmental parameters are taken into account and thus creates energy security, water security, material and resources management, improved indoor air quality, healthy lifestyle etc. In long run, it reduces the operation and maintenance cost, enhances assets value and profit, optimizes life cycle performances. Green Building develops array of practices, techniques and skills to enhance the performance of the building for long term and reduces the adverse impact on the environment. It emphasizes more on passive designing architecture, orientation, climatology, solar, wind, rainwater harvesting, water treatment technology, organic waste treatment systems etc. Green building is an art of synchronizing the design with surrounding site, it may have its own pros and cons but the beauty lies within how skillfully the designing, techniques and managing of the overall development are used considering the green parameters to bring about resource efficient building. There is a rapid growth in construction industry and successively contributing to the Indian economy. With the same agenda of sustainable prosperity, Government has developed a plan for smart cities across our country which promotes the idea of Green technology, infrastructure, energy efficient building. Many initiatives have been taken by the Government to promote Green building in our country. This concept has a holistic approach where it even brings the common man to showcase his need and requirement for having a sustainable future for himself. Green buildings are the smart and sensible way of promoting designs that are beneficial to every aspect of the societies.

Objectives:

The main objective of the Green Building is to use less of natural resources at the time of construction as well as operation. Green Building mainly emphasizes on sustainable site management, water management, energy management, material & resources management and indoor air quality. Each of the parameters needs to be planned and strategized to achieve necessary efficiency and benefit the users in long-term.

1. **Sustainable site**: It is very important to select a site in where maximum potential of it is used to gain efficiency that is needed to conserve the topography, maintain the biodiversity, enhance the local development etc. Also while selecting the site it is very necessary to avoid development on floodplain areas, green field sites, provide buffer in and around the natural water bodies. Planning of the site layout will give a broader vision on how one can orient the building to derive maximum energy efficiency and explore the natural daylight and ventilation. It is important to avoid block pavements and enhance the site perviousness that will help in recharging the groundwater and minimize the heat island effect. Increase in landscape design and selecting the species that are

native to the site helps in consuming less water.

2. **Water Management:** Water is a fundamental necessity of living species, though it is nature's prestigious resource, its consumption and usage in many of the developed and undeveloped countries have remained immeasurable. Hence it optimum use of water is crucial in today's scenario. Water consumption in the building is controlled by fixtures, hence while selection of any fixtures it is necessary to take help from the technical specification of the product and check flow rates from the standards that are available.

   Rainwater harvesting helps in replenishing the groundwater table and is also mandatory in obtaining as per by laws. Wastewater treatment technology, natural or mechanical treatment, reduces the burden on municipal sources for secondary purpose. It is important that one needs to monitor the entire water consumption of the building and improve the planning and strategies for better water conservation, so devices like water meter helps in determining the same.

3. **Energy Management:** The building sector represent about the 33% of electricity consumption in India, with commercial sector and residential sector accounting for 8% and 25% respectively. Therefore designing of the building should be on the basis of minimum energy requirement for energy efficient design and construction of the building and their systems. The applicability to achieve minimum efficiency can be derived from Building envelope, Mechanical Systems, Renewable energy, Interior and exterior lightings, Electrical power & motor.

   Building envelope mainly refers to the exterior facade of the building. This design mainly affects the comfort of the occupants as well as energy consumption of the building, hence building orientation, climatology, material selection, fenestration design are the important factor that needs to be considered.

   For any of the commercial building, its **HVAC system** (Heating, Ventilation & Air- conditioning system) account significant major portion of the energy use. Increase and decrease in energy consumption can be determined on how well the air side system and central plant operates.

   Renewable energy is a must nowadays as it serves maximum benefits to the occupants and the environment. Solar, wind etc. or the combination of both could enhance the performance of the building.

   Lighting system plays a significant role in the designing of the building as it accounts in major consumption of the electricity. Efficient lighting systems such as use of LED, CFL & T5 could be considerably reduced down the energy consumption. Hence efficient lighting controls and equipments are the best way to ensure lighting efficiency. Energy efficient electrical equipments and star rated products helps in conserving energy of the building. To monitor the performance of the building, energy meters are required to determine the same.

4. **Material, Resources & Waste Management:** The concept of Green building integrates various strategies during the design, operation and maintenance stage. Selections of the

materials for green building are mainly environmentally responsible and adhere to the fact that they should be resource efficient, maintaining indoor environmental quality, low on energy etc. Most preferable materials for construction should have recycled contents, refurbished or salvaged materials, locally available, reusable / recyclable and durable. Materials that are low in Volatile organic Compounds (VOC) and emit no carcinogens, toxic pollutants are mainly utilized. Life cycle assessments of the products are necessary as it is the most reliable method to verify the environmental impacts and attributes. Waste generated during construction could be managed by proper technique and strategy before disposing of them to the landfills. For e.g. During construction, excavated soil could be used for refilling. Also during post construction managing of wet and dry waste is a must at source so as to make the further process of treatment easy and convenient.

5. **Indoor Environmental Quality:**IEQ addresses the comfort and subtlety of the occupants in the given space. Projects approaching for Green buildings mainly observe with higher number of presentee, fewer sick days and high productivity. People desire to live and work with healthy environment, building enhances when it allows clean air circulation, comfortable temperatures, adequate daylight and views. Technically, it mainly encompasses the air quality, thermal comfort, lighting and the occupant efficiency in the working environments (ergonomics). Well-designed building envelope can enhance the cross ventilation and daylighting.

Green Building "An Imminent Need"

In the world of construction sector, preserving of the environment is hardly given any importance. In such scenario where we are imposing great threat to our planet it is necessary that we find a better solution of addressing the environmental problems and preserve our natural resources. This is where Green building could play the catalyst to address the environmental concerns. The world around us is evolving rapidly in the process of science, technology and development due to which there are serious and unique environmental challenges. In this rapid growth and development, construction has lot to contribute to preserve the environment. Green Building can play a big role to mitigate and conserve the natural surrounding to a very great extent.

Stakeholders of the construction industry are now taking a gradual step in planning and strategizing this concept in new project. This concept has great to offer for all the stakeholders and set an example to many others in a way that it will only generate to build green and sustainable in near future. We have now larger segments of the built environment that works more on the conventional methods of planning and designing which is majorly responsible for degradation of our environment. Hence it is important to initiate and retrofit the existing buildings tominimize the energy and water consumption and channelize the resource to balance the consumption and cost operation. Incorporating the green features will help in conserving energy, water, minimizing the waste, reduction in fossil fuel and conserving other natural resources. When a project is developed as per Green building criteria, it manages to save upto 30-40 % of the energy, 20-30% of the water, zero waste discharge, and healthy indoor environmental quality and ultimately instigates a green living lifestyle among the occupants. This culture when inculcated during the early level of

living, can mainly changes the thought process of the existing societies.

Organisation Promoting Green Building:

Against this background of Green Building, there are various organization that helps to promote this concept across our country they are namely **GRIHA** (Green Rating Integrated Habitat Assessment) **IGBC** (Indian Green Building Council and **LEED - USGBC** (Leadership in Energy & Environmental Design - United States Green Building Council). These organization have managed to develop larger footprint of Green Building in India and thus propagating this agenda on every national and international platforms.These organization provides certification based on the guidelines provided by them to rate the project as per the standard of design, planning and execution.

GRIHA: GRIHA incepted by TERI (The Energy & Resource Institute) with the support of MNRE (Ministry of Non-renewable resources) promotes and addresses the issues related to sustainable habitat in the Indian sub-continent. Over 330 projects across India of varying scale and function are being built based on GRIHA guidelines.

IGBC: CII – Sohrabji Godrej Green Building Centre established Indian Green Building Council. It encourages builders, developers, architect, consultants, and engineers to design and build high performance orientated buildings. The vision of the council is, "To enable a sustainable built environment for all and facilitate India to be one of the global leaders in the sustainable built environment by 2025". Over 960 Green Building projects are certified and fully functional in India.

LEED-USGBC: LEED, or Leadership in Energy and Environmental Design, is a certification program for buildings and communities that guides their design, construction, operations and maintenance toward sustainability. It was established by USGBC about 20 years ago to promote sustainable development in the construction industry. It is recognized as one of the international standards guideline for Green certification on which the design and planning are implemented.

Benefits of Green Building:

With developing technologies, products and market scenario, Green building can benefit the environment, economic and social life to help create greener structure. Green Building has plenty to offer, when the approach is from the conceptual stage. A lot can be planned from the initial level of the design, planning and execution to receive the benefit later. For e.g. A planted green roof on the building has its own significant environmental benefits; like it will reduce the consumption of energy thereby reducing the pollution from the building power usage also it will reduce the heat island effect of the surrounding areas. Construction creates a great amount of pollution w.r.t burning of fossil fuel which contributes to air pollution, emissions hence leading to smog, acid rains. Green building technique using solar, wind power, adequate design for daylighting and

ventilation, carpooling and public transportation plays a better way of curbing this problem. Using of low flow fixture reduces the consumption of water and hence reducing the demand from the municipal source. Utilizing of storm water and directing through harvesting medium can replenish the groundwater. Minimization of the construction waste by reusing them on site.

Further, approach and establishing on the same outset of Green methods, cost involvement is one of the major aspects of the Green building. Economic benefit could be reaped if cost and budgeting is done in the initial level. Use of Green designs and technology leads to drastic reduction in the maintenance and operation cost. Efficient buildings exert less demand on the local power grid and water supply hence lesser the burden on infrastructure. Also due to easy convenience, operation and maintenance of the systems green building makes lower vacancy rates and higher property value.

Green Building as it emphasizes on enhanced daylighting, ventilation & low emitting VOC materials resulting in higher productivity rate of the people thereby more comfort living and healthy working environment. Sustainable design focuses on preserving natural environment which increases the places of recreational areas for exercising, outdoor activities, yoga &thus attracting many people to conduct a social healthy lifestyle.

Green Building not only serves the environment, social and the occupants of the building but it hasmajor benefit for makers of the Green Building. Builders & developers who process the project of green design and technology are benefitted with branding and long term good market reputation as a Green and Responsible Developer. It makes them socially responsible towards the environment;also it provides them with huge monetary benefits and instigates a major change in the thought process of designing and planning. Due to the high performance and longtime service of the Green Building to the occupant, the market reliability of the developer increases. To encourage this concept, in a very large scale, Government have been providing incentives in terms of FAR (Floor Area Ratio) and discounts on premium to many of the state of our country like Pune, Haryana, Sikkim, West Bengal, Rajasthan etc.

Money Matters!!

Green Building is gradually making its strong foothold in the construction industry. The ideas, strategies, methods are more adopted and warmly welcomed by all the professionals to maximize its use in all the projects. Cost is termed as the main factor before investing in such concept, it is important from the investor’s point of view on how the payback would be recovered with additional gains. Developers/Investor are sometime apprehensive when new concept is about to be materializedwhen large amount of things are at stake. In such scenario it is necessary that before conceptualizing any of the Green concepts, a feasibility study w.r.t cost is necessary as compare to a conventional building including its payback and life span. The project cost mainly intensifies during additional design analysis,

construction materials etc. But these can be recovered by reduced maintenance and renovation cost, reduced utilities bills (energy, water), longer life of building materials, decreased liability and more desirable workplace, work retention and tenant occupancy. Several materials & products that are eco-friendly and which are reasonable than the conventional materials are gaining momentum. For e.g. Glass is the most important and expensive materials for the building facade, where the builder mostly opt for Double glazed unit despite its need, by using the right technical specification and requirement as per green building approach one can even use less expensive single glazed unit to suffice the requirement. Nowadays, it is also observed that Green Building cost escalation is not more than 2% as compared to the earlier cost escalation of 15%, which can also be nullified if all the parameters are considered during the planning level of the project to build a high performance building. There are many more valuable green products that offer cost savings on a life cycle basis rather than merely an initial cost, and many of those products will also become less expensive as manufacturing costs come down with larger-scale production capacity. Green Building, serves as the future of any new construction or infrastructure concept, with the base to serve the environment, hence the new trending in design and construction will be emerging soon on green and sustainable approaches.

Green Building Is The Next Big Thing:

Green Building is a necessity tool to build a brighter and better tomorrow.It is a path that will help to develop and progress our country towards sustainable development. Future cost will incur based on the need and demand. We need to bring awareness and generate the need of it. We as the stakeholders, pose great sets of responsibility to promote sustainability at every stage and platforms. Hence, Green Building can play one such medium and a contributing factor that will increase our economic strength without compromising on the natural resources & to enhance Sustainable Development of our Mother Earth.

Bibliography:

- http://greeneconomypost.com/sustainable-site-planning-18040.htm
- http://www.rugbc.org/en/resources/articles/strategic-approach-to-water-management-in-buildings
- http://www.calrecycle.ca.gov/greenbuilding/materials/
- http://inhabitat.com/green-building-101-indoor-environmental-quality/
- https://bloomington.in.gov/green-building-benefits
- https://www.gsa.gov/portal/content/103662
- http://www.improvenet.com/a/construction-cost-savings-with-green-building
- http://www.usgbc.org/Docs/Archive/General/Docs5049.pdf
- https://igbc.in/igbc/redirectHtml.htm?redVal=showAboutusnosign&id=about-content
- http://www.grihaindia.org/index.php?option=com_content&view=article&id=104
- http://www.usgbc.org/about

Role of NGO & Government in Environmental Protection

Dr. (Mrs) Savitri Dholey,
JVM's Mehta College, Airoli, Navi Mumbai
Contact: 9819162618
Email ID: savitribora19@gmail.com

Abstract:

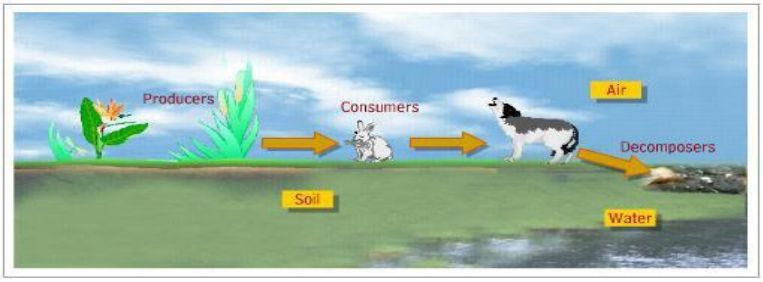
The Environment is the origin of mankind and an integral part of human life. The rapid growth of Industrialization and excessive use of natural resources has developed serious ecological imbalance on the earth. It is a challenge and threat to all living being on the earth. It has become global environmental issue. The Central and state Government own, control and develop almost all the country's forests, Dams, major irrigation system, power stations, Railways, Ports, roads, mines and even industries. The Government of India created the department of Environment and later the Ministry of Environment and forests in 1985. The ministry of Environment involves in conservation and survey of flora, fauna, forests and wildlife prevention and control of pollution by taking major steps against environmental degradation.

In spite of enactment of Statutes on pollution control and experience while its implementation in the past few years, it is felt that Government machinery is alone cannot effectively cope-up with the environmental issues, until supported by the civil society. The NGOs (Non-Governmental Organization) are creating awareness about the importance of protection of environment. It is the most effective media to reach people these days, playing a vital role in this regard. Concerned NGOs and public spirited individual can bring about significant pressure on ecological imbalance and industrial pollution control measures. National & International NGOs such as IGCMC, United Nations Conference on Environment and development (UNCED) RIO de Janeiro- are playing major role in solving the environment problem and hence necessary to have participation of Civil Society, law enforcement and direct action to resolve these problems.

Key Words: - NGOs*- IGCMC, Rio de Janeiro, Environmental policy, Civil Society, Environmental degradation, Ministry of Environment*

Introduction

Environment is defined as the surroundings in which the organism lives. The environment may be the physical environment, the chemical environment or the biological environment. Thus, the environment has two components - abiotic and biotic. The abiotic environment includes the air (atmosphere), water (hydrosphere) and land (lithosphere). The biotic environment includes the plants, animals and the microbes.



Organisms are dependent on the environment to fulfill their needs; man is also constantly interacting with the environment in order to fulfill his needs. These needs include the basic needs of oxygen, food and shelter in addition to the social needs like entertainment, medicines, etc. The things that man requires for his survival and comfort are called the resources. The environment is a reservoir of resources. Maintaining the natural resources of the environment and their careful use is called conservation. The conservation of environment involves the conservation of the natural resources. Human have always inhabited two worlds of plants, animals, soils air, and water that preceded us by billions of years and of which we are a part. The other is the world of social institutions and artifacts that we create for ourselves using science, technology, and political organization. Both worlds are essential to our lives, but interesting them successfully causes enduring tensions. A healthy environment is an absolute necessity for the well-being of all organisms, including man. All our needs, big and small are being met by the environment. However, man having reached the pinnacle of evolution is trying to bring about changes in the environment to suit his convenience. Unfortunately, this convenience is temporary. In the long run, man is losing out on a healthy environment.

Exploitation of Environment by way of growth and Development

The demand of increasing population coupled with the desire of most people for a higher material standard of living are resulting in worldwide pollution on a massive scale. Environmental pollution can be divided among the categories of water, air, and land pollution. Due to large increase in hum population and due to technological revolution the various natural resources are being consumed at a very rapid rate. This overexploitation of natural resources is disturbing the environment in many ways. Due to industrial revolution, demand for various raw materials, such as ores, has increased many times. As a result mining, activities increased about ten-fold and the natural resources quantity of metals consumed during the entire history of mankind. If we keep on consuming meals at such a speed, we would be left with no significant deposits of ores for the future.

Industrial revolution has also increased the demand for energy. In order to satisfy the increased food requirements, fossil fuels such as coal, petroleum and natural gas are being consumed at a very fast rate. The overexploitation of fossil fuels is not only depending important natural resources but is also causing pollution. Industrial evolution has also resulted in the depletion of ozone layer and deforestation.

Large increase in population has also led to overexploitation of natural resources. In order to fulfill the food requirements of large population, more and more land has been brought under cultivation and more irrigation facilities are created through construction of dams. Construction of dams disturbs the environment in many ways as will be discussed later. In order to increase the yield of crops, fertilizers and pesticides are used extensively. These chemicals enter the food chain and create imbalances in the environment.

Some of the adverse effect of over-exploitation of natural resources and industrial revolution are:

4) It has led to the large-scale consumption of fossil fuels.
5) It has led to large-scale mining of ores.

6) It has led to pollution of air, water and soil.
7) It has led to depletion of ozone layer.
8) It has led to bio-concentration of harmful chemicals in the bodies of living organisms.
9) It has led to large-scale deforestation.
10) It has led to construction of many large dams in order to get hydro-power.

Different types of Environmental Degradation

What is Environment Degradation?

Environmental degradation is the disintegration of the earth or deterioration of the environment through consumption of assets, for example, air, water and soil; the destruction of environments and the eradication of wildlife. It is characterized as any change or aggravation to nature's turf seen to be pernicious or undesirable. Ecological effect or degradation is created by the consolidation of an effectively substantial and expanding human populace, constantly expanding monetary development or per capita fortune and the application of asset exhausting and polluting technology. It occurs when earth's natural resources are depleted and environment is compromised in the form of extinction of species, pollution in air, water and soil, and rapid growth in population. Environmental degradation is one of the largest threats that are being looked at in the world today. The United Nations International Strategy for Disaster Reduction characterizes environmental degradation as the lessening of the limit of the earth to meet social and environmental destinations, and needs. Environmental degradation can happen in a number of ways. At the point when environments are wrecked or common assets are exhausted, the environment is considered to be corrupted and harmed. There are a number of different techniques that are being used to prevent this, including environmental resource protection and general protection efforts.

Causes of Environment Degradation

Some environmental life species require substantial areas to help provide food, living space, and other different assets. These creatures are called area specific. It gets to be more troublesome for the wildlife to get the assets they need in order to survive. The environment goes on, even though the animals and plant life are not there to help sustain it properly.

1. Land Disturbance, Pollution, Overpopulation, Landfills, Deforestation, Natural Causes:

Effects of Environment Degradation

Impact on human health, Loss of biodiversity, Ozone layer depletion, Loss for Tourism Industry, Economic impact:

Civic Societies responsibility towards protection of Environment

Tackling environmental problems and fulfilling our obligations to the natural environment must be the responsibility of all of us, at all levels of society. Firstly, civil society is an autonomous and dynamic element which can monitor and keep governments in check. Universities and NGOs must contribute to increasing the visibility of environmental issues on the national level. encouraging increased public participation in decision-making.

Secondly, the formal education system is vital to fostering environmental citizenship among our youth. Many countries include a citizenship element in their formal curricula, with citizenship forming a compulsory element of the English secondary school curriculum since August 2002. education about the environment, rather than awareness of crucial issues affecting the environment. This initiative aims to cultivate a stronger sense of participative democracy in the classroom, which will hopefully translate into a more active citizenry in the future.

Government needs to lead by example reflected in their choice of development projects, and regulation of corporations and multinationals to inspire and achieve maximum public co-operation.

Government Policies in protection of Environment : Chipko Movement, started in 1970's, was a non violent movement aimed at protection and conservation of trees and forests from being destroyed. Chipko movement was based on the Gandhian philosophy of peaceful resistance to achieve the goals. It was the strong uprising against those people, who were destroying the natural resources of the forests and disturbing the whole ecological balance. It was first started in the Chamoli district in the year 1973 and from there it spread to the other parts of the country. There is one very famous story about the girl, Amrita Devi, who died while trying to save the trees grown in her village. The village was under the rule of the local Maharaja, who desired to built a palace for his family. He ordered his servants to bring wood other women of the village from the nearby village**.** The incident inspired the several other rural women's, who in 1970's launched such similar movements in different parts of India. . It is really surprising that the women of that age were better aware about the significance of forests. The Chipko Movement gained momentum under Sunderlal Bahuguna, an eco activist, who spent his whole life persuading and educating the villagers, to protest against the destruction of the forests and the Himalayan Mountains by the government.

The Clean Ganga Campaign was started to keep the legendary river pollution free, however with time many more awareness campaigns have come up to get associated with it. Sankat Mochan Foundation or the SMF is a charitable organization devoted to cleaning and protecting the sacred Ganges river in India. The vision of Sankat Mochan Foundation is to restore the Ganges by alleviating its fast deteriorating environmental conditions,. The SMF runs the Swatcha Ganga (Clean Ganges) program and thus it is sometimes referred to as "Swatcha Ganga".

Contribution of Common People in protection of Environment

Mission Mangrove (Mumbai)

Mangroves are the invisible saviours of our coastal city. They safeguard our shores against natural disasters such as floods, are home to a thriving eco system and help us breathe cleaner air by absorbing carbon at a rate twice that of other plants. They are also being destroyed at an alarming rate.

These individuals have also been educated and sensitized on the importance of Mangroves.

Role of NGO's

Today we come across various non-governmental organizations whose concerns are focused on various areas such as social issues, health issues, and environmental issues. NGOs in India are spread across the country and they have close contacts with communities. They are involved in the whole spectrum of developmental activities from creating environmental awareness to undertaking watershed development: from disaster management to sustainable livelihoods; from joint forest management to giving inputs to policies.

There are large number of NGOs in India and other countries that are exclusively working for environmental, protection, conservation, and awareness. Increasingly, the government is viewing NGOs not only as agencies that will help them to implement their programs, but also as partners shaping policy and programs. NGOs are now playing an important role in framing the environmental policy, mobilizing public support for

environmental conservation, and protecting the endangered species of forests and animals. The issues like future of environmental protection, sustainable development and zero population growth are some of the major concerns of the environmental NGOs. Unless the needs of the people are identified and supported, sustainable development cannot be achieved. Some of the international environmental organizations are Greenpeace, Worldwide Fund for Nature' (WWF), Earth First, etc. Let us now have a detailed discussion on some of the environmental organizations and their efforts in protecting environment.

2. The Energy Research Institute (TERI):

Established in 1974, is a wholly independent, non-profit research institute. Its mission is to develop and promote technologies, policies, and institutions for efficient and sustainable use of natural resources. It has been imparting environmental education through projects, workshops, audio-visual aids, and quiz competitions.

RIO Foundation Model

The Global Environment Facility (GEF), established on the eve of the 1992 Rio Earth Summit, is a catalyst for action on the environment — and much more. Through its strategic investments, the GEF works with partners to tackle the planet's biggest environmental issues. Our funding also helps reduce poverty, strengthen governance and achieve greater equality between women and men. As such, we occupy a unique space in the global partnership for a more sustainable planet.

Conclusion

For over a century, nature protection in Northern Eurasia focused on conservation in set-aside areas. Long traditions, the high priority of conservation as a scientific issue and state land ownership allowed the creation of a fine and extensive system of nature reserves. This system is superior to much other national and regional conservation many countries and regions lack an adequate pool of

qualified experts willing to work in conservation, particularly in more remote areas. The success of conservation depends partly on the environmental quality beyond the boundaries of a protected area. Operating a successful system of protected areas requires effective environmental management in general and national and regional coherence. the integration of local communities into conservation planning, and broadening of governmental support for conservation.

Bibliography

1. Environmental Science and Technology - By Stanley E. Manahan.
2. Environmental Science- A Global Concern – By William P. Cunningham , Mary Ann
3. Cunnigham , Barbara Woodworth Saigo.

Change in the Shopping Pattern In India: Cashless System After Demonitization

Amit A. Naik
Department of Management Studies
Faculty of S. K. Somaiya A.S.C College, Vidyavihar, Mumbai
naik.a@somaiya.edu

Abstract:

The scenario after demonetization has completely changed in India, economy has inching towards cashless and virtual economy. Cashless system not only offers benefits but also bring new problems along with it. Virtual players spending real money on virtual items, bring virtual game scenario to reality. This study examines the cashless economic system so as to assess its feasibility in relation with timeless, preparedness and appropriateness against the backdrop of our level of development both technologically and educationally. India has continued to evolve in different territories. The economy is being reformed, the institutions are being reshaped and laws are being re-examined so as to reposition the nation to take its rightful position in the international community. The current steps after demonetization and emergence of cashless systems will help fight against corruption/money laundering and reduce the risk of carrying cash and can also foster economic growth. Major problems envisaged that can hinder the implementation of the policy are: cyber fraud, limited point of sales and numeracy illiteracy. To overcome probable cons a strong cybercrime laws and policies are needed.
This empirical study used structured questionnaire as a means of data collection and the collected data is analyzed with basic statistical tools.
Keywords: *Virtual World, Demonetization,*

Introduction:

In last decade and more the business and commerce activities around the globe are rapidly dominated by technology and it is more digitized. Internet, virtual social and commercial groups and e-commerce are buzz words. Two important factors that have contributed to thisdevelopment are the use of mobile phones, and the use of the Internet. We are more 'on the go'than ever and get things done while we are on the go via our digital services turning the world toa mobile village.A part of the above mentioned digital purchases is digital payments. And wheneverything else is mobile, the payments have to be mobile too; we have to be able to pay forgoods and services no matter where we are.Mobile payments are defined as "payment forgoods, services and bills with a mobile device such as mobile phone, smart-phone, or personaldigital assistant (PDA) by taking advantage of wireless and other communication technologies". Today, we still pay in cash or cheque, but several other payment instruments, such as credit anddebit cards are widely used. The use of paper money is declining, but at a slow pace.The basics ofmobile payments have been describe and it is relevant to pay attention to what kind of mobilepayment technologies that exist today in order to be able to assess the introduction of a cashlesssociety through mobile

payments.From the foregoing challenges, the objectives of this studytherefore are to examine the benefits of the cashless economy, the essential elements of thecashless economy and assess the preparedness for the implementation of the cashless economy by India especially after recent demonetization move of central government. This study has adopted empirical way to achieve underline objectives.

Review of Literature:

In the last two decades, electronic payment systems (EPS) have attracted much attention from researchers and information system designers due to their vital role in modern electronic commerce.

This led to wide and in-depth researches that produced different perspectives on e-payment definitions among others. These definitions were mainly viewed from different perspectives ranging from scholars in the field of accounting and finance, business technology to those in information systems. For instance, Dennis (2004) defines e-payment system as a form of financial commitment that involves the buyer and the seller facilitated via the use of electronic communications. Also, Briggs and Brooks (2011) sees e-payment as a form of inter-connections between organizations and individuals aided by banks and inter-switch houses that enables monetary exchange electronically.

In another perspective, Peter and Babatunde (2012) viewed e-payment system as any form of fund transfer via the internet. Similarly, according to Adeoti and Osotimehin (2012), electronic payment system refers to an electronic means of making payments for goods and services procured online or in supermarkets and shopping malls. Another definition suggests that e-payment systems are payments made in electronic commerce environment in the form of money exchange through electronic means (Kaur&Pathak, 2015).

Furthermore, Kalakota and Whinston (1997), sees electronic payment as a financial exchange that takes place online between the seller and the buyer. Moreover, Humphrey and Hancock (1997) are in the opinion that electronic payments refer to cash and associated transactions implemented using electronic means. E-payment is also defined as payment by electronic transfer of credit card details, direct credit or other electronic means other than payment by cheque and cash (Agimo, 2004).

Antwi, Hamza, and Bavoh (2015) defined e-payment as a payer's transfer of a monetary claim on a party acceptable to the beneficially. Lin and Nguyen (2001) define e-payment as payments made via the automated clearing house, commercial card systems and electronic transfers. Shon and Swatman (1998) define e-payment as any exchange of funds initiated via an electronic communication channel. Gans and Scheelings (1999) define e-payment as payments made through electronic signals linked directly to deposit or credit accounts. Hord (2005) also sees epayment as any kind of non-cash payment that does not involve a paper cheque. Also, Teoh, Chong, Lin, and Chua (2013) viewed epayment as any transfer of an electronic value of payment from a payer to payee through an epayment channel that allows customers to remotely access and manage their bank accounts and transactions over an electronic network. In a nutshell, going by the above definitions, e-payment system can simply be defined as a collection of

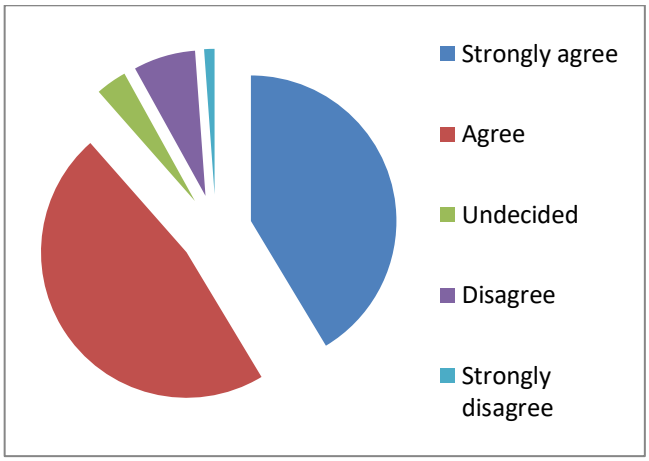
components and processes that enables two or more parties to transact and exchange monetary value via electronic means.

Research Methodology:

The research design used in this study is the descriptive survey method. The population of thisstudy is the entire academic community. A sample size of 100 was selected using the conveniencesampling procedure. The sample includes both literate and illiterate Indian since they are theones that can respond to determine the reliability of the numeracy of users knowing fully that anaverage Indian can use mobile phones. The method used to collect data for this study isstructured questionnaire. A total of 100 copies of the questionnaire were personally administered out of which 86 copies were retrieved in usable form. This represents a response rate of 86%. Theresponses from the respondents were collated and analyzed.

Data Analysis:

Knows about cashless economy

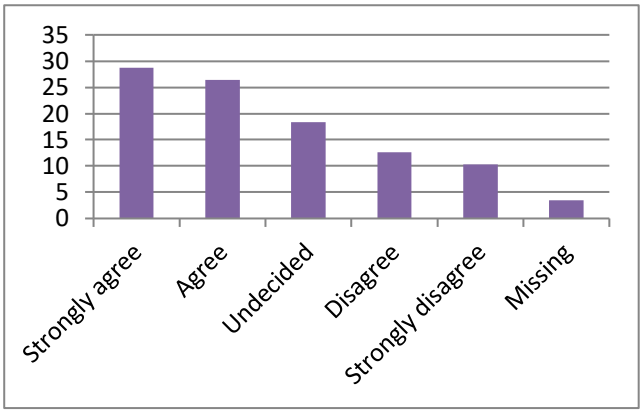


Source: Primary data

The survey was conducted to know awareness about cashless economy. Around 42% respondents were strongly knows about cashless economy and its benefits, whereas 47% were agree and 3.4 % & and 6.9% undecided and disagree respectively.

Cashless economy should be introduced in India?

Opinions were collected about the implementation of cashless economy in India, out of that 29% were in strongly in favor 26% were agree and 18% undecided and others were strongly disagree rest didn't responded to it.



Source: Primary data

Survey was also conducted on benefits of cashless economy: the aspect is stoppage of money laundering, corruption and stimulation of economic growth. Nearly 22% were strongly in favor of positive outcome on stoppage of money laundering, 32% are agree and 19% were unaware about its positive impact on money laundering.

The other aspects is corruption and 15%, 26%, 21% were strongly agree and positive, agree and did not aware about its impact respectively and 21% disagree whereas remaining did not answered it properly.

The question on economic growth due to cashless economy was also included in the survey and 20%, 35%, 28%, 9% were strongly agree, agree, undecided and disagree on this aspect if cashless system is adopted by India.

The survey also focused on other aspects related to cashless economy like limited point of sale from sellers, literacy required to use this system effectively by uneducated and poor section of society, increase in frauds through ATMs and Internet. The majority of respondents were highly in favor of cashless economy provided proper measure should be taken in order to resolve loopholes and lacunas.

Conclusion & Recommendations:

From the above stated analysis, it appears that much has already been done on the issue ofawareness of cashless economy and that a sizeable proportion of the people are actually awaitingthe introduction of the cashless economy.

It also appears that many people actually agree with thegovernment on the usefulness of the cashless economy. It is agreed that the cashless system willbe helpful in the fight against corruption and money laundering. One most significantcontribution of the cashless economy is that it is expected to reduce the risk associated withcarrying cash. Since most transactions will now be settled electronically, people will have lessneed to move around with cash and therefore, loss of cash, theft and armed robbery willdrastically reduce.One major problem in the working of the cashless economy is internet relatedfraud. India is also encountering major problems related to electronic

fraud and this can only be expected to increase as wemarch into the cashless economy.

A country as large as India should have a signed lawpreventing cybercrime. Numeracy illiteracy is also a major factor. The level of literacy in India is still very high. The cashless economy is effectively an e-economy and in any e-system there isalmost no place for the non-literate. It is concluded among other things that since the world ismoving from cash to a cashless one through the use of electronic- based transactions, it isimperative for India to move in the same direction. The benefits of the above suggestionsinclude increased economic growth, greater financial inclusion, and faster access to capital;reduce risk of cash related crimes among others.

To make for the smooth implementation of thecashless system in India, the following measures are recommended.

There is the need tointensify the public enlightenment programme about the cashless system so that everybody willbe acquainted with the system before its introduction since it will affect everybody. Since there isa high rate of illiteracy, and all people must be brought into the system, the government should design special enlightenment programmes for the non-literates, using probably signs and symbolsto educate this segment on how to operate the cashless system (post on sale vis-à-vis mobilephones).

India should make concerted efforts to design an internet security framework to checkonline fraud so that the public can be assured and protected against cyber-attack and fraud. Thereshould be a careful study of the system to determine the number of point of sales terminals thatwill ensure its smooth running in India so as to prevent unnecessary friction in the system.

There should be adequate legislation on all aspects of the operations of the cashless system so thatboth the operators of the system and the public can be adequately protected.

References:

1. R. J. Anderson. (2008)Security Engineering: A guide to Building Dependable Distributed Systems. Wiley

2. Au, Y.A & R.J, Kauffman. (2007). The economics of mobile payments; Understanding stakeholder issues for an emerging financial technology application. Electronic Commerce research and Pllication, Volume 7, issue 2, (pp. 141-164)
3. D. Balaban. (2010). Sony Faces and Uncertain Market forltsFeliCa Technology. From NFC Times.Retrieved from http://www.nfctimes.com/news/chart-article-contactless-e- money-jaqpanfelica-chips
4. E.V Buskirt.(2010). Why your Phone Can't Really Replace Your Credit Card. Retrieved from wired.com http://www.wired.com/epicenter/2010/08/phone-credit/all/1
5. S. Calrk. AT & T, Verrizon, (2010). T-Mobile confirm Isis mobile payments joint venture, Retrieved from http://www.nearfieldcommunicationsworld International Journal of Information Sciences and Techniques (IJIST) Vol.3, No.2, March 2013 11

6. T. Dahlberg, N. Mallat, J. Ondrus, & A. Zmijewska . (2008) Past, present and future of mobile payments research: A literature review. Electronic Commerce Research and Applications, Volume, Issue 2, (pp. 165-181)
7. EIU & IBM (2010) Digital economy ranking 2010-Beyond e-readiness. Retrieved from http://www.graphics.eiu.com/upload/EIU_Digital_economy_2010_FINAL_WEB.pdf
8. D. D. Garcia-Swartz, R. W, Hahnn, & A. Layne-Farra.(2006). The move Towards a Cashless Society: Calculating the costs and Benefits. Review of Netwol Economics, Volume 5, Issue 2, (pp. 199-228)
9. L.Gormes.Visa's Mobile Payments Plan, 2010. Retrieved from http://www.forbes.com/forbes/2010/1025/technology-mobile-payments-cellphones-fraud-visacalling.html
10. D. Knights, F. Noble, T. Vurdubakis, & H. Willmott (2007). Electronic Cash and Virtual Marketplace: Reflection on a Revolution Postponed. Organisation, Volume 14, Issue 6. (pp. 147-768)
11. V.G. Kopytoff. (2010) For PayPal, the future is Mobile. Retrieved from http://www.nytimes.com/2010/11/29/technology/29paypal.html!_r=1&ref=business
12. N. Mallat. (2006). Exploring Consumer adoption of Mobile Payments-AQualittative Study. Sprouts: Working Papers on Information Systems, Volume 6, Article 44.
13. Jan Ondrus& Yves Pigneur,(2006) "Towards A Holistic Analysis of Mobile Payments: A Multiple Perspectives Approach", Electronic Commerce Research and Applications, Vol. 5, Issue 3, pp. 246- 257.
14. K. Prashanth. (2004). PayPal's Business Model. ECCH Collection, (pp.1-18)
15. M. E. Porter, & V. E. Miller,(1985). "How Information Gives you Comparative Advantage" Harvard Business Review (July-Aug.) 63 (4), 149-174
16. Central Bank of Nigeria "Towards a cashlite Lagos" retrieved from www.cbn.gov.ng/cashlite
17. European Payment Council (2010)
18. S.L. Sanusi, 2012 Central Bank Governor http://www.voiceofnigeria.org/Nigeria/Cashless-Policyenabler-of-Economic-growth-Sanusi.html

6. T. Dahlberg, N. Mallat, J. Ondrus, & A. Zmijewska . (2008) Past, present and future of mobile payments research: A literature review. Electronic Commerce Research and Applications, Volume, Issue 2, (pp. 165-181)
7. EIU & IBM (2010) Digital economy ranking 2010-Beyond e-readiness. Retrieved from http://www.graphics.eiu.com/upload/EIU_Digital_economy_2010_FINAL_WEB.pdf
8. D. D. Garcia-Swartz, R. W, Hahnn, & A. Layne-Farra.(2006). The move Towards a Cashless Society: Calculating the costs and Benefits. Review of Netwol Economics, Volume 5, Issue 2, (pp. 199-228)
9. L.Gormes.Visa's Mobile Payments Plan, 2010. Retrieved from http://www.forbes.com/forbes/2010/1025/technology-mobile-payments-cellphones-fraud-visacalling.html
10. D. Knights, F. Noble, T. Vurdubakis, & H. Willmott (2007). Electronic Cash and Virtual Marketplace: Reflection on a Revolution Postponed. Organisation, Volume 14, Issue 6. (pp. 147-768)
11. V.G. Kopytoff. (2010) For PayPal, the future is Mobile. Retrieved from http://www.nytimes.com/2010/11/29/technology/29paypal.html!_r=1&ref=business
12. N. Mallat. (2006). Exploring Consumer adoption of Mobile Payments-AQualittative Study. Sprouts: Working Papers on Information Systems, Volume 6, Article 44.
13. Jan Ondrus& Yves Pigneur,(2006) "Towards A Holistic Analysis of Mobile Payments: A Multiple Perspectives Approach", Electronic Commerce Research and Applications, Vol. 5, Issue 3, pp. 246-257.
14. K. Prashanth. (2004). PayPal's Business Model. ECCH Collection, (pp.1-18)
15. M. E. Porter, & V. E. Miller,(1985). "How Information Gives you Comparative Advantage" Harvard Business Review (July-Aug.) 63 (4), 149-174
16. Central Bank of Nigeria "Towards a cashlite Lagos" retrieved from www.cbn.gov.ng/cashlite
17. European Payment Council (2010)
18. S.L. Sanusi, 2012 Central Bank Governor http://www.voiceofnigeria.org/Nigeria/Cashless-Policyenabler-of-Economic-growth-Sanusi.html

Role of NGOs in Environment Protection in Mumbai

Dr K Satyavati Patnaik,
MA MLISc MBA PhD
Email: kspatnaik17@gmail.com mob: 9619481960
Lecturer S .K College of Science and Commerce
Plot No 31, Secor 25,Nerul

Abstract

Many countries world over are facing profound environmental problems and climate change. As a result there is growing awareness among the individuals and communities about environment protection. This increase in awareness has resulted in the proliferation of non-governmental organisations(NGOs) committed towards environmental protection and conservation of natural resources. This paper explores the role played by NGOs in environmental protection and their contribution in solving environmental problems in the city of Mumbai.

Introduction

World over NGOs (Non-Government Organizations) and government agencies, institutions and individuals are rallying together to ensure a safe and healthy environment to humanity. NGOs today are involved in whole spectrum of developmental activities for creating environmental awareness. Their actions have made significant contributions to preventing deterioration in the environment and they have facilitated the development of environmental policies. NGOs are important especially in areas where the government cannot serve adequately in addressing the issue of environmental management. The increasing importance and role of NGOs in various sectors of environment protection makes it necessary to have knowledge of the grass root level organizations and their activities in environment protection and bio diversity conservation. There are a large number of NGOs in Mumbai working for environmental protection, conservation and awareness.

Objectives:

- To highlight the role of NGOs in environmental awareness programmes in Mumbai.
- To outline the various activities used for imparting environmental awareness.
- To give relevant suggestions to the NGOs working in the area of environment protection.

Methodology: The present paper is a descriptive study undertaken by the researcher .The data is collected from secondary sources such as books, journals, newspapers and websites.

Discussion:

Many large cities in India and Mumbai in particular are facing profound environmental problems. Mumbai, the city of dreams is located on the west coast covers an area of about 4400 sq km. It is one of the largest cities in India, considered as financial capital of the country. Mumbai occupies a site of natural scenic beauty. Since independence Mumbai, been a centre for development and financial activities in India. High population growth, inward migration and rapid industrialization have contributed to some serious environmental problems and

environmental degradation.. Although several attempts have been made by the local authorities to improve the environment and promote sustainable development plan, this is hampered by uncontrolled growth of population and economic activity of the region. The environmental problems that have emerged are largely due to excessive developmental projects and faulty government policies.These growing challenges to the environment degradation in Mumbai city has given rise to increasing growth of NGOs to protect the environment and increase is awareness.

Environmental problems faced by Mumbai:

i. Shrinking Mangroves: Rapid developments like housing, industrialization, pollution and increasing population of Mumbai has resulted into degradation of mangroves. There are two important creeks, Vasai Creek towards north and Thane Creek toward south where luxuriant mangrove patches are still left. Otherwise the State Govt. agencies have failed to protect this important, productive mangrove ecosystem from building mafias'

The worst affected area in Mumbai is the entire western front excepting Carter Road where the mangroves have grown and have also registered an increase in height in the last 10 years. This has been possible due to the participation of citizen's forums fighting individually.

Encroachments, agriculture ponds, and infrastructure developments are taking a toll on the stretches of mangroves. Mangroves prevent soil erosion and protect shorelines against cyclones and ecological disasters. Environmentalists found out that around 80 aquaculture ponds have been set up in a range of less than 6 km in Navi Mumbai. Also there are cases of mangroves being destroyed in Airoli,Bhandup, Kasheli,Vashi, Vasai,Borivili and areas close to Gorai creek reported frequently. Mangroves are being perforated and damaged by influential locals for creating these ponds.

In the past few years there has been an increase in the awareness of the people in Mumbai. Residents associations are coming together to spread this awareness. They realize that the rapid destruction of mangroves along the coast of Mumbai will have far-reaching effects on the city. The NGOs in Mumbai are making efforts to highlight the issues like land reclamation, coastal regulation zone notification and illegal destruction of the mangrove areas through the interventions of the local state government and a local bodies.

ii. Toxic Air: Poor air quality standards are a major problem for city's inhabitants. Road construction is the main cause of pollutants especially in suburbs. Vehicular emissions and smoke from bakeries and crematoriums are other reasons. The industrial belt of Thane- Belapur is mainly responsible for releasing high levels of toxic and carcinogenic chemicals. Carbon monoxide levels and particulate matter emissions have risen owing to traffic congestion. It has also been found out that sulphur di oxide levels have fallen in recent years and nitrogen di oxide levels have raised. Particulate matter, carbon monoxide and oxides of nitrogen and a host of other pollutants make Mumbai's air toxic. Studies have found out that Mumbai has a very high incidence of chronic respiratory problems arising from extreme air pollution.

iii. Dying Powai lake: The Powai Lake is the artificial lake situated in the northern suburb of Mumbai. Around 50% of the surface of Powailake is covered with water hyacinth, an invasive weed. The presence of water hyacinths is an indication of low dissolved oxygen levels and high pollution levels. The lake has also used

to dump construction debris and sewage. The catchment of the lake has also been affected badly due to unplanned quarrying activities.

iv. Dying Marine Creatures: Dolphins, whales, turtles are dying due to viral infections known as " Morbillivirus" The unusual frequency of these deaths have perplexed marine ecologists and environmentalists alike. They claim the effluents released in creeks and sea. Oil pollution and plastic debris is responsible for this damage.

v. Dumping ground fires: Frequent fires erupting in dumping grounds of Deonar and Mulund have posed serious health hazards to local residents. These residents are exposed to a concoction of chemicals released in air due frequent fires. Incidents of frequent fires in these grounds have highlighted the poor solid waste management amenities provided by the civic body. Excessive smoke a the dumping ground is reducing the air quality and also causing skin and eye problems of the residents.

vi. E- waste poisoning: Mumbai is country's e-waste capital. Around 96,000 tonnes of e- waste is generated annually. Compact florescent lamps, cathode ray tubes, mobile phones chargers and CDs directly go into the landfills contaminating soil and ground water. E-waste involves complex material with huge amount of toxicity that can lead to health and environmental problems if it is not managed well.

vii. Plastic Waste: Mumbai produces 800 tonnes of plastic waste per day . There is no policy to separate plastic waste. Rag pickers collect PET bottles, milk pouches and plastic bags and sell them to recycling units in Dharavi, Bhandup,Vasai and Saki Naka. With this Pellets, moulded plastic and yarn is made.

viii. Polluted Mithi River: One of the oldest rivers in State, mithi now is nothing more than a sewage drain. The stream consisted of 93% domestic sewage and 7% of industrial waste.

According to experts, nearly 54% of the original river had been lost to encroachments, roads and development. The BandraWorlisealink has constricted the mouth of the with as much as 27 hectares of land fills in Mahim Bay.

Environmental NGOs in Mumbai:

i. Awaaz Foundaion: Awaaz foundation was founded on 21 February 2006 by Sumair Abdulali, a well-known environmentalist. It is a charitable trust and non-governmental organisation in Mumbai which builds awareness, carries out advocacy and is involved in educational projects to protect the environment and prevent environmental pollution. It has impacted many important decisions by the government and influenced policy making in important environmental matters in Mumbai. Awaaz is actively campaigning for air pollution, noise pollution, protection of tress in Mumbai. It has played a pioneering role in educating citizens about the effects of noisy environment. If Mumbai has witnessed a gradual decline in noise levels during and other festivals, much of the credit goes to the anti-noise campaign created by Awaaz foundation.

ii. Vanashakti:Vanashakti is a Mumbai based NGO whose thrust areas are forest, mangrove and wetland protection, environment education for schools both and rural , livelihood for forest based communities and scientific investigation ino local environmental degradation.

Vanasakti is a public information initiative aiming at creating awareness of major issues. It primarily advocates the crucial role played by forests in human wellbeing. Vanashakti has

many partner NGOs which they support. Of these Ekvira Ali Pratisthan works towards mangroves conservation, New link Road Residents Forum fights encroachments mangrove area and Awaaz foundation focuses on prevention of mining in ecologically sensitive areas apar from noise and marine pollution as well as other environmental issues. Other areas of its activity include wetlands, anti-mining, community conservation, urban issues, educational initiatives and research into mining etc

iii. The Bombay National History Society(BNHS): .Founded in 1883, it is recognized as one of the foremost conservation research organizations in the world. It is dedicated to the conservation of nature and natural resources. This society is focused on conservation of nature primarily bio diversity through action based research, education and public awareness. BNHS aims to collect data on the specimen on natural history throughout the Indian sub-continent. I also disseminate knowledge of flora and fauna by means of lectures, field trips literature and expeditions. Besides the society also recommends management plans o conserve wildlife and its habitat. The BNHS has associated with top corporate names of the likes of Tata- group ,Godrej group and State bank of India.

iv. Clean Mumbai Foundation: Founded in 1942 , CMF works towards cleanliness and beautification of Mumbai. Creating awareness on the need for a cleaner city among all sections of the society is its prime objective. Its programmes include house to house garbage collection, eliminating open garbage spots, putting enough dustbins near bus stops and conducting health camps. The foundation collaborated wih college like KC College to spread environmental awareness.

v.I Love Mumbai: I love Mumbai is an NGO .that started in 1989 under the guidance of Nana Chudasama with the mission of clean and green Mumbai. Since is inception it is persistently putting in conscious efforts to beautify Mumbai,by planting saplings and launching cleanliness drives. Till date I has also distributed over 50,000 free saplings all over Mumbai and its suburbs. It also organizes plant exhibitions from time to time to create environmental awareness . In these events a variety of plant related workshops are also arranged to make people environmentally conscience.

vi. Mangrove Society of India: It is a nonprofit nonpolitical organization working towards the protection, conservation and sustainable use of mangroves. Established in 1990 ,it has affiliation with research, government institutions . corporate houses and stakeholders and NGOs from various southern states. Its functions include promoting different aspects of basic and applied aspects of mangrove sciences for human welfare.

vii. Conservation Action Trust: This NGO mainly focused on providing assistance in the form of technical information .legal advice .aid and equipment to all those who are confronting environmental problems. It currently concentrating on protecting the mangroves of Mumbai solving the Tiger crisis.

Conclusion: The city of Mumbai is facing grave environmental problems due to lack of proper planning and unprecedented population growth. To solve these problems a number of NGOs are dedicated to fight tirelessly to secure a future for a city that is heading towards environmental suicide. Environmental NGOs in Mumbai have emerged as one of the strongest external pressure groups in bringing about the changes in environmental laws and regulations as well as enforcement of environmental rules and

regulations.NGOs are playing crucial role inEnvironmental Protection, conservation anddevelopment. Government, NGO and peoplecollaboration is the imminent need of the hour.NGOs are the watch dogs of the environmentalissues. Multi-sectoral coordination andconvergence and holistic and sustainabledevelopment can be achieved withparticipation of NGOs.

References:

1. SandhuDildeep and AroraPooja'Role andimpact of environmental NGOS onenvironmental sustainability in India',Gian. Jyoti (2012).
2. PotdarAditi, UnnikrishnanSeema, SinghAnju and NaikNeelima," A comparativeassessment of environment law and policiesof India and China, J. Environ. Res. Develop., 8(1), 204-214, (2013).
3. Sharma Nishant, Shrivastava B. R. andShrivastavArchana, Exposures ofenvironment for risk of oral cancer, J.Environ. Res. Develop., 8(3A), 584-589,(2014).
4. TiwariJeetendra Kumar and Rawani A. N.,Environmental impact analysis: A casestudy, J. Environ. Res. Develop., 8(2), 802-808, (2014).

Study of Khazan Lands of Goa and Its Impact on Ecosystem

Bhagyashree Shaikh
LTA College of Beauty

Abstract

Khazan land is a low lying area having basin shaped topography and it is mostly situated near the bank of salt water fed rivers. Hence, it is difficult to cultivate such lands. Khazan land area in Goa is estimated around 15,000 acres. It is important to undertake such areas for cultivation. In this study we are collecting data to understand about current status of Khazan lands by processing collected soil samples throughout Goa for soil fertility, electric conductance. Parameters like source of water in the fields, month of salt water invasion, types of crops cultivated, season of crop cultivation and status of agricultural production, other use of agricultural field were studied. Main objectives of study included to identify the extent of area affected by soil salinity in different talukas of Goa, to study physio-chemical characteristics of salt affected soil, to know time period of salt water intrusion during different months of year. Collected soil samples were tested for their organic Carbon, Nitrogen, Phosphorous and Potassium content by titration method. In data collection sheets, parameters were discussed with local farmers and for information reports from Pollution Control Board, Goa were also taken into consideration. In results from the soil analysis we found pH of soil is strongly acidic for Mapusa taluka. Almost all talukas under observation show electric conductivity at injurious level to crop plant health. Soluble salt contamination which is indicated by high amount of electric conductivity of soil has caused problems for Khazan lands in Goa. Salt devastates many areas and is increasingly a serious limitation to plant growth. In general, all soil samples show high organic Carbon and Nitrogen content and uneven distribution for Potassium content. Powdered limestone, wood ashes, burned limestone (forming CaO), and marl (soft calcium carbonate and clay) are used in acidic soils to increase soil pH and plant growth. Most commonly salt water intrusion is influenced by rains and changes in tidal currents so bund formation can be suggested.

Key Words – *Khazan land, Soil fertility, electric conductance, soil salinity, organic Carbon*

Introduction

***Khazan* lands** are low lying areas near river banks in Goa. The sea water during the high tides brings in extra sea water into the rivers which then spills into the low lying areas. During low tides this water ebbs back into the rivers, but only after depositing salt into the soil. The extent of salinity in the soil differs from place to place.

In old days, sluice gates were great saviors. They were wooden gates to prevent entry of salt water in low lying areas. Now days, this problem has become more critical due to various socioeconomic reasons.

Soil salinity is a major problem faced by farmers cultivating coastal saline soil in Goa. Such soil condition is caused due to periodic salt water intrusion. It is a natural phenomenon so unavoidable but most farmers build 'bunds'. The efficiency of these structures depends upon frequency of soil erosion, depression of land, material used for construction and its maintenance.

As a result of salt water intrusion soil becomes accumulated with salts. During rainy seasons when fields become flooded with water, it has flushing action on soil but as it starts drying salts accumulate on the soil, blocking gas exchange of soil particles.

As estimated by department of Land survey and settlement the extent of such *Khazan* land is around 18,000 ha and out of that 12,000 ha is cultivated by farmers for paddy during monsoon. Surprisingly, there is no specific baseline data available about the distribution and systemic classification of these *Khazan* lands. This study is an attempt to understand various parameters associated with *Khazan* lands and to collect baseline data about these *Khazan* lands.

Study Sites – Locations: While selecting the study sites for soil samples few considerations like its distance from river, salt affected area of the field, severity of the problem and access to the field were given preference.

- In **taluka Pernem**, soil samples were collected from **Conadi – Corgao and Warchawada – Morjim**.
- In **taluka Tiswadi**, soil samples were collected from **Carambolim – Saklebhat, Ambai and Kahdap – Chorao.**
- In **taluka Salcete**, soil samples were collected from **Chinchinim – Coddewado, Curtorim – Firuguebhat, Lotulim – Carvota, Makazana – Cupator, rachole – Piddade**.
- In **taluka Bardez**, soil samples were collected from **Khazanwado, Carona, Salvador -de- mundo – Aldona**.
- In **taluka Canacona**, soil samples were collected from **Palolem**.

Material and Methods

Methods Used to Collect Soil Samples:

A. Collection of a Soil Sample:

1. Generally, one sample is to be taken from an area of one acre. To get a representing sample, dig at four to five different places for area of one acre by using auger.

2. Collect and thoroughly mix the soil drawn by an auger from different places.

3. Dig 'V' shape or square shape pits with required depth to take sample by pit method. For paddy crop dig 'V' shape pit of approximately 20 cm depth.

4. Collect and mix the soil from all 4 to 5 pits in a container. Remove the stones and pebbles if any.

5. Now, mark the square diagonally with the help of a stick. Then remove the soil from the opposite two portions of diagonal and save other two portions.

6. Repeat this procedure till a half kg of soil is retained which is proper representative of soil sample.

7. Dry the soil sample in the shade if it is wet. Cover it in dry paper to avoid eventual sample loss.

B. Packaging and Transport Of Soil Sample:

Soil sample is collected in a polyethylene bag of dimension 10 cm breadth, 25cm length and thickness of 5 cm. The bag is packed by means of stapler pin and transported by road to the Soil testing laboratory.

C. Analysis of Soil Samples:

Estimation of Phosphorus was conducted using spectrophotometer. The intensity of the color was read at 600 nm using red filter.

Estimation of Potassium was conducted using flame photometer with 1N Ammonium acetate and standard Potassium solution.

Organic Carbon was **estimated using titration** method developed by Walky and Black in 1934. Here, intensity was read at 660 n with red filter.

Electric conductivity was measured using **Conductivity meter** with reference to specific conductance of 1.41 mmhos/ cm at $25^{O}C$ with 0.01 N KCl solution.

The pH was measured by using **pH meter**.

In order to understand how these *Khazan* lands support cultivations and different other problems related with it we interviewed some *Khazan* land farmers. Few parameters discussed were,

a. Ownership of *Khazan* land- can be private, owned by Communidade or owned by tenant or tenant association.

b. Sourc of water used for irrigation in the *Khazan* land – river water, water from canal taken from dams, Fresh water from tap, Fresh water from Pond, Well water.

c. Season of cultivation of *Khazan* land – *Kharif* and *Rabbi.*

d. Month of salt water intrusion – January to December.

e. Types of crops cultivated in *Khazan* land – Only rice, rice and Cowpea, rice and chilies and fruits.

f. Status of *Khazan* land used for other activities – Fish rearing, Crabs and Prawns are grown, Fruits plants like Mango, Banana are cultivated.

Standard range for different soil fertility parameters

pH range	Suitability for cultivation
< 6.0	Acidic
6.0 to 7.5	Normal (neutral)
> 7.5	Alkali

Standard range for different soil fertility parameters:

Parameter	Low	Normal	High
pH	<6.0	6.0	>7.5
Nitrogen (Kg/ha)	<280	280 to 560	>560 and above
Phosphorus (Kg/ha)	<20	20 to 56	56 and above
Potassium (Kg/ha)	0 to 140	141 to 336	337 and above
Organic Carbon (%)	0.50	0.50 to 0.75	0.75 and above

Results:

General soil fertility status of saline soils in Goa

Taluka	pH	Electric conductivity (ds/m)	Nitrogen/ Organic Carbon (%)	Phosphorus (Kg/ha)	Potassium(Kg/ ha)
Pernem	6.7	8.02	0.98	5.0	877.3
Tiswadi	5.42	14.23	0.93	114.23	1189.0
Salcete	6.1	9.18	0.85	10.56	799.4
Bardez	4.15	10.66	1.33	101.82	1161.1
Canacona	5.1	2.70	0.86	17.2	252.0

It is found that for pH of *Khazan* soils in Pernem taluka is in normal range (pH 6.7). Further, in Salcettt taluka it was slightly acidic (pH 6.1). Other than these two taukas, Tiswadi, Bardez, Canacona exhibit highly acidic pH which is of major concern in case of cultivation. The lowest pH was observed in Bardez taluka (pH 4.15) which nedds immediate corrective measures.

Electric conductivity (E.C.) of *Khazan* soil is highest for Tiswadi taluka (14.23 ds/m) and is lowest in Canacona (2.0 ds/m). In Bardez, Salvador- de- mundo region shows normal range of E.C. (1.67 ds/m). Almost all coastal talukas under observation exhibit higher E.C. in *Khazan* soils which is injurious to crop heath. It requires good management.

For organic content of soils in *Khazan* land area under observation show higher values indicating their sufficiency for crop growth and development.

For most of *Khazan* soils of the different talukas undr study viz., Tiswadi and Bardez they showed high content of Phosphorus. However in Pernem, salcette and Canacona Phosphorus content was found to be low.

In general, it was observed that there was uneven distribution of Phosphorus content in *Khazan* soils of Goa, necessitating the need for the nutrient management.

In case of Potassium content of *Khazan* soils Pernem and Tiswadi taluka showed high amount of Potassium present. However, the soil sample from Tiswadi (Ambai Chorao) had low Potassium content (112 kh/ha). Simillarly, in salcette taluka it is high but at the locations 'Curtorim - Firuguebhat', 'Chinchini - Coddewado' and *Khazan* soils of Canacona taluka showed normal Potassium content as per standard range of Potassium content.

In general, it was observed that there was uneven distribution of Potassium content in *Khazan* soils of Goa and the nutrient needs to be applied only in locations where they are required.

Discussion

As per our results, we can conclude that most of the talukas in Goa has acidic pH in their *Khazan* soils. Goa is a humid region and in such regions, soils become acidic as heavy rainfall containing weak acids flow through them, replacing basic cations from cation exchange sites with Hydrogen and Aluminum ions. So, in remediation measure we suggest to add lime. **Lime** is the material added to acidic soils to

raise their pH i.e. to reduce their acidity. Commonly, in such cases lime which is used is impure, crushed Calcium Carbonate, powdered limestone, wood ashes or burned limestone.

Soluble salts are measured by **electric conductivity**. Soluble salts are those inorganic chemicals that are more soluble than gypsum ($CaSO_4.2H_2O$). This gypsum has solubility 0.241 gm/100 mL of water. Our common table salt, Sodium Chloride NaCl has 150 times more solubility in water than gypsum. Unit of conductance is Simens per meter (SI unit).

Soluble salt contamination which is indicated by high amount of electric conductivity of soil has caused problems for *Khazan* lands in Goa. These *Khazan* lands are salt affected low lying areas which become very dry in summer and shows tendency to remain wet during whole of rainy season due to salt water of rivers. Salt devastates many areas and is increasingly a serious limitation to plant growth as water supply becomes more limited and polluted with soluble salts. **The high level of organic content** is due to river *Mandovi* and its river tributaries. while flowing through these areas they also bring in different depositions along with their flow which adds fertility to the soil.

Variations in the of Phosphorus and Potassium is observed in *Khazan* soils of Goa. This can be mainly because **indiscriminate use of Phosphorus and Potassium rich fertilizers** and **improper management of land which contributes to the uneven distribution of nutrients.** Monoculture practices which also adds to this. In such practices most of the farmers from this region shows tendency to cultivate a variety of rice which will fetch high market price and prefer the same every year. As result, of all these factors soils in *Khazan* land have become deficit for certain nutrients and for other nutrients it exhibits much higher values than prescribed range. Hence, the proper use of fertilizer is a major concern here.

Acknowledgements

I wish to thank our honorable Director of Institute of Science **Dr. B. G. Kulkarni**, Coordinator , Department of Environmental Science **Dr. Seema Misra-Thakur** and new coordinator **Dr. Manekar** for permitting me and cooperating with me in my dissertation project on *Khazan* lands of Goa. I am grateful to **Dr. V.S. Korikanthimath**, Director Indian Council For Agricultural Research (ICAR) research complex, Goa for giving me an opportunity to work with ICAR. I give my heartful gratitutre to my guide **Dr. B.L. Manjunath** for his constant guidance throughout the project. He has been very kind and genuine in explaining many concepts and developing proper scientific approach and has taken keen interest and time from his busy schedule. Thank you so much sir.

I give my sincere thanks to **Mr. Shirodkar**, the head of Soil testing laboratory. Thank you sir for allowing me soil samples in state soil testing laboratory. I would like to thank **Mrs. A.L. Ticlo** from Directorate of Fisheries**, Dr. Sandhya Dias** from Environmental Information Centre (ENVIS) Goa**, Mr. Nelson** from Directorate of Agriculture. I am thankful for the information provided by Department of Soil Conservation Taligao, Directorate of Statistics, Goa, State polluton control board, Department Of Watershed management, I am grateful for the help and valuable inputs by **Mr. Raghunath Joshi** from Zonal Agricultural office Mapusa, **Mr. Premanand Mhabre** from Chorao farmers club, Tiswadi, Mr. Jaggnath Pai, Ex-deputy collector from Tiswadi, **Mr. Babu Komarpanth** from Palolem Farmer's club, Canacona.

I thank all villagers and farmers of Goa who shared their issues and experiences with , me

and trusted me to help and find solution for their agricultural grievances.

Thanks a lot my friends **Irfhan, Mrunmayee, Trupti, Alison, Kamini, Srividya, Shrikant** and my dear family for supporting me in this project. Thank you everyone for encouraging me in all difficult times.

Above all, I thank to supreme power which has been there with me all the time. Thank you so much dear God for giving me this life.

References

Literature sited:

1. Chandrabhushan and Mohali Zeya Hazra, Rich land's Poor people, Centre for Science and Environment, 2008.
2. D.R.Bhumbla, Central Soil Salinity Research Institute, Karnal, 1977.
3. Dr. B.L. Manjunath, H.R. Prabhudesai, H.W. Wasnik, J.R. Flaerio, R.Ramesh, Sunetra Talalikar, Glimpses of three decades of rice research in Goa, ICAR research complex Goa, 2009.
4. Dr. Goldin Quodros, proceedings of the National Seminar on Creeks, estuaries and Mangrove's pollution and conservation, Thane 2002.
5. Dr, Salim Ali, The book of Indian birds, 1998.
6. Dr. J.A. Daji and Dr. J.R. Kadam, A textbook of soil sciences, 1996.
7. ' *Khazan* land report ' submitted to Government of Goa. 1991-92.
8. Mr. Milind Shelar, Community structure of mangrove habitat from Island of Mandovi Estuary, Goa. Submitted at National Institute of Oceanography, Goa, 1992.
9. 'Mangroves of Goa' Botanical society of Goa and P.E.S. College of Arts and Science, Farmgudi, Goa, 1992.
10. T.D. Biswas and S.K. Mukherjee, textbook of Soil science, 1991.
11. 'Towards the knowledge of a farmer', Directorate of Agriculture, Krishi bhavan, Tonka, Caranzalem, Goa, 2008-2009.

Online references:

1. http://india.gov.in/citizen/agriculture/soil.php
2. http://www.water portal of Inida.com.
3. http://india.gov.in/citizen/agriculture/soil.php
4. http://www.goaindiatourism.com/goa/climate-in-goa.html
5. http://www.goaforest.com/forestofgoa/body_typesofforests.html
6. http://goaenvis.nic.in

Role of NGOs and Government in Environment Protection

Dr. Prafull B. Chavate
I/c Principal
Bharati Vidyapeeth's Yashwantrao Chavan Law College, Malkapur-Karad
(Affiliated to Shivaji University, Kolhapur)

Abstract
India is having great heritage of environment and culture. In this great territory we are having long coastal area, dense forests, Mountains, ample minerals and ores beneath the land, great rivers etc. Despite the nature's precious gift, due to various developmental projects and like activities, indiscriminate exploitation of environment throughout the territory, in India we come across the problem of environmental pollution and degradation in recent years. Moreover, environmental concern is most important in India as people's sustainable lives and well being are at stake. In India for conservation, preservation and protection of environment and prevention of environmental pollution some direct legislation have been enacted and been implemented. However, there are verities of problems in respect of implementation of the same. The Union Government has declared the 'Bharat Swachhata Abhiyan', 'Hagandari Mukta Gaon Yojana', 'Gram Swachhata Abhiyan' etc. with sole object to imbibe in the minds of the people the importance of the environment in their life. So also many NGOs have come forward to create awareness and sensitize society regarding conservation, preservation and protection of natural environment. Number of cases has been filed by NGOs and environmentalist before Supreme Court and different High Courts on the grounds of pollution and degradation of environment and Judiciary has also taken initiative in the protection of environment.

In this backdrop, an attempt has been made in the instant paper, to take review of the legislation, role of NGOs and various measures adopted by the government for the protection of environment and analyze the status of environment in India.

I Introduction

India is having great heritage of environment and culture. In this great territory we are having long coastal area, dense forests, Mountains, ample minerals and ores beneath the land, great rivers etc. Despite the nature's precious gift, due to various developmental projects and like activities, indiscriminate exploitation of environment throughout the territory, in India we come across the problem of environmental pollution and degradation in recent years. Moreover, environmental concern is most important in India as people's sustainable lives and well being are at stake. In India for conservation, preservation and protection of environment and prevention of environmental pollution some direct legislation have been enacted and been implemented. However, there are verities of problems in respect of implementation of the same. The Union Government has declared the '*Bharat Swachhata Abhiyan*', '*Hagandari Mukta Gaon Yojana*', '*Gram Swachhata Abhiyan*' etc. with sole object to imbibe in the minds of the people the importance of the environment in their life. So also many NGOs have come forward to create awareness and sensitize society regarding conservation, preservation and protection of natural environment. Number of cases has been filed by NGOs and environmentalist before Supreme Court and different High Courts on the grounds of pollution and degradation of environment and Judiciary has also taken initiative in the protection of environment.

In this backdrop, an attempt has been made in the instant paper, to take review of the legislation, role of NGOs and various measures adopted by the government for the

protection of environment and analyze the status of environment in India.

II NGOs Working In The Interest Of Environment

There are large number of NGOs in India and other countries that are exclusively working for environmental, protection, conservation, and awareness. The number of these non-governmental organizations which are actively involved in environmental protection in our country is, in fact, more than in any of the developing country. Increasingly, the government is viewing NGOs not only as agencies that will help them to implement their programs, but also as partners shaping policy and programs.

NGOs are now playing an important role in framing the environmental policy, mobilizing public support for environmental conservation, and protecting the endangered species of forests and animals. Environmental organizations such as Earth watch and Sea Shepherd Conservation Society have been successful in creating awareness about the environmental dangers in using drift nets in the commercial fishing industry[1].

Some of the international environmental organizations are Greenpeace, Worldwide Fund for Nature' (WWF), Earth First, etc. Here is a brief discussion on some of the environmental organizations at International and National level with their efforts in protecting environment.

Greenpeace[2]:

Greenpeace is an environment-friendly international organization, which aims at promoting environmental awareness. It is an independent, campaigning organization, addressing the environmental abuse through direct, non-violent confrontations with governments and companies. It exposes the global environmental problems and provides solutions for a healthy environment. Greenpeace focuses on the most crucial worldwide threats to our planets biodiversity and environment.

It campaigns to:

1. Stop Climate Change:
2. Protect Ancient Forests:
3. Save the Oceans:
4. Stop Whaling:
5. Say No to Genetic Engineering:
6. Stop the Nuclear Threat:
7. Eliminate Toxic Chemicals:
8. Encourage Sustainable Trade:

Greenpeace has played an important role in preserving the environment, which is proved by its successful achievements:

1. A ban on toxic waste exports to less developed countries
2. A moratorium on commercial whaling
3. A United Nations convention providing for better management of world fisheries
4. A Southern Ocean Whale Sanctuary
5. A 50-year moratorium on mineral exploitation in Antarctica
6. Ban on the dumping at sea of radioactive and industrial waste and disused oil installations.
7. An end to high-sea, large-scale driftnet fishing
8. A ban on all nuclear weapons testing their first ever campaign

Worldwide Fund for Nature (WWF)—India[3]:

WWF is an international organization for wildlife conservation with its focus on protecting particular species of wildlife fauna.

[1] http://www.yourarticlelibrary.com/essay/role-of-non-governmental-organizations-ngo-in-environment-protection/32980/ Article shared by Puja Mondal

[2] *Ibid*

[3] *Ibid*

As its range of activities broadened, the international organization believed that its name no longer reflected the scope of its activities and became the Worldwide Fund for Nature in 1986. But the affiliated groups in the United States and Canada retained the original name. The organization is now simply, referred to as WWF.

WWF-India is committed to protecting and saving the already degraded and threatened natural bounties in the country. The organization is today dedicated to the conservation of natural habitats and ecosystems in India. WWF-India was established as a Charitable Trust in 1969. With its network of State/Divisional and Field Offices spread across the country to implement its programs, WWF-India is the largest and one of the most experienced conservation organizations in the country. WWF-India implements its conservation programs through Field Programs, Public Policy, Education, Communications, NGO Networking, and Resource Mobilization. In order to suit India's specific ecological and socio-cultural situation, WWF-India articulated its mission in 1987 as follows: "The promotion of nature conservation and environmental protection as the basis for sustainable and equitable development."

The key environmental issues, which WWF-India has involved itself with, are: The tiger conservation program, fresh-water and wetlands program, river dolphin conservation program, wildlife trade monitoring, managing forests, environmental law, information management and environmental education.

Some Other Environmental Organizations in India:

1. The Bombay Natural History Society (BNHS):
Founded in 1883, is recognized as one of the foremost conservation research organizations in the world. It aims to collect data on the specimens on natural history throughout the Indian sub-continent. To disseminate knowledge of flora and fauna by means of lectures, field trips, literature, expeditions and to study wildlife-related problems and recommend management plans to conserve wildlife and its habitat. It conducts field research projects on bird migration. It also conducts studies of certain endangered species of wildlife and their habitat and through environmental education imparts the knowledge and awareness of the need to conserve wildlife. It has undertaken a wide range of projects in conjunction with both local and overseas counterpart organizations on birds, reptiles, mammals, natural history, and the impact of developmental programs on wildlife.

2. Development Alternatives Group:
Development Alternatives Group based in Delhi works in all parts of the country. It was established in 1983 to design options and promote sustainable development through programs of economic efficiency, equity and social justice, resource conservation, and self-reliance. Its activities cover the entire nation: It is working in the field of pollution monitoring and control, waste recycling management, wasteland development, and appropriate technology.

3. The Energy Research Institute (TERI)[4]:
Established in 1974, is a wholly independent, non-profit research institute. Its mission is to develop and promote technologies, policies, and institutions for efficient and sustainable use of natural resources. It has been imparting environmental education through projects, workshops, audio-visual aids, and quiz competitions. It deals with policy-related works in the energy sector, research on

[4] http://earthuntouched.com/top-ngos-working-environment-conservation-writing/Top NGO's Working on Environment Conservation: Henry Hill

environmental subjects, development of renewable energy technologies and promotion of energy efficiency in the industry and transport sector. TERI also has a major program in biotechnology, the applications of which are oriented toward increased biomass production, conversion of waste into useful products and mitigating the harmful environmental impacts of several economic activities. TERI established the TERI University in 1998. Initially set up as the TERI School of Advanced Studies, it received the status of a deemed university in 1999. The University is a unique institution of higher learning exclusively for programs leading to PhD and master level degrees. Its uniqueness lies in the wealth of research carried out within TERI as well as by its faculty and students making it a genuinely research oriented University.

4. Agency for Non-conventional Energy and Rural Technology (ANERT):

ANERT is an organization working under Government of Kerala, in Kerala, India, for gathering and disseminating knowledge about non-conventional energy, energy conservation and rural technology. The organisation was established in 1985 with headquarters at Thiruvananthapuram.

Programmes

The major programmes being implemented by ANERT are the following:

- Solar Photovoltaic Programme
- Solar Thermal Energy Programme
- Wind Energy Programme
- Bio-energy Programme
- Micro Hydel Programme
- National Programme on Improved Chulha
- Integrated Rural Energy Programme
- Rural Technology Programme

5. Intergovernmental Panel on Climate Change (IPCC)[5]:

A leading non-governmental international group, is one of the most trusted organization working on environment conservation. It works on quite a large scale and produces several yearly reports on the said issue which are taken into consideration while deciding environmental laws in the international circuit. Though it says, does not conduct any research on its own, but it works mainly through analysis of several reports and data produced worldwide. Involving actively around hundred of leading scientists IPCC focuses on environmental issues such as climate change, global warming etc.

6. National Geographic Society[6]:

Our beloved and most iconic National Geographic Society (NGS) is one of the most well-funded, largest and prominent environmental organizations at present. Ranging from TV shows, advertisements, campaigns to working on grass root level this society has it all planned wee enough to carry out the expedition of saving the mother earth. Nat Geo core agenda lies in celebrating the beauty of the earth and its creatures with amazing stories, videos and various educational programmes for students.

7. Rainforest Action Network[7]:

One of the most recent organizations RAN is quite active in its approach when it comes to saving the beauty of the earth. They are quick to give praise when any corporate biggies incline towards environment conservation but often harsh in its criticism whenever it is required.

8. Centre for Science and Environment (CSE):

CSE is a not-for-profit public interest research and advocacy organization based in New Delhi, India. Established in 1980, CSE works as a think tank on environment-development issues in India, poor planning, climate shifts

[5] *Ibid*

[6] *Ibid*

[7] *Ibid*

devastating India's Sundarbans and advocates for policy changes and better implementation of the already existing policies. CSE uses knowledge-based activism to create awareness about problems and propose sustainable solutions. The director of the Centre is Sunita Narain.

9. Environmentalist Foundation of India:

The **Environmentalist Foundation of India** (**EFI**) is an environmental conservation group based out of Chennai, Hyderabad, Puducherry and Coimbatore which focuses on wildlife conservation and habitat restoration. Started in 2007 and registered in 2011, the organization is known for its work in cleaning and scientific restoration of lakes in India for biodiversity.

EFI focuses on restoration of lakes, flora, care of stray animals and a village development programme. Most of the organization's work is carried out through volunteer support. EFI organizes lake clean ups every Sunday and as of 2014 had cleaned 39 lakes across India. This includes Madambakkam, Keezhkattalai, Narayanapuram, and Arasankazhani lakes in Chennai; the Selvachintamani Kulam in Coimbatore; and the Kapra, Alwal, Gurunadham Cheruvu lakes in Hyderabad.

EFI is also involved in the setting up of herbal biodiversity gardens at schools and special interest zones. The idea behind the herbal gardens is to increase people's interest in green cover and live healthy with native Indian herbs. EFI's "Clean for Olive Green" is a beach cleanup project that is organized every year in the months of December to May to keep Chennai's beaches clean for the nesting Sea Turtle Mothers.

10. Delhi Greens*:*

It is a non-governmental organisation, founded by the trio Dr. Govind Singh, a university Professor at Dept. of Environment, University of Delhi and his likeminded friends Ravinder Bawa, Aastha Kukreti for spreading the messages of green environment and sustainable development and working towards achieving those goals. The organization is headquartered in New Delhi, India. Delhi Greens has a mandated mission to educate the masses and invite their participation in the demand for sustainable development. It proposes to propagate the message of environmentalism and green economy and support the global initiatives with these goals. It also intends to act as a watchdog for protecting the forests and biodiversity of India. Delhi Greens operations may broadly be classified under three protocols. Efforts on dissemination of information and creation of public awareness are considered a priority by the organization. It regularly organizes seminars independently or in coordination with other agencies. The *Third Delhi Youth Summit on Climate Change* (DYSoC 2013) was one such initiative for rallying the youth together, conceived and organized by Delhi Greens and supported by Cluster Innovation Centre of the University of Delhi.

11. The Vindhyan Ecology and Natural History Foundation (VENHF):

It is a registered non-profit organisation (2012) with its headquarter in Mirzapur, Uttar Pradesh, India working for protection and conservation of the nature, natural resources and rights of the nature dependent communities in the ecologically fragile landscape of Vindhya Range in India. Vindhya Bachao Abhiyan is the flagship campaign of the organization, which works towards environmental equity and bringing ecological justice through research-based environmental litigation, strengthening grass-root environmental movements, supporting institution of local governance and protecting the rights of nature dependent indigenous communities. In June, 2015 VENHF reviewed the Draft Notification on Emission Standards for Thermal Power Plants in India and sent a

representation to Government of India. In October, 2015 VENHF sent a representation on the Draft Environment Laws (Amendment) Bill, 2015 to Government of India in which it claimed that the bill will dilute the Environment Protection Act, 1986.

12. MC Mehta Environmental Foundation[8]:

MCMEF is a non-profit, non-governmental committed organization working nationwide for the protection of the environment, the rights of the people to clean and fresh water and air, the promotion of sustainable development, and the protection of the cultural heritage of India. **MCMEF** has been actively involved in creating awareness among NGO's, Lawyers, Scientists, Senior Officials, Academicians, Students & Youth through training and capacity building programmes, seminars, workshops, declamation contests and other grass roots level activities.

III Government Policies and Legislations For Protection Of Environment In India

With effect from 1 April 1999, the Government of India restructured the Comprehensive Rural Sanitation Programme[9] and launched the Total Sanitation Campaign (TSC) which was later (on 1 April 2012) renamed *Nirmal Bharat Abhiyan* (NBA).

On 2 October 2014, Prime Minister of India Narendra Modi launched the Swachh Bharat Mission, which aims to eradicate open defecation by 2019,[6] thus restructuring the Nirmal Bharat Abhiyan. **Swachh Bharat Abhiyan[10]** is a national campaign, covering 4,041 statutory cities and towns, to clean the streets, roads and infrastructure of the country. The campaign was officially launched on 2 October 2014 at Rajghat, New Delhi, by Prime Minister Narendra Modi. It is India's biggest ever cleanliness drive with 3 million government employees and school and college students of India participating in this event.

The government is aiming to achieve an Open-Defecation Free (ODF) India by 2 October 2019, the 150th birth anniversary of Mahatma Gandhi, by constructing 12 million toilets in rural India, at a projected cost of 1.96 lakh crore (US$29 billion). Prime Minister spoke of the need for toilets in his 2014 Independence Day speech.

Environment Policies of the Government of India includes legislations related to Environment.

The beginning of Environmental legislation is traceable during the British Rule. Amongst the earliest ones were Shore Nuisance (Bombay and Kolaba) Act of 1853 and the Oriental Gas Company Act of 1857. The Indian Penal Code of 1860, Section 268 to 290, imposed a fine on anyone who voluntarily fouls the water of a public spring or reservoir. In addition the Code penalized negligent acts. British India also enacted laws aimed at controlling air pollution. Prominent amongst these were the Bengal Smoke Nuisance Act of 1905 and the Bombay Smoke Nuisance Act of 1912. Whilst these laws failed in having the intended effect, British-enacted legislations pioneered the growth of environmental regulations in India.

After independence, India adopted a Constitution and numerous British-enacted laws, without any specific Constitutional provision on protecting environment. However, this lacuna was overcome by

[8] http://mcmef.org/new1/

[9] https://www.cleanindiajournal.com/maharashtra_villages_lead_in_sanitation/

[10] https://en.wikipedia.org/wiki/Swachh_Bharat_Abhiyan

Amendment in the Constitution in 1976. By this amendment, Art. 48 (A) was inserted in Part IV of the Constitution, which provides "The State shall endeavor to protect and improve the environment and to safeguard the forests and wildlife of the country". By the same amendment yet another clause was inserted in Part IV-A i.e. Fundamental Duties, viz. Art. 51 A (g), which impose additional environmental mandates on the Indian citizens. In India we are having some direct legislation for protection, preservation and conservation of natural environment. These include the Water (Prevention and Control of Pollution) Act, 1974, Forest (Conservation) Act, 1980, the Air (Prevention and Control of Pollution) Act, 1981. The Wildlife Protection Act 1972, Indian Forest Act. The Bhopal gas tragedy triggered the government of India to enact the Environment (Protection) Act, 1986, Prevention of Cruelty to Animals Act 1960. Section 133 to 143 of Criminal Procedure Code and Section 91 of Civil Procedure Code envisages that a person may approach a Magistrate and District Judge respectively by filling a complaint or petition about the public nuisance.

In addition to this, as per the provisions of Environment Protection Act, ample delegated legislation in the form of Rules and Regulation, Notifications etc. are available in India. e.g. Coastal Regulations Zone, Noise Pollution (Regulation and Control) Rules 2000, Hazardous Waste Handling and Management Rules, Bio-Medical Waste Management Rules, etc.

In 1985, Indian government created the Ministry of Environment and Forests. This ministry is the central administrative organization in India for regulating and ensuring environmental protection. Despite active passage of laws and rules and regulations by the Central government of India, the reality of environmental quality mostly worsened in last two decade. Most of Indian economy was nationalized and owned by India and regulations were mostly ignored by State run enterprise as well as private sector. Rural poor had no choice, but to sustain life in whatever way possible. The State governments of India often regarded environmental laws enacted by the Central government as a mere paperwork formality. Air emission increased, water pollution worsened, forest cover decreased and wildlife is in danger.

In addition to these acts, the government passed the Foreign Trade (Development and Regulation) Act 1992 for control of biodiversity.

IV Judicial Response towards Protection Of Environment

Since about the late 1980s, the Supreme Court of India has been pro-actively engaged in India's environmental issues. In most countries, it is the executive and the legislative branches of the government that plan, implement and address environmental issues; the Indian experience is different. The Supreme Court of India has been engaged in interpreting and introducing new changes in the environmental jurisprudence directly. The Court has laid down new principles to protect the environment, re-interpreted environmental laws, created new institutions and structures, and conferred additional powers on the existing ones through a series of directions and judgments.

Some of the following decisions of the Supreme Court of India has a great ramification towards the protection and safeguarding the environment and maintain the ecological balance.

Article 21 of the Constitution of India is very important provision in Part III. Art. 21 speak about the Right to Life and Personal Liberty of the persons. This provision has very expansive

source scope and has immense content in to lesser words. The judiciary has resolved most of the environmental cases where they considered right to good environment as fundamental for life and upheld that fundamental right. Right to life extended its scope to include right to wholesome environment and right to sustainable development.

Link between environmental quality and the right to live was first addressed by a constitutional bench of the SC in ***Charanlal Sahu Case*** and ***Subhash Kumar vs State of Bihar***[11], the court observed that 'right to life in Art. 21 include the right to enjoyment of pollution free water and air for full enjoyment of life'. Through this case, the court recognized the right to a wholesome environment as part of the fundamental right to life.

M.C. Mehta vs. Union of India[12], the case concerned the deterioration of the world environment and the duty of the State government, under Article 21, to ensure a better quality of the environment. The SC has held that life, public health and ecology have priority over unemployment and loss of revenue. In ***Vellore Citizens Welfare Forum vs. UOI***[13], the SC held that industries are vital for the country's development, but having regard to pollution caused by them, principle of 'sustainable Development' has to be adopted as the balancing concept. In ***Indian Council of Enviro-Legal Action vs. UOI***[14], following the decision in the Oleam Gas Leak case and based on the Polluter Pays Principle, the polluter industries were directed to compensate for the harm caused by them to the villagers in the affected areas, especially to the soil and underground water. In ***M. C. Mehta vs UOI***[15], SC held that mining activity in the vicinity of tourist resorts of Bad Kal Lake and Surajkund are bound to cause several impacts on the ecology and directed that mining activity should be stopped within 3 km of the tourist resort. ***Pradeep Kishen vs. UOI***[16], a PIL was filed against the order issued by the Govt. of Madhya Pradesh permitting collection of tender leaves from the forest by the local villagers/tribals. However, Supreme Court did not interfere with the said order but directed the authorities to look to the aspect that only bonafide villager can collect tender leaves and to take necessary steps to protect the shrinkage of forest. ***M. C. Mehta vs. UOI***[17], this case was based on Polluter Pays Principle. In this case Calcutta tanneries were discharging untreated poisonous effluents into the river Ganga. Accordingly SC issued directions for unconditional closure of tanneries, relocation, and payment of compensation by them for reversing the damage.

Three landmark judgments and a number of Orders against polluting industries numbering more than fifty thousand in the Ganga basin passed from time to time. A substantial success has been achieved by way of creating awareness and controlling pollution in the river Ganges. In this case, apart from industries, more than 250 towns and cities have been ordered to put sewage treatment plants. As a result of these directions millions of people have been saved from the effects of air and water pollution in Ganga basin covering 8 States in India. ***T. N. Goda Varman Thiru Mulkpad vs. UOI***[18], this matter relates to usefulness of modern Shrimp (Prawn) farming and traditional shrimp farming. Commercial aquaculture farming in the coastal area caused depletion of mangrove ecosystem. SC held

[11] AIR 1991 SC 420/ 1991 (1) SCC 598
[12] AIR 1991 SC 813
[13] AIR 1996 SC 2715
[14] 1996 (3) SCC 212
[15] (1996) 8 SCC 462
[16] (1996) 8 SCC 599
[17] (1997) 2 SCC 411
[18] (1997) 7 SCC 440

that, modern shrimp farming is violative of Environment Protection Act and cannot be permitted. However traditional farming is pollution free and directed to constitute High Power Authority to scrutinize each and every case. Again in ***T. N. Goda Varman Thiru Mulkpad vs. UOI***[19], a Writ petition was filed for relocation of wood industries and ban for timber trade in the North Eastern States was filed. SC held that complete ban on timber trade is not feasible or desirable and directed the State governments of North Eastern States to notify industrial area for relocation of wood based industrial units. In ***Goa Foundation vs. UOI***[20], SC passed the order directing the Central Government to issue directives to close down 218 industrial units across the country to close down for flouting environmental norms. From all these cases, it reveals that the Apex Court has given utmost priority to the protection and conservation of natural environment.

M. C. Mehata Vs. UOI[21] Taj Mahal, one of the wonders of the world and the pride of India was facing serious threat from pollution caused by Mathura Refinery, iron foundries, glass and other chemical industries. As a result of very high toxic emissions from these industries, the Taj Mahal and 255 other historic monuments within the Taj trapezium were facing serious threat because of acid rain. The Petition was filed in the year 1984. The Supreme Court of India delivered a historic Judgment in December 1996. The apex Court gave various directions including banning the use of coal and coke and directing the industries to switch over to Compressed Natural Gas (CNG). ***Vehicular Pollution Case*** Against vehicular pollution in India the Supreme Court delivered a landmark judgment in 1992. A retired Judge of the Supreme Court was appointed along with three members to recommend measures for the nationwide control of vehicular pollution. Orders for providing Lead free petrol in the country and for the use of natural gas and other mode of fuels for use in the vehicles in India have been passed and carried out. Lead-free petrol had been introduced in the four metropolitan cities from April 1995; all new cars registered from April 1995 onwards have been fitted with catalytic convertors; COG outlets have been set up to provide CNG as a clean fuel in Delhi and other cities in India apart from Euro 2 norms. As a result of this case, Delhi has become the first city in the world to have complete public transportation running on CNG.

M.C.Mehata Vs UOI[22] **-- Oleum Gas Leak Case** -- This is a landmark judgment in which the principle of Absolute Liability was laid down. The fertilizer plant was situated very close to human habitation and the court held that the carrying on of a hazardous industry in such proximity to population could not be permitted and the factory was relocated. The deep pocket principle was also laid down in the instant case. This judgment also ushered in a period of dramatic legislative progress in India. The Parliament added an entirely new chapter to the 1948 Factory Act, incorporating sections almost verbatim from the Judgment. The Public Liability Insurance Act was passed and the policy for the abatement of Pollution Control was established. Moreover, the Environment Protection Act was passed and the Policy for the Abatement of Pollution Control was established.

Environmental Awareness and Education Case Succeeded in getting orders from the Court that all over the country the cinema theaters will exhibit two slides free of cost on environment in each show failing which their licenses will be cancelled, a minimum 5 to 7 minutes will be given by the television

[19] (1999) 9 SCC 151
[20] Decided by SC on 22/02/2005
[21] (1996) 4 SCC 750
[22] AIR 1987 SC 1086

network in the Country to televise programmes on environment apart from giving a regular weekly programme on environment. Environment has become a compulsory subject up to 12th standard from academic session 1992 and University Grants Commission will also introduce this subject in higher classes in different Universities. ***M.C.Mehata Vs UOI***[23] **--** ***Dust Pollution Case*** -- In a historic case, 212 stone crushers were shifted out of Delhi to a 'Crushing Zone' set up in Haryana by an order of the Supreme Court on May 15th, 1992. Emission of more than 1500 tons of dust emitted daily in the atmosphere has been eliminated.

In Kamal Nath Vs UOI[24] In the State of Himachal Pradesh, Span motel, owned by the family members of Shri Kamal Nath, Minister for Environment and Forests, Govt. of India diverted the Course of river Beas to beautify the motel and also encroached upon some forest land. The apex court ordered the management of the Span motel to hand over forest land to the Govt. of Himachal Pradesh and remove all sorts of encroachments. The Court delivered a land mark judgment and established principle of exemplary damages for the first time in India. The Court said that polluter must pay to reverse the damage caused by his act and imposed a fine of Rs Ten Lakhs (Rs 10,00,000) on the Span motel as exemplary damages. The Supreme Court of India recognized Polluter Pays Principle and Public Trust Doctrine.

Coastal Areas Case - Despite Coastal Zone Regulation Notification of February 1991, none of the coastal states had formulated coastal zone management plan, with the result that haphazard construction and industrial activity was being permitted anywhere in the coast leading to large scale damage to coastal ecology and loss of livelihood to lakhs of fishermen and other indigenous communities dependent on marine resources. A writ petition was filed on behalf of Indian Council for Enviro- Legal Action (ICELA) and the Supreme Court delivered a landmark Judgement banning industrial/ construction activity within 500 mtrs of the High Tide Line and set a time limit for the coastal states to formulate coastal management plans. ***Ground Water Pollution Case-- Indian Council for Enviro-Legal Action Vs. UOI***[25] In Rajasthan at Bichhri, 5 small chemical industries, owned by a single owner, were operating without effluent treatment plant. Toxic effluents from the industries entered the ground water and wells of 14 villages became affected. After six years of battle in the Court, the Supreme Court delivered a Judgment in March 1996 directing the closure of the factories and attached the property of the polluter and directed the Department of Environment and Forests Govt. of India to recover the cost of eco- restoration from the industries held responsible for causing damage to the environment. ***M. C. Mehata Vs. UOI***[26] ***– DELHI RIDGE CASE*** - -Delhi Ridge Management prayed for direction to Haryana government to stop mining and pumping ground water. To save the Delhi ridge from destruction an order from the Supreme Court was obtained directing NCT of Delhi to declare it as 'Reserved Forest'. Court made it clear that mining activity can be permitted only on the basis of Sustainable Development and on compliance of stringent conditions.

V Conclusion and Suggestions

There are large number of NGOs in India and other countries that are exclusively working for environmental, protection, conservation, and awareness. The number of these non-governmental organizations which are actively

[23] (1992) 2 SCC 256
[24] (1997) SCC 388
[25] AIR 1996 SC 1069
[26] AIR 2004 SC 4016

involved in environmental protection in our country is, in fact, more than in any of the developing country. Increasingly, the government is viewing NGOs not only as agencies that will help them to implement their programs, but also as partners shaping policy and programs.

NGOs are now playing an important role in framing the environmental policy, mobilizing public support for environmental conservation, and protecting the endangered species of forests and animals. Environmental organizations such as Earth watch and Sea Shepherd Conservation Society have been successful in creating awareness about the environmental dangers in using drift nets in the commercial fishing industry.

Although several steps by enacting different legislation and implementing different policies for protection and conservation of environment have been taken, the position is far from satisfactory. The protection, preservation and conservation of environment cannot be achieved without giving utmost priority towards it. It is need of the hour to protect forest, land and water resources, by filling the gap between the demand and supply of forest products, use of land etc. The governments implement a series of rural development activities. However, it needs to be implemented effectively.

The laws enacted by the government should not remain on paper and dead letters, but need to be implemented stringently so that there will be less and less environmental degradation. So also these laws shall be given wide publicity and people shall be sensitized for conservation and protection environment. There shall be public participation in the movement of reducing environmental degradation and to overcome problem of livelihood.

M.C. Mehta's public interest environmental litigation cases have formed the foundation for the development of environmental jurisprudence in India, and indeed, South Asia today.

Through the mechanism of PIL hundreds of cases have been filed in and dealt with by Supreme Court. In these cases Supreme Court has tried to make a balance between the development vis-à-vis environmental degradation.

To sum up, it can be said that, because of efforts by NGO's and judicial activism by the higher judiciary, the environmental degradation is being checked in the present time.

Since the NGO's are playing important role and assisting in the efforts of environment protection. There shall be provision for special incentives and appreciations by announcing awards for their efforts for protection and preservation of environment. All this would reduce the environmental degradation.

References –

1. Dr. Sukanta K. Nanda, Environmental Law, Central Law Publication, 2nd ed. 2009
2. Dr. Tiwari H. N., Environmental Law, Allahabad Law Agency, 3rd ed. 2005
3. Jaiswal P. S. and Jaiswal Nishta, Environmental Law, Allahabad Law Agency, 3rd ed. 2009
4. P. Leelakrishnan, Environmental Law in India, LexisNexis, Buterworths, 2nd reprint 2002
5. Armen Rozencranz, Environmental Law and Policy in India

Critical Review on Performance Evaluation of Sequencing Batch Reactor based on Cyclic Activated Sludge Technology

[1] Prof.Snehjit.Kumbhar, [2]Mr.Ketan.Kahandal, [3]Mr.Darshan.Chavan

[1,] Assistant Professor Civil Engineering Department, (SPCE), Mumbai -400058, India

[2,3] Graduate Student Civil Engineering Department, (SPCE), Mumbai -400058, India

Abstract:

Treatment of waste water has always been an important aspect in environmental engineering. We have been using the conventional activated sludge system of waste water treatment for a long time. Sequencing Batch Reactor (SBR) has now come up as a much better option because of its low energy consumption, lower space requirements, and better treatment efficiency. Even when compared with other advanced treatment systems, SBR is more cost efficient process. A brief study of comparison of SBR technology with the conventional sewage treatment plant and some advanced wastewater treatment technologies viz. Membrane Bioreactor (MBR), Fluidised Bed reactor (FBR) was done. In the present paper, reuse potential of the effluent coming from the wastewater treatment plant based on cyclic activated SBR technology situated at Nerul, Navi Mumbai was studied.

Keywords: Sequencing batch reactors, wastewater treatment, reuse potential;

1. Introduction

1.1 Necessity of sewage treatment

Sewage indicates the liquid waste originating from the domestic uses of water. It includes sullage, discharge from toilets, urinals, wastewater generated from commercial establishments, institutions, industrial establishment and also the groundwater and storm water that may enter the sewers. Its decomposition produces large quantities of malodorous gases, and it contains numerous pathogenic or diseases producing bacteria, along with high concentration of organic matter and suspended solids. Across the world, there continues to be huge volumes of sewage pumped directly into rivers, streams and the ocean itself. The impact of this is severe – aside from the damage to the marine environment and to fisheries it can cause, it does little to preserve water at a time when many are predicting that a global shortage is just around the corner.

1.2 Necessity of Advanced wastewater treatment

The effluent from a typical secondary treatment plant still contains 20-40 mg/L Biochemical Oxygen Demand (BOD) which may be objectionable in some streams. Suspended solids, in addition to contributing to BOD, may settle on the stream bed and inhibit certain forms of aquatic life. The BOD if discharged into a stream with low flow can cause damage to aquatic life by reducing the dissolved oxygen content. In addition the secondary effluent contains significant amounts of plant nutrients and dissolved solids. If the waste water is of industrial origin, it may also contain traces of organic chemicals, heavy metals and other contaminants.

Different methods are used in advanced waste treatment to satisfy any of the several specific goals, which include the removal of (1) suspended solids (2) BOD (3) plant nutrients (4) dissolved solids and (5) toxic substances. These methods may be introduced at any stage of the total treatment process as in the case of industrial waterways or may be used for

complete removal of pollutants after secondary treatment.

Also low area requirements, low cost of plants, low costs of operations and maintenance and automation of procedures are some important factors to be considered which can be achieved in advanced wastewater treatment technologies.

2. Introduction to Sequencing Batch Reactors

2.1 General

The sequencing batch reactor (SBR) is a fill and draw activated sludge system for wastewater treatment. In this system, wastewater is added to a single "batch" reactor, treated to remove undesirable components, and then discharged. Equalization, aeration, and clarification can all be achieved using a single batch reactor. SBR systems have been successfully used to treat both municipal and industrial wastewater. They are uniquely suited for wastewater treatment applications characterized by low or intermittent flow conditions.

2.2 Basic Treatment Process

The operation of an SBR is based on a fill-and-draw principle, which consists of five steps—

- Fills –React- Settle- Decant- Idle

These steps can be altered for different operational applications.

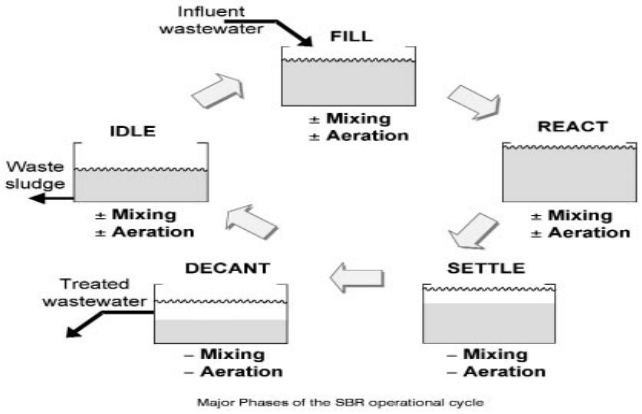


Fig 1.1: Operation of SBR cycle

2.3 Performance

Table 2.1: Performance of parameters

Parameters	Efficiency	SBR (mg/l)	Conventional ASP (mg/l)
BOD	89-98%	<5	<30
COD	80%	<50	<250
TSS	85-97%	<10	<30
Total Nitrogen	>75%	<10	<30
Bio-P	57-69%	<1	<7

3. Materials and Methods

3.1 Comparison with other advanced technologies.

Other than SBR, some advanced treatments are Membrane Bioreactor (MBR) and Fluidised bed reactor (FBR). To assess the advantages of SBR over these advanced technologies, comparison of various factors such as space requirements, plant establishment cost, operation and maintenance cost, ease of operation (use of programmable logic controllers), effluent quality, etc. was done.

3.2 Finding Reuse potential of effluent through SBR Technology

Effluent coming from a standard Sewage Treatment Plant (STP) is always of reuse quality. Certain quality standards must be satisfied depending on the reuse of the effluent. Various guidelines are provided by CPHEEO (Central Public Health and Environmental Engineering Organisation) and CPCB (Central Pollution Control Board) for the determination of the reuse potential for Indian conditions. The STP is located at Nerul under the entity of Navi Mumbai Municipal Corporation in Maharashtra was selected for study to measure the reuse potential of effluent coming through SBR.

3.2.1 Nerul STP

Nerul STP was visited for sample collection at the inflow (before treatment) and outflow (after chlorination) levels. Technical details of the monitored STP is tabulated below

Fig. 3.1 Nerul STP

Table 3.1 Nerul STP

Design Flow • Average flow • Peak factor • Peak flow	 100 MLD 2.25 times average flow 225 MLD
No. of C-Tech basins	6
No. of Basins receiving flow simultaneously	3
No. of Basins Aerating simultaneously	3
No. of Basins Decanting simultaneously	2
Hourly Flow rate	4167 m^3/hr
No. of Cycles per day/basin • Filling and aeration • Settling • Decanting **Total Cycle Time**	8 90 min 30 min 60 min 3 Hr
Hours of Aeration time/ day/ basin	12 Hr
MLSS	5000 mg/L

MLVSS	4000 mg/L
F/M	0.105

3.2.2 Cyclic Activated Sludge Technology (C-Tech)

The Nerul STP is based on Cyclic Activated Sludge Technology. The operation for same is stated below.

The system makes use of variable volume treatment in combination with a biological selector that is operated in a fed-batch reactor mode. The complete biological operation is divided into cycles. A basic cycle of 3 hours (Total 8 cycles per day) comprises:

- Fill-aeration: 90 minutes
- Settling: 45 minutes
- Decanting: 45 minutes

Three sequences constitute a cycle, which is then repeated. During the period of a cycle,
The liquid volume inside the reactor increases from a set operating bottom water level.

2. During the Fill-Aeration Sequence mixed liquor from the aeration zone is recycled into the selector. Aeration ends at a predetermined period of the cycle to allow the biomass to flocculate and settle under absolute quiescent conditions.

3. After a specific settling period, the treated supernatant is decanted using as electromechanically operated downward moving weir decanter.

4. When the liquid level in the reactor is returned to the bottom water level, cycle is then repeated.

5. The surplus sludge is wasted from the reactor during the decanting sequence.

The system is capable of achieving the following:

i. Anoxic denitrification of nitrates and phosphorus release and uptake in the biological selector zone of C-Tech (anoxic zone) using incoming sewage.

I. Bio-degradation of organics present in the wastewater in the main aeration zone

II. Simultaneous nitrification and denitrification (under low DO) in the aeration zone of each C-Tech basin

III. Endogenous denitrification during settling sequence

IV. Phosphorus release and uptake in the selector and main aeration zone

Various tests were done on the composite sample collected from the Nerul plant and results were obtained and compared with the reuse standards given by CPHEEO and CPCB.

Guidelines given by CPHEEO manual for cooling tower in Indian condition

Table 3.2: Cooling Water Quality Requirements as per CPHEEO manual.

Parameter/ condition	**Recommended value**
In makeup water	
pH	6.8-7.0 (variation less than 0.6 units in 8 hr.)
Average TDS value 3000 mg/l 1500 mg/l 500 mg/l	Cycles of concentration in re-circulating water 2.0 3.5 6.0
Oil and grease	Absent
BOD_5	Less than 50 mg/l
Chloride	Less than 175 mg/l
Caustic alkalinity	Absent
Methyl orange alkalinity	Less than 200 mg/l
Ammonia	No appreciable amount
In Re-circulating water	
Silica (SiO_2)	Less than 150 mg/l
Phosphates & sulphates	Not to exceed solubility limit
Alkyl benzene sulphonate (ABS)	Foam not to persist more than 1 min. after 10 sec. of shaking water

Water Quality Criterion for Designated Use as Per CPCB

Table 3.3. Water Quality Criterion for Designated Use as Per CPCB

Designated –Best-Use	**Criteria**
Drinking water source without conventional treatment but after disinfection [Drinkable quality]	1.Total coliforms organism MPN/100ml shall be 50 or less 2. pH between 6.5 and 8.5 3. Dissolved Oxygen 6 mg/l or more 4. Biochemical Oxygen Demand 5 days 20°C -2 mg/l or Less
Outdoor bathing (Organized) [Swimmable quality]	1. Total coliforms organism MPN/100ml shall be 500 or Less. 2. pH between 6.5 and 8.5, Dissolved Oxygen 5 mg/l or more 3. Biochemical Oxygen Demand 5 days 20°C 3 mg/l or less
Drinking water source after conventional treatment disinfection [Drinkable quality after treatment]	1. Total coliforms organism MPN/100ml shall be 5000 or less. 2. pH between 6 to 9, Dissolved Oxygen 4mg/l or more 3. Biochemical Oxygen Demand 5 days 20°C - 3 mg/l.
Propagation of wild life and Fisheries [Fishable quality]	1. pH between 6.5 to 8.5, Dissolved Oxygen - 4mg/l or more 2. Free Ammonia (as N) - 1.2 mg/l or les
Irrigation, industrial cooling, controlled waste disposal [Boatable quality]	1. pH between 6.0 to 8.5 2. Electrical Conductivity at 25°C max., 2250 micro mhos/cm 3. Sodium absorption ratio max., 26 4. Boron max. 2 m

3.3 Result and Discussion

3.4 Comparison of SBR with other technologies.

Comparison of SBR with Conventional STP and Aerated lagoons is as follows

Table 4.1 Comparison of SBR with Conventional STP and Aerated lagoons

Parameters	SBR	Conventional STP	Aerated Lagoons
Degree of treatment	High	Low	Very low
Space requirement	Less	High	High
Initial cost	Low	High	High
Ease of operation	Fully automated	No control	No control
Power consumption	Low	High	Low
Flow variation	Can take variation of 0-250%	Point load design	Cannot handle any flow variation
Future augmentation	Extra basins can be added easily	A complete new system is required	A complete new system is required
Global technology	Globally accepted	Globally accepted	Defunct technology
Operational and maintenance cost	Low	High	Low

After comparing SBR with advanced technologies such as MBR and FBR considering various factors following results were obtained.

Table 4.2 Comparison of SBR, MBR and FBR

Parameters	SBR	MBR	FBR
Degree of treatment	High	High	Comparatively less
Space requirement	Less	Low	High
Initial cost	Low	High	High
Ease of operation	Fully automated	Partially automated	No Control on any process
Power consumption	Low	High	Very high
Flow variation	Can take variation of 0-250%	Can take variation of 0-100%	Cannot handle any variation
Future augmentation	Extra basins can be added easily	Composite membranes can be adopted	A complete new system is required
Global technology	Globally accepted	Globally accepted	Very few large scale installations are available
Operational and maintenance cost	Low	High	High

4.2 Results of analysed parameters

Data obtained by physio-chemical analysis of treated wastewater is depicted in following tables with respect to their date of testing. Table 4.2 represents influent and effluent parameters at Nerul STP.

Table 3.1. Parameter analysis at Nerul 100 MLD STP

Parameter	Unit	01/12/2016		02/12/2016		03/12/2016	
		Influent	Effluent	Influent	Effluent	Influent	Effluent
BOD	mg/l	158	4.2	152	4.0	162	4.6
COD	mg/l	424	40	402	40	392	38
TSS	mg/l	182	10	176	8	184	8
Electrical Conductivity	Mmho/cm	0.892	0.793	0.863	0.750	0.883	0.731
Chloride content	mg/l	228	160	208	135	226	145

Total hardness	mg/l	412	156	422	164	442	168
Alkalinity	mg/l	194	122	170	96	182	112
Res. Chlorine	mg/l	N/A	1.01	N/A	1	N/A	1.01
pH	-	6.9	8.0	6.8	7.9	6.9	7.8
Silica Content	mg/l	0.19	0.11	0.20	0.11	0.19	0.10
temperature	° C	24.5	24.9	24.8	25.3	24.5	24.9
Ammonical nitrogen (NH_4-N)	mg/l	38.0	5.6	40.0	5.6	39.0	5.8
Phosphorus (PO_4-P)	Mg/l	2.1	0.3	1	0.2	1.1	0.2

Comment

1.1. Comparison of SBR with other technologies

From the study it is found that SBR gives a much better effluent quality than conventional STP, Aerated lagoons and FBR and nearly as good as MBR. The factors considered show that space requirement, initial cost, operational & maintenance cost are lesser in SBR as compared to all other technologies mentioned above. In SBR it is found out that it can operate at a large range of flow variation (0-250%) while other technologies are unable to handle as such. In case of SBR if in future there is any requirement of expansion of plant capacity it can be easily enhanced by just building extra basins while in case of other technologies they require a completely new system to handle any extra load.

1.2. Reuse potential of SBR

Reuse potential is collectively concerned with quantity as well as quality. And above study revealed that the potential of treated sewage on following observed points.

1.2.1 **Excellent effluent quality**

The ST was found to produce an effluent having less BOD (<5mg/L) and TSS (<10mg/L).

1.2.2 **Excellent biological nutrient removal system.**

A significant removal was observed in ammonical nitrogen (NH_4-N) concentration of 85% and phosphorous (PO_4-P) concentration of 86%.

1.2.3 **Excellent sludge settling**

After studying zone settling, settling period of 30 mins the sludge settled upto 40% of original water depth (4.5m). No sludge bulking or pinpoint flow was observed in C-Tech basins.

Conclusion

On the basis of above study we can say that the effluent from SBR satisfies CPCB and CPHEEO standards and its requirements for non-potable such as toilet flushing, vehicle washing, landscape irrigation, fire uses and recreational. Also another study shows that considering factors such as space requirements, initial cost, flow variation, future augmentation, effluent quality, operation & maintenance cost and power consumption, sequencing batch reactor is more feasible as compared to other technologies.

References

1) Shu-Hai You , Dyi-Hwa Tseng, (1998), "The potential for the recovery and reuse of
Cooling water in Taiwan", Journal Elsevier Science, pp 53–70.
2) Amr M. Abdel Kader. Comparison between Sequencing Batch Reactor and

Conventional Activated Sludge by using simulation mathematical model. Thirteenth International Water technology Conference, IWTC 13 2009, Hurghada, Egypt.

3) Metcalf & Eddy, Inc. Revised by: George Tchobanoglous and Franklin L. Burton. 1991. Wastewater Engineering – Treatment, Disposal, and Reuse. New York: McGraw-Hill.
4) CPHEEO Manual,(1993) "Manual on Sewage and Sewerage Treatment", The Government of India, New India.
5) Tsvetko Prokopov, Dasha Mihaylova, Nikolay Mihalkov. Biological Treatment of Wastewater by Sequencing Batch Reactors. Ecologia Balkania, Vol. 5, Page no. 33-39.
6) Maharashtra Pollution Control Board (MPCB)(2010)," ACTION PLAN FOR INDUSTRIAL CLUSTER : NAVI MUMBAI"21-26.

Tackling PAHs Pollution Using Microbial Consortia

Siddiqui S.*, Phadke M., Tambe D.
SIES College of Arts, Science and Commerce, Sion (West), Mumbai 400022
Maharashtra, India.

Abstract

Polycyclic aromatic hydrocarbons (PAHs) constitute a diverse class of organic compounds formed by two or more aromatic rings in several structural configurations. PAHs are known to have carcinogenic, mutagenic and toxic properties, hence environmental contamination of PAHs is of great concern. Studies have shown that bioremediation of PAHs is the most efficient means to restore the original environmental conditions. This study evaluates the ability of bacterial consortia, taken from two different environments (petrol pump soil and garden soil), to degrade low and high molecular weight PAHs like toluene and naphthalene, by using them as the sole carbon source on M9 medium. Morphological identification of the isolated bacteria was done using biochemicals. Growth curve of every isolate was studied. Isolate was checked for its ability to degrade PAH and the degradation was monitored using GC. Labscale bioreactor was build and the bioremediation efficiency of the isolated consortium was evaluated by COD assay and GC.

Keywords: *PAHs, bioremediation, consortia, COD, GC.*

1. Introduction

Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous pollutants of either anthropogenic or natural origin. PAHs of anthropogenic origin are typically derived from fossil fuel combustion, refining of crude oil, tar production, waste incineration, and food technologies, whereas naturally derived PAHs originate from forest fires, natural oil seeps, and some microbial processes.

PAHs consist of two or more fused benzene rings in linear, angular, or cluster arrangements. By definition, PAHs contain only C and H atoms, although N, S, and O atoms may readily substitute in the benzene ring to form heterocyclic aromatic compounds, commonly grouped with the PAHs. PAHs has been divided into two category i.e. low molecular weight (LMW) PAHs (two or three rings) which are relatively volatile, soluble and more degradable than are the higher molecular weight compounds and other were high molecular weight (HMW) PAHs (four or more rings) which sorbs strongly to soils and sediments and are more resistant to degradation because of its high molecular weight and hydrophobicity. Volatility and solubility of PAHs decreases with an increasing number of fused rings.Human exposure to PAHs occurs in three ways, inhalation, dermal contact and consumption of contaminated foods, which account for 88–98% of such contamination; in other words, diet is the major source of human exposure to these contaminants.

Numerous research efforts are being dedicated to the search of proper remediation technologies to remove as much as possible contaminants from the environment or to transform them into less toxic compounds. Six main ways of dissipation, i.e. disappearance, are recognized in the environment: volatilization, photooxidation, chemical oxidation, sorption, leaching and biodegradation. Microbial degradation is considered to be the main process involved in

the dissipation of PAHs. Biodegradation is expected to be an economic and environmentally friendly alternative for removal of PAHs. *Alcaligenes*, *Burkholderia*, Mycobacterium, P olaromonas, *Pseudomonas*, Ralstonia, Rhodococcus, *Sphingomonas* and Streptomyces are the examples of some important PAHs degraders.

2. Materials and method:

2.1 Sample collection:

Two soil samples were collected from garden and petrol pump. For collection of the sample, surface soil was removed and the sample is taken from a depth 5-15cm. Samples is collected in clean polyethylene bags and transported to laboratory for further processing.

2.2 Enrichment:

As soon as the sample reaches laboratory, 1g of soil is measured and added 100ml of M9 medium containing naphthalene and toluene as the carbon source and kept on shaker for 2-3 weeks at RT for enrichment.

2.3 Isolation:

After enrichment, the samples were plated on M9 agar plate containing toluene and naphthalene as a

sole carbon source. The plates are kept at RT for 1 week.

2.4 Purification of Cultures:

Colonies from above plates was further purified on M9 agar plate with respective carbon source (naphthalene or toluene).

2.5 Identification:

Morphological characteristics of these isolates was studied using biochemicals (Table)and maintained on M9 slants containing PAH as the sole carbon source.

2.6 Growth Curve:

Each of the isolated bacteria was studies for its growth on M9 medium with both toluene and naphthalene and the growth was monitored colorimetrically at 530 nm.

Isolate	Gram nature	Indole	MR	VP	Citrate	Tsi Slant butt gas h2s	Oxidase	Catalase
1	Gram positive coccobacilli	-	-	-	+	Alk A - -	-	+
2	Gram negative coccobacilli	-	-	-	+	Alk A - -	-	+
3	Gram negative coccobacilli	-	-	-	+	Alk A - -	-	+
4	Gram positive bacilli	-	-	-	**No growth**	Alk A - -	-	+
5	Gram negative coccobacilli	-	+	+		A A + -	-	+
6	Gram negative coccobacilli	-	+	+	+	A A + -	-	+
7	Gram negative coccobacilli	-	+	+	-	A A + -	-	+
8	Gram negative coccobacilli	-	+	+	+	A A + -	+	+

2.7 Degradation Study of Isolate:

Isolated bacteria were inoculated in M9 medium with toluene and naphthalene as the carbon source and degradation was studied using GC.

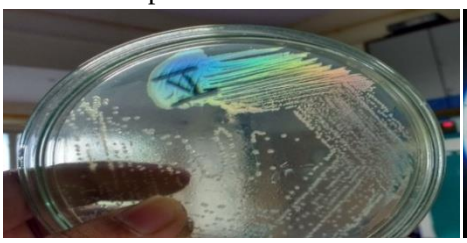
2.8 Lab Scale Bioreactor:

Using effluent sample, lab scale bioreactor was build up. Consortium of isolated bacteria was used and degradation was studied by COD assay and GC

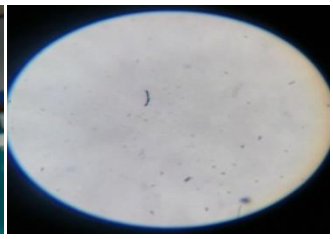
.3. Results:

3.1 Isolation:

Growth on plate in the form of colonies is scored positive for that particular PAH degradation (naphthalene or toluene). 8 isolates were found to grow on M9 agar with PAHs as sole carbon source



Isolation



gram positive rods

3.2 Purification:

Colony on the plate was further purified on respective plate (toluene or naphthalene) to obtain pure culture and stored on M9 slant containing toluene or naphthalene as the sole carbon source.

3.3 Identification:

Identification was done on the basis of gram staining and basic biochemical Tests

Table 1: Key: (+) growth, (-) no growth. **TSI**: (Alk) alkaline, (A) Acid

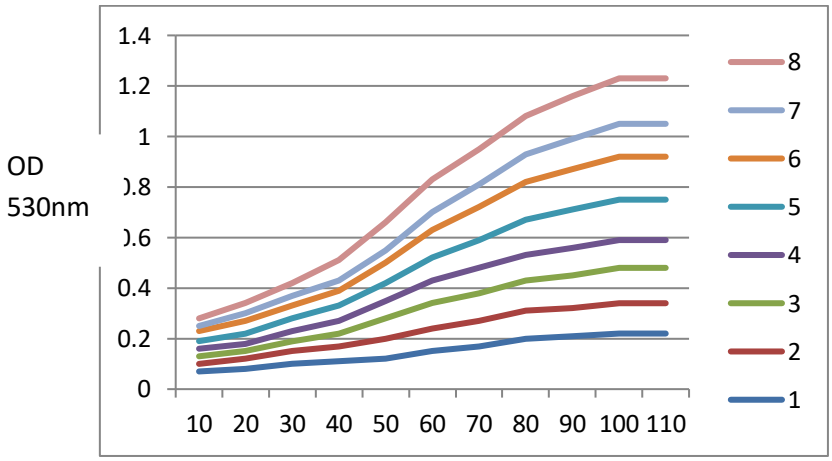


Fig: 1 Growth Curve

3.5. Degradation **Study of Isolate:**

GC was performed for studying degradation by single isolated bacteria (Fig. 1)

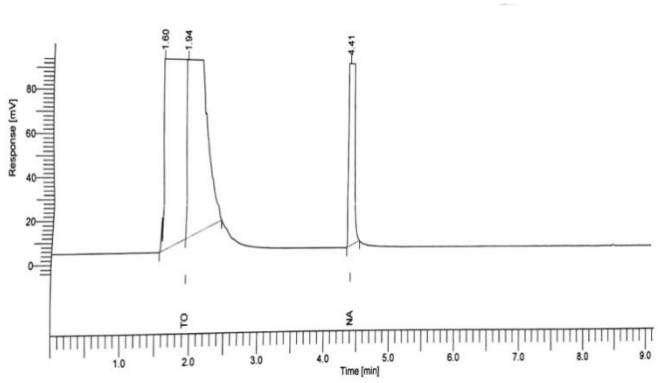


Fig.2: GC for degradation by single isolated bacteria

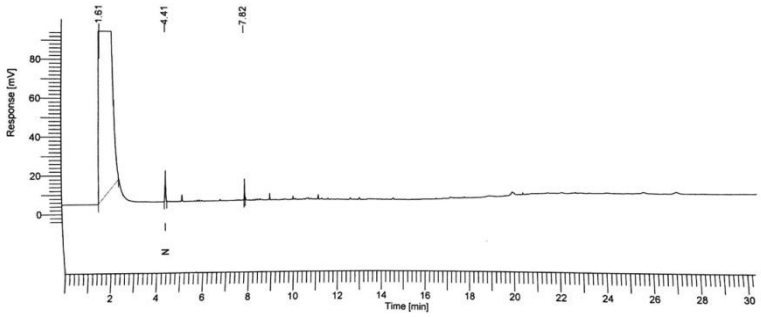


Fig. 3: **GC for standard toluene and naphthalene**

3.6 Lab Scale Bioreactor: Lab scale bioreactor was build up using bacterial consortium of isolated bactria.(Fig. 3.)

Fig. 3. Lab scale bioreactor

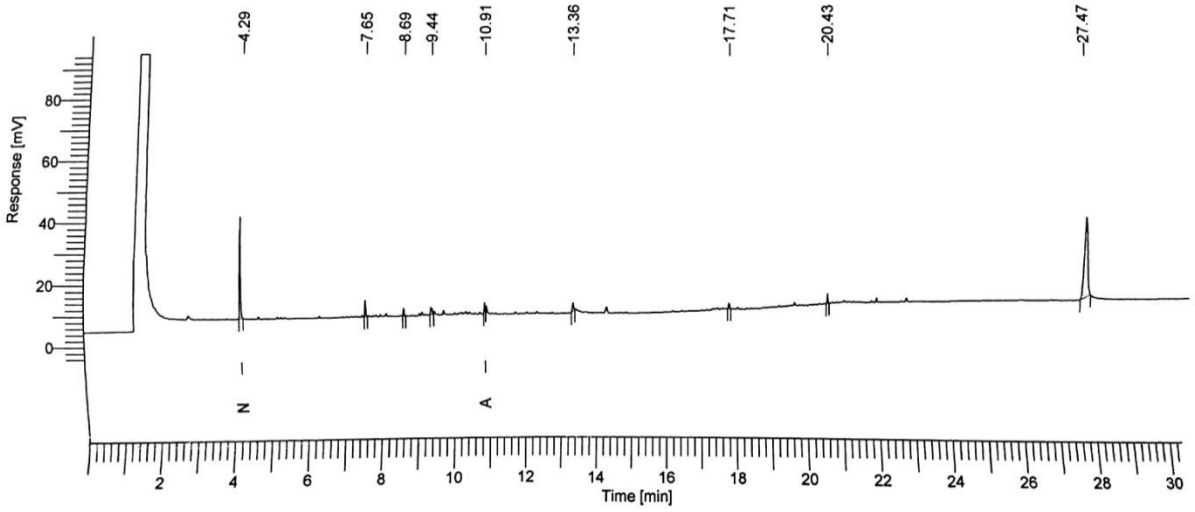


Fig. 4: GC of water sample (untreated)

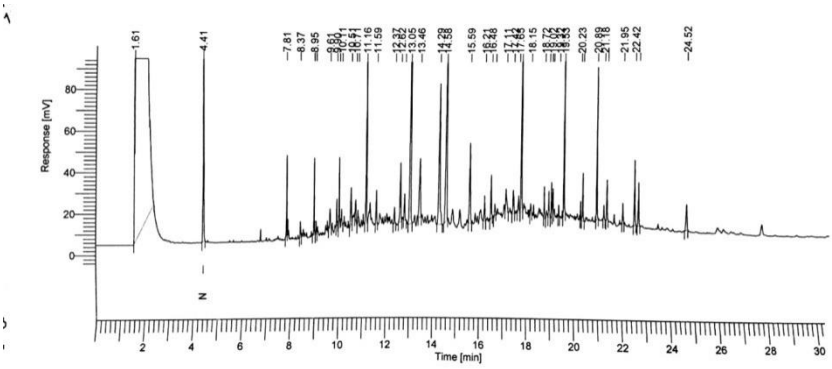


Fig. 5: GC of water sample (treated) from bioreactor

4. Discussion

The contamination of soils and groundwater with petroleum compounds is among the most prevalent problems in environments worldwide. These compounds enter the environment in many ways like incomplete combustion of organic materials arising from natural combustion such as forest fires and volcanic eruptions, but mainly it spread through anthropogenic activities like industrial production, transportation, refuse burning, gasification and plastic waste incineration.

Petroleum compounds consist of four fractions: saturated hydrocarbons, aromatic hydrocarbons, nitrogen-sulphur-oxygen containing compounds and asphalthenes. Normally, of the saturated hydrocarbons, the straight-chain *n*-alkanes are most susceptible to biodegradation, whereas branched alkanes are less vulnerable to microbial attack. The aromatic fraction is more difficult to degrade and the susceptibility of its components decreases as the number of aromatic or alicyclic rings in the molecule increases. Polycyclic (polynuclear) aromatic hydrocarbons (PAH) occur extensively as pollutants in soil and water and are important environmental contaminants because of their recalcitrance. These compounds also constitute

a potential risk to human health, as many of them are carcinogens.

Numerous research efforts are being dedicated to the search of proper remediation technologies to remove as much as possible contaminants from the environment or to transform them into less toxic compounds. Bioremediation appears to be an appealing technology to approach the recovery of PAH-polluted sites The ultimate aim of bioremediation is to degrade organic contaminants completely to harmless constituents, such as carbon dioxide and water.

Studies have shown that prior exposure and acclimatisation of subsurface and surface microbes to PAHs or other hydrocarbons in soil or sediment enhance degradation rates. Herbes and Schwall (1978) found that absolute rates of PAH transformation were 3000-725000 times as great in contaminated soil as in unacclimatised soil. In order to reduce the acclimatisation period and increase the rate of PAH biodegradation, microbes used in remediation projects are frequently isolated from the contaminated site itself. Those that show the fastest rates of PAH degradation are cultured and reapplied to the soil for bioremediation.

PAH biodegradation under aerobic conditions is much more rapid and complete than under anaerobic conditions. The mechanisms of aerobic and anaerobic PAH biodegradation are different in principle. Aerobic bacterial PAH degradation begins with hydroxylation of one of the aromatic rings of the substrate. Bacteria initiate PAH degradation by the action of intracellular dioxygenases after the PAHs is taken up by the cell.

The basic biochemicals were done to study the basic identification of the isolates. Majority of them were found to gram negative coccobacilli. Growth curve was studied on M9 medium with PAHs as sole source of carbon.

One of the isolate showing highest rate of growth on toluene and naphthalene was used to study the sing bacterial degradation of PAH. Degradation was analysed using GC. Standards of pure toluene and naphthalene were also analysed by GC. There was no peak seen in the test for toluene (Fig. 2) which means toluene was completely degraded. But a small peak was seen for naphthalene when compared to standard shows the degradation of naphthalene. By calculating the area of the peak, the % of naphthalene remaining in the medium was 0.79% and the rest is degraded.

GC for water sample(untreated) shows the presence of various PAHs. Also there was presence of a unknown hydrocarbon of high molecular weight. GC of treated sample (reactor) showed the decrease in PAHs concentration. Also the unknown hydrocarbon was degraded and small intermediates of this was seen. By calculating the area % naphthalene and unknown hydrocarbon left in the medium 7.96% and 0.48% respectively.

Employment of single microorganisms may not suffice the purpose of remediation. A mixture of microorganisms may have a cumulative effect on increasing the biomass activity, growth efficiency, and enzyme production. In addition, mixed cultures serve to overcome feedback regulation and catabolic repression, as the products of one microorganism act as substrate for the other.

The chemical oxygen demand (COD) test is used to measure the total organic content of industrial wastes and municipal and natural wastewaters. During the determination of COD, organic matter is converted to carbon dioxide and water using a strong chemical oxidizing agent (dichromate) in the presence of a catalyst and strong acid. In the COD test, organic materials are oxidized regardless of the biological assimilability of the substances.

The COD of the untreated water sample was 3200ppm and after treatment (reactor) it was 1530ppm, that is about 50% decrease in COD

5. Conclusion

The use of bioreactors has increased recently, since optimum-degradation conditions are easier to maintain and good mixing with the microbial population and other additives, such as nutrients and surfactants, can be achieved. However, running costs are generally higher than *in-situ* and on-site treatments. Bioreactors have tended to be used to treat the fine-soil fraction which is not so amenable to on-site treatment.

6. Acknowledgements:

S.I.E.S. College of Arts, Science, Commerce, Sion, Mumbai, India is greatfully acknowledged for providing necessary infrastructure and facilities.

REFERENCES

1. **Ahn Y, Sanseverino J, Sayler G. S**. 1999. Analyses of polycyclic aromatic hydrocarbon-degrading bacteria isolated from contaminated soils. Biodegradation **10:** 149–157.
2. **Ainon H, Tavakoli A, Rabu A.** 2011. Detection of Toluene Degradation in Bacteria Isolated from Oil Contaminated Soils. Sains Malaysiana **40(11):** 1231–1235.
3. **Al- Turki.** 2009. Microbial polycyclic aromatic hydrocarbon degradation in soil. Research journal of environmental toxicology **3 (1):** 1-8.
4. **Alcalde M, Bulter T, Arnold F.H.** 2002. Colorimetric Assays for Biodegradation of Polycyclic Aromatic Hydrocarbons by Fungal Laccases. Journal Of Biomolecular Screening **7:** 547-553.
5. **Andreoni V, Cavalca L, Rao M.A, Nocerino G, Bernasconi S, DellAmico E, Colombo M, Gianfreda L.** 2004. Bacterial communities and enzyme activities of PAHs polluted soils. Chemosphere **57:**401–412.
6. **Angela R, Bielefeldt, Stensel H. D.** 1999. Biodegradation of aromatic compounds and TCE by a filamentous bacteria-dominated consortium. Biodegradation **10:** 1–13.
7. **Bamforth S. M, Singleton I.** 2005. Bioremediation of polycyclic aromatic hydrocarbons: current knowledge and future directions. Journal of Chemical Technology and Biotechnology **80:**723–736.
8. **Bisht S, Pandey P, Bhargava B, Sharma S, Kumar V, Sharma K. D.** 2015. Bioremediation of polyaromatic hydrocarbons (PAHs) using rhizosphere technology. Brazilian Journal of Microbiology **46 (1):** 7-21.
9. **Cerniglia C. E.** 1992. Biodegradation of polycyclic aromatic hydrocarbons. Biodegradation **3:** 351-368.
10. **Cerniglia C. E.** 1997. Fungal metabolism of polycyclic aromatic hydrocarbons: past, present and future applications in bioremediation. Journal of Industrial Microbiology & Biotechnology **19:** 324–333
11. **Dhall P, Kumar R, Kumar A.** 2012. Biodegradation of Sewage Waste water Using Autochthonous Bacteria. The Scientific World Journal **20:** 1-8
12. **Fredrickson J.K, Brockman F.J, Workman D.J, Li S.W.** 1991. Isolation and characterization of a subsurface bacterium capable of growth on toluene, naphthalene, and other aromatic compounds. Applied and Environmental Microbiology 796-803.
13. **Hamzah A, Rabu A, Azmy R. F , Yussoff N. A.** 2010. Isolation and characterization of bacteria degrading sumandak and south angsi oils. Sains Malaysiana **39(2):** 161–168.
14. **Harayama S, Kishira H, Kasai Y, Shutsubo K.** 1999. Petroleum Biodegradation in Marine Environments. Journal of Molecular Microbiology and Biotechnology **1(1):** 63-70.
15. **Hussein I, Abdel- Shafy, Mansour S. M.** 2016. A review on PAHs: Sources, environmental impact, effect on human health and remediation. Egyptian journal of petroleum **25:** 107-123.

16. **Jindrova E, Chocova M, Demnerova K, Brenner V.** 2001. Bacterial aerobic degradation of benzene, toluene, ethylbenzene and xylene. Folia microbiology **47 (2):** 83-93.
17. **Juhasz A.L, Naidu R.** 2000. Bioremediation of high molecular weight polycyclic aromatic hydrocarbons: a review of the microbial degradation of benzo[a]pyrene. International Biodeterioration & Biodegradation **45:** 57-88.
18. **Kanaly R.A, Harayama S.** 2000. Biodegradation of High-Molecular-Weight Polycyclic Aromatic Hydrocarbons by Bacteria. Journal of bacteriology 2059–2067.
19. **Liu A, Dalpe Y.** 2009. Reduction in soil polycyclic aromatic hydrocarbons by arbuscular mycorrhizal leek plants. International Journal of Phytoremediation **11:** 39–52.
20. **Otenio M. H, Lopes da Silva M. T, Marques M. L. O, Roseiro J. C, Bidoia E. D.** 2005. Benzene, toluene and xylene biodegradation by *Pseudomonas putida* CCMI 852. Brazilian Journal of Microbiology **36:**258-261.
21. **Parales R. E, Resnick S. M, Yu C. L, Boyd D. R, Sharma N. D, Gibson D. T.** 2000. Regioselectivity and Enantioselectivity of Naphthalene Dioxygenase during Arene cis-Dihydroxylation: Control by Phenylalanine 352 in the alpha Subunit. Journal of Bacteriology **182(19):** 5495-5504.
22. **Sayyed H. M, Giti E, Mohammad H. G, Hossein G.** 2010. Biodegradation of Petroleum and Aromatic Hydrocarbons by Bacteria Isolated from Petroleum-Contaminated Soil. Journal of Petroleum & Environmental Biotechnology **1:**102.
23. **Seo J. S, Keum Y. S, Li Q. X**. 2009. Bacterial Degradation of Aromatic Compounds. International Journal of EnvironmeAntal Research and Public Health **6:**278- 309.
24. **Shuttleworth K. L, Cerniglia C. E.** 1995. Environmental Aspects of PAH Biodegradation. Applied Biochemistry and Biotechnology **54:** 291-302.
25. **Simarro R, Gonzalez N, Bautista L. F, Molina M. C.** 2013. Biodegradation of high-molecular-weight polycyclic aromatic hydrocarbons by a wood-degrading consortium at low temperatures. FEMS Microbiological Ecology **83**:438–449.
26. **Singleton D. R, Richardson S. D, Aitken M. D.** 2011. Pyrosequence analysis of bacterial communities in aerobic bioreactors treating polycyclic aromatic hydrocarbon contaminated soil. Biodegradation **22(6):** 1061–1073.
27. **Ukiwe L. N, Egereonu U. U, Njoku P. C, Nwoko C. I. A, Allinor J. I.** 2013. Polycyclic Aromatic Hydrocarbons Degradation Techniques: A Review. International Journal of Chemistry **5(4):** 43-55.
28. **Wald J, Hroudova M, Jansa J, Vrchotova B, Macek T, Uhlik O.** 2015. *Pseudomonads* rule degradation of PAHs in aerated sediment. Frontiers in microbiology **6:**1268.
29. **Walter D, Weissenfels, Hans-J K, Langhof J.**1991. Adsorption of polycyclic aromatic hydrocarbons (PAHs) by soil particles: influence on biodegradability and biotoxicity. Applied Microbiology and Biotechnology **36:**689-696.
30. **Wilson S.C, Jones K. C.** 1993. Bioremediation of soil contaminated with Polynuclear Aromatic Hydrocarbons (PAHs). Environmental Pollution **81:** 229-249.

BIOCEMENT: A Biologically Induced Eco Friendly Construction Material Produced from an Ureolytic Bacteria

Yashasvi M Tadepalli [1], Pramod Ghogare [2]& Deepika R Tambe [3]

[1, 2, 3]Department of Microbiology, S.I.E.S College of Arts, Science & Commerce,
Sion (west),Mumbai-400022
University of Mumbai, Maharashtra, INDIA

Abstract

Micro cracks are the main cause to a structure failure. A novel technique in remediating cracks and fissures in concrete is by Microbiologically Induced Calcite Precipitation (MICP).It is advancement in biomineralization where bacteria giving a high amount of urease activity help to yield a microbial sealant, calcite. This study-involved isolation of bacteria from limestone quarry used to sculpt idols. The several soil sample isolates were analyzed for the activity of urease enzyme. The isolates showing maximum activity were further studied for the production of biocement using different sources of calcium salts such as calcium chloride, calcium sulphate, calcium hydroxide (slaked lime) and calcium nitrate. The production of biocement was also checked using waste material obtained from crushed bones and waste shrimp shells. The isolate showing maximum urease activity and production of biocement was identified till the genus level. The effects of physical parameters on production of biocement were studied. Biobricks were also prepared using the property of bioconsolidation of garden soil, biocement, Portland cement and sand to study water absorptivity.

Keywords:- *Microbiologically Induced Calcite Precipitation (MICP), biocement, bioconsolidation, urease activity*

Introduction

Concrete is the most widely used construction material. Despite its versatility in construction, it is known to have several limitations. It is weak in tension, has limited ductility and little resistance to cracking (Sarda D.et al, 2009). The consequent corrosion, susceptibility to chemical attack and capillary water movements into it estimate the durability and life of cement mortar/concrete specimens. Higher absorption of water by the specimen would imply higher damage and vice versa (Senthilkumar V .et al, 2014). Construction engineering consumes a large amount of materials from non-renewable resources, most of which contribute CO_2 emission to the air at their production or application stage. Technology development related to the construction material and their production is necessary, in order to maintain the sustainability and to reduce the production of CO_2 emission (Reddy R L .et al, 2015). Biomineralization is the chemical alteration of an environment by microbial activity that results in the precipitation of minerals. Microbially induced calcite precipitation (MICP) refers to the formation of calcium carbonate from a supersaturated solution due to the presence of their microbial cells and biochemical activities. During MICP, organisms are able to secrete one or more metabolic products (CO_3^{2-}) that react with ions (Ca^{2+}) in the environment resulting in the subsequent precipitation of minerals. The precipitation of calcite is by bacteria showing urea hydrolysis The microbial urease hydrolysis involves conversion of urea into ammonium and carbonate. One mole of urea is

hydrolyzed intracellularly to ammonia and carbamic acid, then forms bicarbonate, ammonium and hydroxide ions in water .The production of hydroxide ions results in the increase of pH, which in turn can shift the bicarbonate equilibrium, resulting in the formation of carbonate ions. The produced carbonate ions precipitate in the presence of calcium ions as calcium carbonate crystals (Varalakshmi .et al, 2014). The "Bacterial Concrete" can be made by embedding bacteria in the concrete that are able to constantly precipitate calcite. These carbonates/ calcite crystals act as cloggers in the building materials by filling the voids and thereby reducing permeability (Dhami et al. 2012).

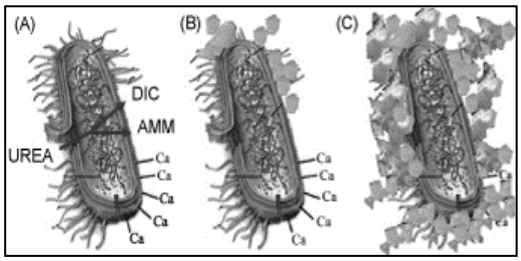


Figure 1: Illustration of calcite precipitation mechanism induced by urease enzyme activity in micro organism

Calcium carbonate precipitation is a rather straightforward chemical process governed mainly by four key factors: (1) the calcium concentration, (2) the concentration of dissolved inorganic carbon (DIC), (3) the pH and (4) the availability of nucleation sites (Hammes .et al , 2002).

The objective of this paper is to evaluate the isolation of potential ureolytic bacteria and characterize the isolated strains that are capable of calcite precipitation and investigate the effect of the selected strain on enhancing the production of biocement under various physical parameters.

Materials and Methods

Isolation of bacteria:

The isolation of the urease-producing microbes was done from soil samples collected from limestone deposits, idol sculpture factories, quarries and marble cutting factories. The enrichment of the sample was carried on yeast extract ammonium sulphate urea broth (YAU broth) .The isolation of urease producing bacteria was done on christensen's urea agar The plates and broths showing shocking pink appearance were selected. Colonies were picked and further streaked for purification. The cultures were maintained at 4 ˚C on nutrient agar as well as urea agar slants by repeated sub-culturing fortnightly

Urease activity:

All the isolates were tested for urease activity. This was done by streaking the purified cultures on christensen's urea agar and the positive cultures were further checked using pH indicator assay using phenol red, indophenol assay or phenol hypochlorite assay. The reagent ammonium chloride (50 to 100 µM) was used as standard. The culture filtrates (250 µl) were added to the mixture containing 1 ml of 0.1 M potassium phosphate buffer (pH 8.0) and 2.5 ml of urea (0.1 M). The mixture was incubated at 37°C for 5 min followed by addition of phenol nitroprusside and alkaline hypochlorite, 1 ml each and incubated at 37°C for 25 min. Optical density was measured at 626 nm (Natarajan .et al, 1995). Urease enzyme was isolated from pea & jack beans by extraction from germinated seeds. This crude extract was used as reference to confirm urease activity.

Optimization of growth conditions for the isolates: Temperature and time optimization-

The isolates were grown in urea broth at varying temperatures (0˚C,4˚C,25˚C,37˚C & 55˚C) and were incubated for 20 hours. Samples were collected post incubation to measure the optical density spectrophotometrically at 660 nm. The time intervals included (24hrs, 48hrs, 72hrs, 96hrs, 120hrs, 144hrs, 168hrs and 192hrs

Optimum pH –

The media with varying pH values (6,6.5,7,7.5,8,8.5,9,9.5,10) were prepared and incubated to check the growth of the isolate

Aeration Condition Optimization- The effect of aeration facilities on the production was checked by keeping the flasks on static conditions and shaker conditions (100-250 rpm) for 20 hours both at room temperatures containing same urea broth

Selection of appropriate growth media-Cementation media consisting of nutrient broth 0.3g/L, Urea (200 mM0 , Calcium salt (100 mM). **Calcite broth** consisting of sodium carbonate (2.12g/L), ammonium chloride (10g/L) , nutrient broth (3g/L) , calcium acetate (25g/L)

Tryptic soy broth contains tryptone (15g/L), Soy peptone (5g/L),urea (20%),calcium salts(0.1% -5 %)

Urea concentration in the media –

The media is further analysed for substrate concentration of urea for urease production (5%,10%,15%,20%,25%,30%,35% & 40%) at room temperature, optimum alkaline pH

Biocement production using various calcium salts The production of biocement is studied using various calcium salts such as calcium chloride, calcium sulphate, calcium nitrate and calcium oxide.

Biocement production using chicken bone crush and waste shrimp powder as calcium source for biocement production

Optimum time for biocement production

Different time intervals were analysed as incubation periods. The time intervals included (24hrs,48hrs, 72hrs , 96hrs,120hrs,144hrs,168hrs,192hrs).

Extraction & Purification

Double filtration and centrifugation at 5000 rpm. The filtrate is dried in hot air oven at 55˚C for 48 hrs and stored in glass vials.

Biobricks Formation

Biobricks were prepared with the ratio (1:9) biocement is to portland cement, sand and soil respectively. The ratio was put in latex molds and dried in the hot air oven for 48 hrs. The bricks were further analyzed for their water absorptivity. The water absorption is calculated from the following equation:

Water absorption: % = (W2-W1) / W1 x 100, where W1 is dry weight and W2 is wet weight

Isolation & Screening :

The samples gave 14 isolates i.e 1a, 1b , 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, C1,C2,C3 & C4. All the strains have utilized urea provided as the sole carbon source. In this study, out of 14 strains 3a, 3b & C3 were found to be best on the basis of calcite formation.

Study of urease activity

A change in coloration following incubation 24 hrs incubation at 37˚ C was seen on christensen's urea broth and agar. In all cases, urease activity was cell associated. When organisms utilize urea, ammonia is formed and this in turn makes the media alkaline which leads to reddish pink colouration.

The pH indicator assay, phenol hypochlorite and nesslerization assay indicated that strains 3a, 3b, C3, 5a, 4b, 1b showed maximum urease activity

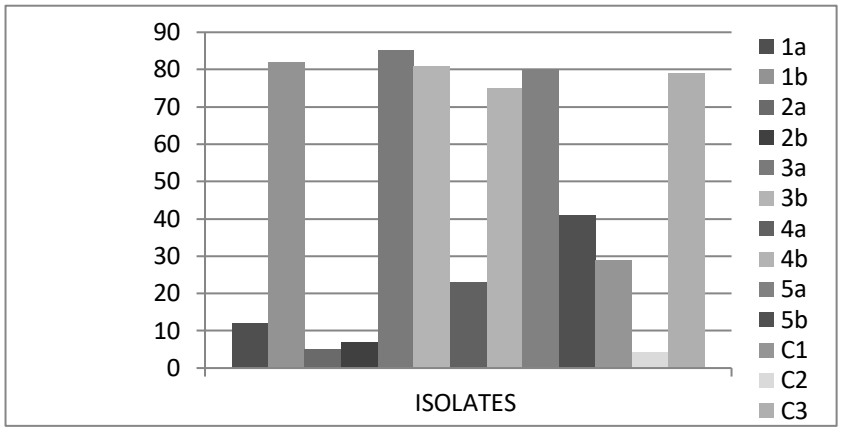
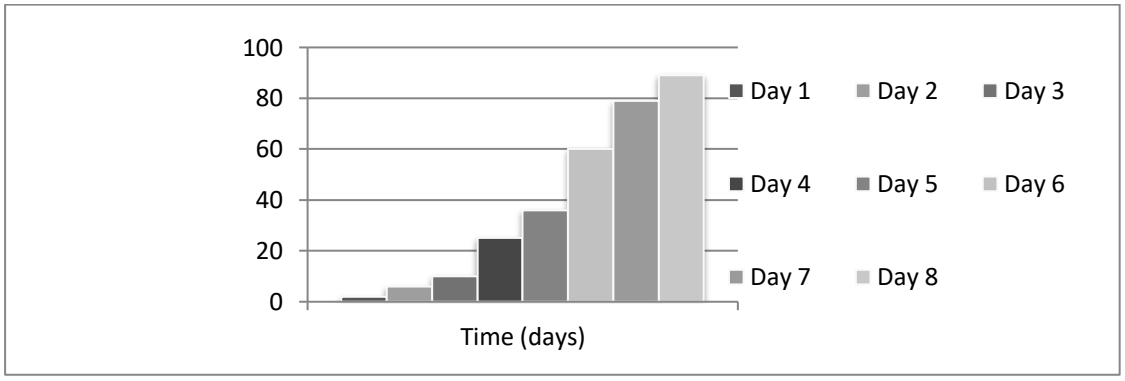
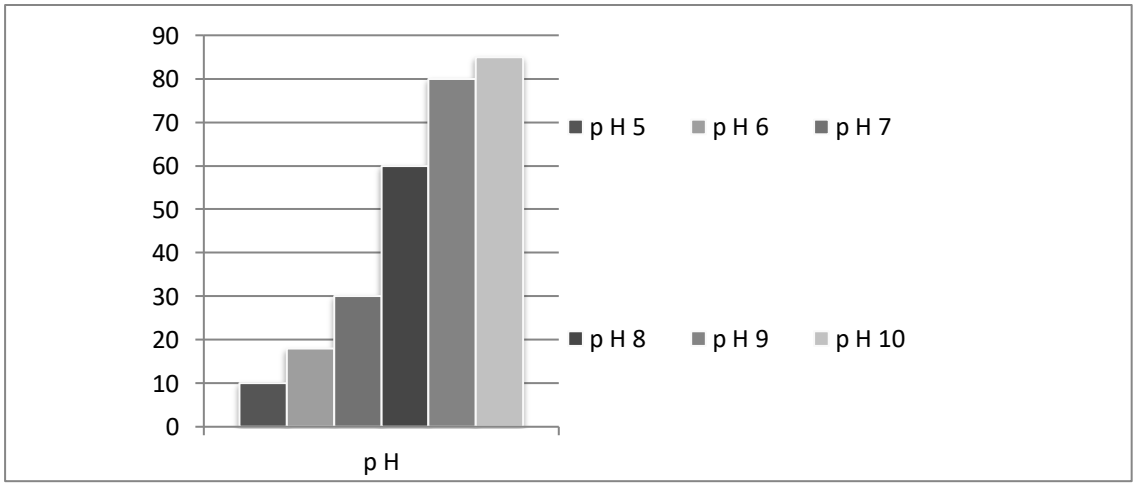


Figure 2: graphical representation of isolates showing urease activity

Growth profile of ureolytic bacteria: The growth profile was studied up to 192 hrs. Strains showed different time profiles for growth, isolates 3a, 3b, 4a, 5b, c1, c2, c3 showed growth within 24hrs.The pH of the medium was significantly increased with the increase in growth of these isolates.

Optimization of isolates for urease/calcite production : The optimization of isolates for urease production was carried on several parameters such as temperature ,pH , aeration facilities & time period





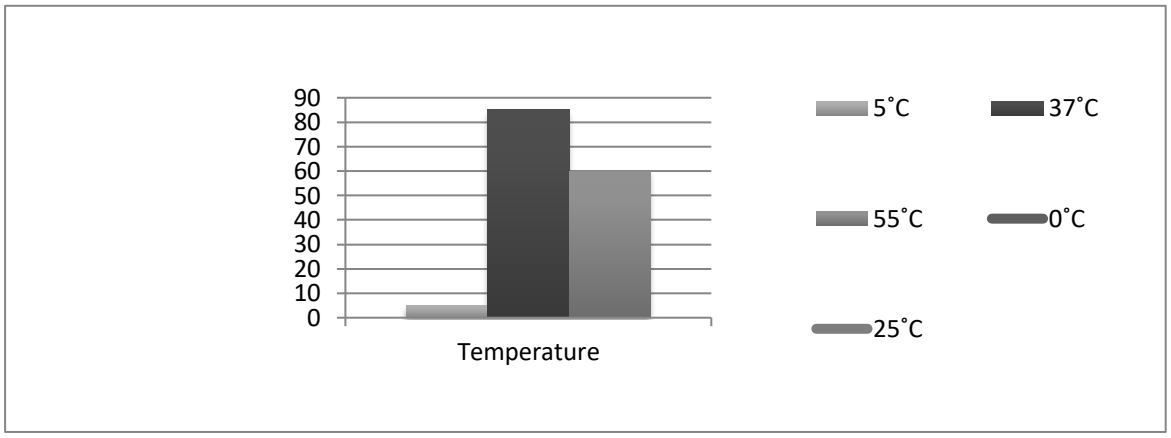


Figure 2 a: graphical representation of optimization of isolates for urease/calcite production (temperature, time period and pH factors

The maximum calcite precipitation was seen on shaker conditions at 250 rpm.

Growth media optimization for calcite production The three media were prepared containing varying urea and calcium salt concentrations to analyse the suitable media for growth and production of biocement. Tryptic soy broth showed most promising growth factors for production of urease and calcite. **Biocement production using various calcium salts** Various calcium salts were used keeping the concentration of substrate constant and other factors. The calcium salts included calcium chloride, calcium sulphate, calcium hydroxide and calcium nitrate

Figure 3: biocement produced for different calcium salts

Isolates	Calcium chloride /100ml	Calcium sulphate /100ml	Calcium hydroxide /100ml	Calcium nitrate /100ml
3a	0.51g	0.79g	0.86g	0.41g
3b	0.65g	0.95g	0.54g	0.30g

C3	0.54g	0.84g	1.06g	0.23g

Table no. 1 biocement from different calcium salts weights calculated

Time optimization for biocement production

Different incubation time periods were set to check the production of maximum calcite production. The initial time periods of 24-72 hrs hardly showed production whereas 192 hrs incubation showed maximum calcite production

Biocement production using chicken bone crush and waste shrimp powder

Biocement was produced using waste matter as cheap calcium source. It was carried out using crushed powder and calcite formation was visualized

Urea concentration for calcite precipitation:

The effect of increasing concentration of substrate on activity of urease enzyme was carried out. Different concentrations ranging from 0.1 %, 0.5%, 1%, 1.5%, 2% upto 30% was provided for production. The maximum production was seen at 20% urea solution in broth containing the isolate

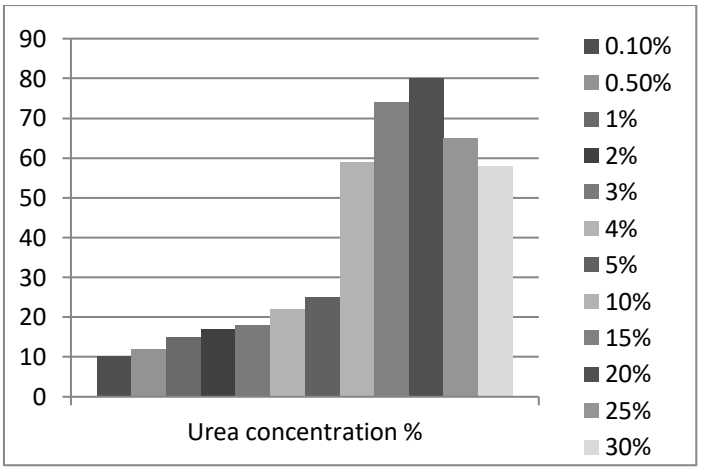


Figure 4: Graphical representation of urea tolerance for urease production to precipitate calcite.

Identification of isolate :

Optimization tests carried out to enhance the activity and the selected isolate strain was checked for its identification upto genus level using biochemical tests. The isolate was found to be of the genus *Baciilus spp.*

Extraction and purification of biocement :

Biocement was extracted via double filtration using whatman filter paper no 1 and the filtrate was further centrifuged at 5000rpm for 10 minutes . The sample was dried for 48 hrs in the hot air oven at 55 ˚C.

Biobricks production: Biobricks were prepared using the principle of bioconsolidation. The ratio of cement to gravel mixture was prepared were added to the biocement sample mixed thoroughly and molded out. The bricks were strong as the normal bricks made as controls.

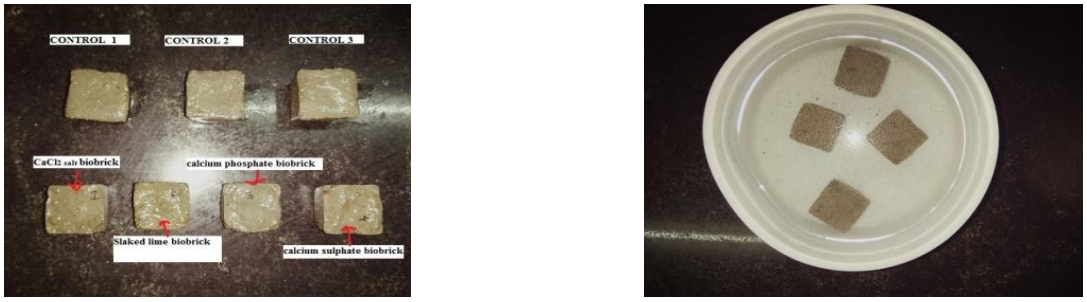


Figure 5: Biocement bricks formed using different calcium salts biobricks immersed in 200ml D/W for water absorptivity test

Water absorptivity tests

The water absorptivity test was carried out on the biobricks by measuring the dry weight, wet weight and post incubation in still water for 24 hrs. The wet weight post incubation was comparatively less as compared to the controls without the biocement.

Sr no	SALT	W2-W 1	Water absorption %
1.	$CaCl_2$	1.57	10.42%
2.	$Ca(OH)_2$	1.9	11.80%
3.	$CaHPO_4$	1.35	13.60%
4.	CaSO4	1.55	12.9%
5.	CONTROL	3.56	23%

Table 2 : values obtained for water absorptivity test done for 24 hrs

Discussions

Numerous diverse microbial species participate in the precipitation of mineral carbonates in various natural environments (Chahal N .et al, 2011). Urease producing microorganisms were selected on the basis of their survival in alkaline environments When microorganisms utilize urea, ammonia is formed during incubation that makes proceedings of the reaction of media (composition explained in isolation earlier alkaline, producing a red pink color due to the presence of phenol red; a pH indicator. Christensen's urea agar (Himedia) in general was used for the selection of bacterial strains.

This mechanism is a function of the cell concentration, ionic strength and the pH of the medium. The media for the growth of the micro organisms are supplemented with a calcium source such as calcium chloride which is precipitated as calcium carbonate. The high pH of the localized areas without any initial increase in pH in the entire medium, commences the growth of calcium carbonate crystals around the cell.

The growth profile of bacterial strains which were isolated on the basis of calcium carbonate production was studied and it was observed that bacterial growth was divided into 4 stages: The first log phase where growth and reproduction will occur. During the second log phase, reproduction occurs at an exponential rate, leading to a mass production of carbonate and hydrogen carbonate. It is the stage where actual calcium particles are formed. In the third phase stationary phase, reproduction goes on but not with the same speed as in the log phase. Finally, in the death phases, where the bacterial cell started dying and calcium production also started decreasing. The samples were enriched in a yeast rich media as it helped for the isolates to develop and repair their organelles and help them grow in stress free environments. The enriched samples were isolated on urea containing media consisting only urease as the sole carbon source.

The isolates were tested for their production of calcite as calcite precipitation along with biomass was the significant factor for the experiments carried out .The maximum number of calcium carbonate peaks was observed in strains 3a, 3b and C3. Urease acitivity is extremely important for calcite precipitation thereby they show a direct relationship. Several concentrations of urea % was used to check the production of calcite and 20% was found to be the most suitable concentration. The optimization of various factors for production of calcite was checked and the optimum temperature was found to be 37 ˚ C .The aeration facilities were most suited under shaker conditions and the time required for production was almost 192 hrs beyond which no further improvement was seen. The production of biocement was analysed using different calcium salts. The production was also checked using waste chicken bones & shrimp shells powder .The phenotypic and biochemical properties of the bacteria isolates were resemble those of Bacillus species reported. The biocement produced was used to prepare biobricks, their water absorptivity was checked, and the biobricks were found to absorb less water as compared to controls. Bio brick samples were analyzed for their water absorption capacity, and the results are depicted in Table 2. It can be seen that the absorption of water by bricks made up of biocement was lower than that by a control sample, indicating that pores on the surface are blocked because of calcite deposition, thus preventing water and other pollutants from penetrating into the body of bricks. Evidently, with increasing bacterial cells concentrations, the biomass and precipitated calcite content increases which fill some of the open pores and therefore, decreases the extent of water absorption. The water absorption is linearly proportional to the total porosity of the cement mortar. Thus, this process of bio-mineralization retarding the water absorption in bricks may be effective in enhancing the durability & longevity of civil structures, (Sarda D.et al, 2009

We have presented a combined experimental approach for microbial concrete technology that has proved to be better than many conventional technologies because of its eco-friendly nature, self-healing abilities and increase in durability of various building materials. In this study, we studied the bacterial isolates on the basis of their urease activity, calcite precipitation and survival at higher pH. The bacterial isolates which showed increased urease activity, calcite precipitation and survival at higher pH, could be used in the remediation of cracks in building materials

Acknowledgment

The authors would like to acknowledge S.I.E.S College of Arts, Science and Commerce for providing technical support and the Management of S.I.E.S College as they

provided us with the Infrastructural support.

References

1. **Bang S S , Lippert J J , Yerra U , Mulukutla S & Ramakrishnan V ,**2010. "Microbial calcite, a bio-based smart nanomaterial in concrete remediation". International Journal of Smart and Nano Materials .**Vol. 1, No. 1:page no-28–39**
2. **Bhathena Z P and Gadkar N,** 2014." Bacteria-based concrete: a novel approach for increasing its durability. International Journal of Applied Biosciences, **Volume 02, Number 01, 2014: page no- 67-77**
3. **Chahal1 N, Rajor A and Siddique R,** 2011." Calcium carbonates precipitation by different bacterial strains". African Journal of Biotechnology **,Vol. 10 (42): Page no 8359-8372**
4. **Gandhimathi A, Vigneswari N, Janani S M , Ramya D, Suji D and Meenambal T,**2012." Experimental Study on Self –Healing Concrete ". Bonfring ,**volume no 25 page no -17-28**
5. **Gupta S, Rathi C and Kumar S,** 2013." Biologically induced self healing concrete: A futuristic solution for crack repair.Int J Appl Sci Biotechnol, **Vol. 1 (3) :page no- 85-89.**
6. **Hamdan N, Kavazanjian K , Rittmann B E & Karatas I,** 2016." Carbonate Mineral Precipitation for Soil Improvement through Microbial Denitrification". Geomicrobiology Journal ,**Volume 20:Page no - 1-34**
7. **Hammes F, Boon N, Villiers J , Verstraete W and Siciliano S D,**2003." Strain-Specific Ureolytic Microbial Calcium Carbonate Precipitation". Applied and Environmental Microbiology, **Vol. 69, No. 8: Page no-4901–4909**
8. **Hammes F, Seka A, Knijf S and Verstrete W, 2003**." A novel approach to calcium removal from calcium-rich industrial wastewater". Elsevier -Water Research, Volume **no 37: Page no 699-704.**
9. **Kumari B,** 2015**."** Microbial Concrete: A Multi-Purpose Building Material-An Overview". International Journal of Advances in Engineering & Technology, **Vol. 7, Issue 6, page no 1608-1619.**
10. **Lin H, Suleiman M T, Brown D G and Kavazanijan E,** 2015." Mechanical Behavior of Sands Treated by Microbially Induced Carbonate Precipitation". J. Geotech. Geoenviron. Eng., **Volume no 12, Page no 4015066-1 to 4015066-13.**
11. **Mobley H L T and Hausinger R P,** 1989." Microbial Ureases: Significance, Regulation, and Molecular Characterization". Microbiological reviews , **Volume 53 no 1:page no 85-108**
12. **Mukherjee A , Dhami N K , Reddy B V V and Reddy M S,** 2011." Bacterial Calcification for Enhancing Performance of Low Embodied Energy Soil-Cement Bricks". ACI Mater J, **Volume 109:page no-157- 164**
13. **13.Okwadha G D O and Li J, 2010**. "Chemosphere, Volume **81: Page no 1143-1148.**
14. **Paassen L A, Ghose R, Linden T J M, Star W R L and Loosdrecht M C M,** 2010." Quantifying Biomediated Ground Improvement by Ureolysis:Large-Scale Biogrout Experiment". Journal of Geotechnical and Geoenvironmental Engineering **Volume no 136: Page no 1721-1728.**
15. **Ramachandran S K, Ramakrishnan V and Bang S S,** 2001." ACI Materials Journal **Page no 1-9**

16. **Ramakrishnan V, Ramesh K P and Bang S S ,** 2011. "Improvement of Concrete Durability by Bacterial Mineral Precipitation". ACI Materials Journal, **volume no .98, No.1: page no - 587-594**
17. **Reddy R L, Manjusha A and Kumar M A, 2015**." Bio Cement – An Eco Friendly Construction Material". Bio Cement – An Eco Friendly Construction Material , **Vol.5, No.4: page no -2880-2883**
18. **Rokidi S , Mavrilas D and Koutsoukos P G**,2015. "Calcification of Biomaterials ".Mineral Scales and Deposits Chapter 16 **: page no- 417-441**
19. **Sivakumar G, Hariharan V and Barathan S,** 2013." Preparation of Bio-cement using sugarcane bagasse ash and its Hydration behaviour". International Journal of Science, Engineering and Technology Research (IJSETR), **Volume 2, Issue 10:Page no 1887-1889.**
20. **Stocks-Fisher,S., Galiant J K and S S Bang**.1999 Microbiological precipitation of CaCO3. Soil Biol. Biochem.**31:1563-1571**
21. **Soundari L, Kumar C S M, Anthoniraj S and Karthikeyan E,** 2015." An Experimental Study on Strengthening of Concrete by using Bacterial Mineral Precipitation". International Journal of Core Engineering & Management (IJCEM), **Volume 2, Issue 9: Page -92-100.**
22. **Varalakshmi R and Devi A, 2014**." Isolation and Characterization of Urease Utilizing Bacteria to Produce Biocement".IOSR Journal of Environmental Science, Toxicology & Food Technology, **Volume 8, Issue 4 Ver. II,Page no 52-57**

Green Assessment: A case study of S.I.E.S. College of Arts, Science and Commerce, Nerul

Ankita Bagwe*[1], Rupali Zele[2]
1,2- S.I.E.S. (Nerul) College of Arts, Commerce and Science
*bagweankita94@gmail.com

Abstract:

The term "Green" is used to describe product or services which are eco-friendly. Green Assessment includes inspecting the environment of the institution to make necessary changes to achieve the goal of sustainability. Many institutions of higher education have come to recognize their unique role and responsibility in promoting an environmentally sustainable society. Conducting a green assessment is a first step in successful management, planning and advancing the overall sustainability of an institution of higher education. The objectives of the present study is to summarize the existing status of the consumption of resources and suggesting suitable conservation strategies. This study describes the solid waste generation sources, waste characterization and quantification of waste. And also identify opportunities for the enhancement of waste reduction, recycling and composting while improving the overall sustainability of a waste management program. The paper too focuses on the importance of energy assessment by considering the conventional lighting loads and also states energy saving opportunities by comparing with energy efficient electric appliances. It also evaluate non potable water consumption and methods to conserve it .This research project also provides recommendations for the college administration to enhance the efficiency and sustainability of campus waste management systems and for becoming a more sustainable educational institution.

Key words*: Green assessment, Solid waste, water consumption, energy assessment, sustainability*

Introduction:

In current scenario people are least concerned about nature, they are directly or indirectly damaging the environment and it causes problems like global warming, air pollution, water pollution etc. Green Assessment is the most effective way to solve such an environmental problem. It is also widely known as Environmental Audit. Green Audit was founded in 1992 as an environmental consultancy and review organisation with the aim of monitoring the performance of companies and organizations whose activities might threaten the environment [1]. For protecting the nature, we have to show our sense of humour towards the mother earth. In corporate sector the practice of saving environment through the various programmes like CSR (Corporate Social Responsibility), GO Green, Save Water, Save Trees, Plantation of trees are to be taken. It will definitely work for the future. Green assessment and sustainable development process help to reduce the wastage and associated cost as well as increases the product quality. There is relationship between Green Assessment and Sustainable Development of the any business organization. The primarily needs for achieving the sustainable development of the business are to determine the Green Audit policy, Green Audit Framework, Accurate implementation, and Result analysis of it. Strong Green Audit process can help to achieve the sustainability. Green Audit framework helps to achieve the goal set by an organization [2]. "Man has the fundamental right to freedom, equality and adequate conditions of life, in an environment of a quality that permits a life of dignity and

well-being and he bears a solemn responsibility to protect and improve the environment for present and future generation." Most countries today face environmental threats due to the increase in pollution of the atmosphere, water and land. Environment related problems are linked closely to the rapid growth of population, as well as to technological advancements [3]. The intention of organizing Green Assessment is to upgrade the environment condition in and around the colleges, companies and other organization. It is carried out with the aid of performing tasks like waste management, energy and water saving and to turn into a better environment friendly institute. The objective of carrying out green assessment is securing the environment and its resources as well as to suggest the best protocol for adding to sustainable development [4].

Methodology:

Water Assessment:

- The project started with the steps to identify the sources of water and its uses for various purposes in college premise.
- A walk through the entire building was carried out to understand the nature of water uses and the systems installed in the building.
- Moreover discussion with the administrative officers, housekeeping and kitchen employees on the various water uses during the day was done.
- Primary data was collected by the development of questionnaire format for individual water use, mopping and cleaning.
- Flow rate calculation from all the taps and number of all water using fixtures/ equipment was also undertaken.

Energy Assessment:

- The methodology adopted focuses on understanding the existing energy consumption by various electric appliances in the college.
- It identifies energy saving opportunities by making comparison between energy efficient and non-efficient lamp.

Solid Waste Assessment:

- **Identifying the Sources of Waste Generation:** The different sources and types of waste generated in the college were determined.
- **Segregation of waste:** The waste was collected on a daily basis from all dust bins and further segregated by category.
- **Weighing of different categories of waste:** The different waste segregated was then weighed by weighing machine.

RESULT AND DISCUSSION:

Water Consumption per day is 27510.64 litres /Day

Sr. No.	Water Used For	Litres/day	% Water used
1.	Flushing	22560.4	82
2.	Washing hands/face	4399.24	16
3.	Cleaning/Mopping of floor	551	2
4.	Total	27510.64	100

Table 1: Water consumption per day for various purposes

The total water consumption for various purposes is 27510.64litres/day. Of the total water, 22560.4 litres water is only use for flushing purpose in both male n female washroom. As the flush tank in all the washroom are without any water saving system, the loss of water per flush is 6 litres in women washroom and 4 litres in male

washroom. The amount of water used for hand/face washing is 4399.24 litres/day which accounts for 16% of the total water usage. As all the basin faucets are of high flow rate, a vast amount of water is lost from all the faucets. For cleaning and mopping of floors 551 litres of water per day is used .

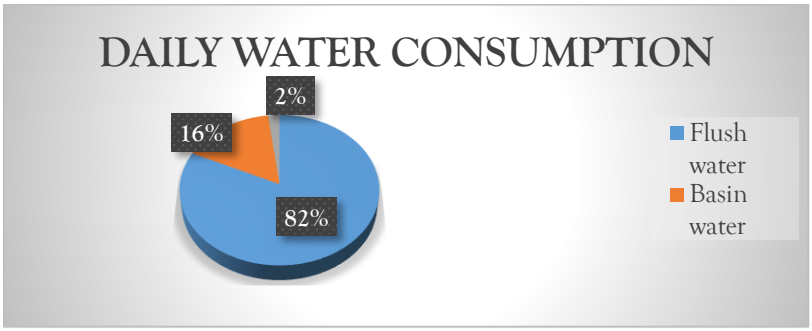


Fig.1 Daily water use for various purposes

Fig. 1 clearly shows that large amount of water is used for flushing activity which account for almost 82% of the total water usage. About 16% of the water is used for face/hand washing purpose. Only a small quantity is used for floor mopping and cleaning purpose.

Water Saving Analysis:

When a comparative study between water efficient faucet and the conventional faucets present in the college was done, it was found that the flow rate of the faucet is reduced to 6 litres/ minute from 10 litres/minutes .

Water fixtures	Faucet water Litres/day	Flush tank water Litres/day	Total Litres/day
Actual	4399.24	22560.4	26959.64
Consumption of water after	2639.54	18295.8	20935.34
Water	1759.7	4264.6	6024.3

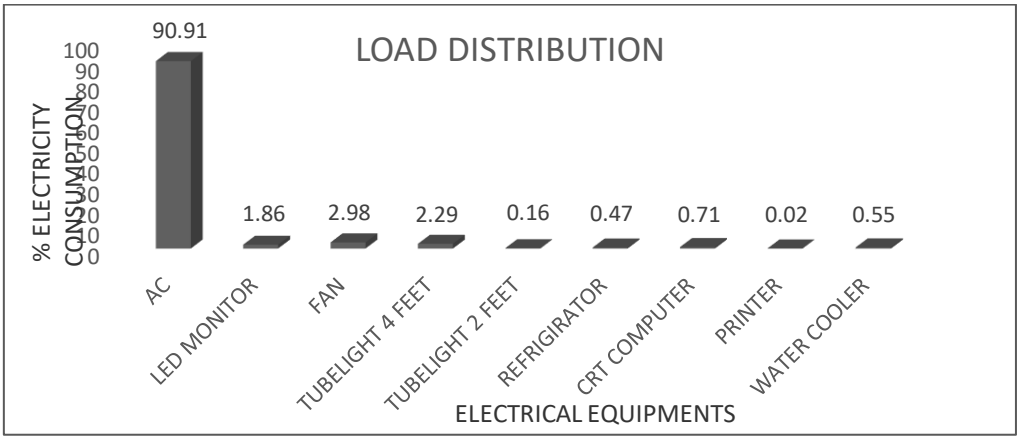
Table 2.Comparison between water efficient and non-efficient faucets

The actual consumption of water from faucet for hand/face washing and that for flushing purpose was found to be 4399.24 litres/day and 22560.4 litres/day respectively. But when compared with water efficient faucet, the use of water is reduced to 2639.54litres/day. The actual consumption of water for flushing purposes was found to be 22560.4litres/day. But when a 600ml bottle filled with water was placed in flush tank, it was found that the capacity of the tank reduced by approximately 1 litre. Then the estimated consumption of water from flush tank is reduced to 18295.8 litres/day. So by adopting some common techniques and replacing high flow rate faucets by water efficient faucets, a total of 6024.3 litres of water per day can be conserved.

Energy Consumption:

Load	No. of equipments X watts X duration	Energy consumption per day in kwh	Energy consumption per month in kwh
Tubelight 4 feet	258*36watts*10hrs	92.880	2414.88
Tubelight 2 feet	38*18watts*10hrs	6.840	177.84
Fan	161*75watts*10hrs	120.750	3139.50
Water cooler		22.592	587.392
Led monitor	135*70watts*8hrs	75.600	1965.6
Crt computer	40*90watts*8hrs	28.800	748.8
Printer	5*25watts*8hrs	1	26
Ac		3679.76	95673.76
Refrigirator		19.2	499.2
Total		4047.422	105232.972

Table 3: Energy consumption of various electric appliances



he sum total electrical energy consumption by different equipment is4047.422 kWh per day. And the monthly energy consumption is 105232.972 kWh.

Fig 2. Above gives the clear picture of percentage of electrical power consumption between different electrical appliances. The measure of highest power consumption is obtained from Air Conditioner used in laboratories, office and library. The next highest power consumption is by the Fan load and Light loads respectively.

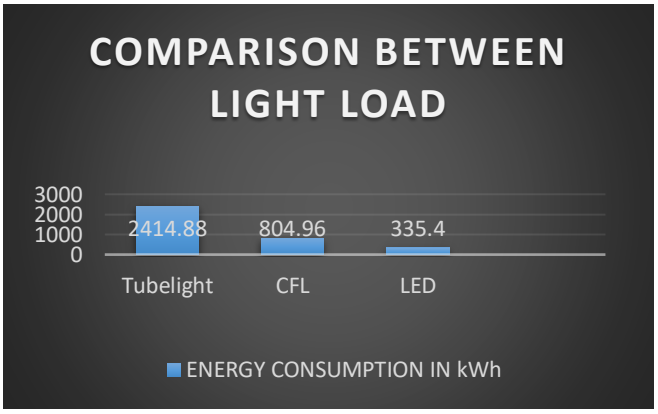


Fig.4 Energy consumption comparison between tube light, CFL and LED

The above graph shows that replacing the conventional tube lights with energy saving CFLs or LEDs reduces the energy consumption drastically.

	TUBELIGHT	CFL	LED
Number of bulbs	258	258	258
Watt per bulb	36 W	12W	5W
Energy consumed by the bulbs	9.288 kWh.	3.096kWh	1.29kWh
Energy consumed in a month Assuming 10 hrs. and 26 days	2414.88 kWh	804.96 kWh	335.4 kWh
Energy saved	nil	1609.92 kWh	2079.48 kWh
Initial investment	low	moderate	high

Above table 4. shows that the energy consumption of tube light is greater than the CFL and LED. Whereas the initial investment of LED is more than the CFL and Tube light

As seen, the life span of a LED is approximately 50,000 hours which is approximately 40 times more than the life span of tube light and 5 times more than the life span of CFL

.**Solid Waste Assessment:**

Sr. No.	SOURCES	TYPE OF WASTE
1.	Classroom	Paper, plastic (Polythene covers, PET bottles, Wrappers-chocolate and chips) pens, disposable cups, metal cans, Charts, Cardboards.
2.	Staffroom	Paper, plastic(polythene covers, plastic bottles, disposable cups).
3.	Office	Paper and plastic.
4.	Library	Paper, plastics and disposable cups.
5.	Tiolet	Paper, sanitary napkins
6..	Corridor	Paper, plastic (Polythene covers, PET bottles, Wrappers-chocolate and chips) pens, disposable cups, metal cans, Charts, Cardboards.

Table 5: Sources and Type of waste generated from various sources

Waste category	Total waste produced in kg	% of waste produced
Paper	6.96	39.32
Plastic	5.42	30.62
Cardboard	3.5	19.77
Papercups	0.67	3.78
Styrofoam	0.24	1.35
Metal tins	0.43	2.42
Aluminium	0.16	0.90
Tetra packs	0.32	1.80
Total	17.7	100

Table 6: Amount of different waste generated by various source

Above table shows different types of waste generated in the SIES ASC College (Nerul). The highest amount of waste generated is from paper which is about 6.94 kg/day followed by plastic 5.42 kg/day. Most of the solid waste generated can be recycled thus reducing the quantity of waste for disposal in landfills.

With proper segregation of waste at the source itself will optimise the chances of reuse and recycle.

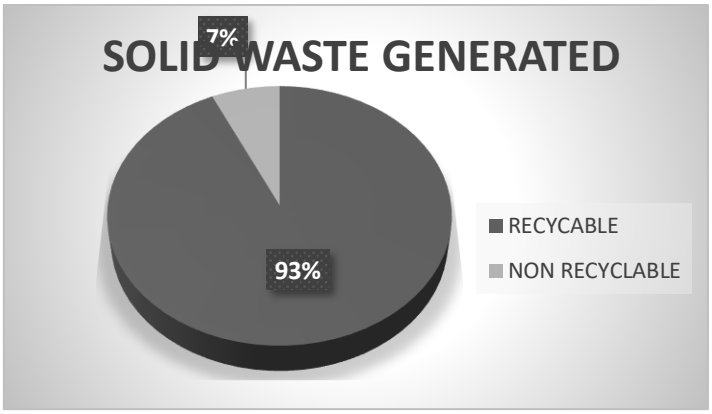


Fig. 5 Amount of recyclable and non-recyclable waste

The above fig. shows that the 93% of the total waste produced is recyclable and the rest 7% is non-recyclable. The non-recyclable waste which constitutes 7 % of the total waste mainly consisted of Styrofoam bowls and plastic coated paper cups. Recyclable waste mainly consisted of paper and recyclable plastic. In another words, only 7 % of total waste left would need to be disposed in the landfill.

Conclusion:

Energy audit is an effective tool in identifying and perusing a comprehensive energy management program. In this paper, a detailed study has been made to reduce the electrical energy consumption in the SIES ASC College (Nerul). It highlights the amount of energy savings that can be obtained in an educational Institution, thereby energy crisis can be reduced considerably. This audit was conducted to seek the opportunities to improve the energy efficiency of the campus. Beyond simply identifying the energy consumption pattern, this audit sought to identify the most energy efficient appliances.

With the help of Water Audit we can able to find the leakage and calculate the losses in the system and take the necessary measure for the future. In this paper, it highlights the water saving opportunity by either replacing the water equipment or by following certain water conservation techniques. It was seen that the

usage of water can be reduced to by simply changing the water use pattern.

Solid waste is any garbage or rubbish which includes domestic, commercial and industrial wastes. Improper handling of solid waste and indiscriminate disposal in open spaces give rise to numerous potential risks to the environment and to human health. To reduce their effect on health, the environment or aesthetics Solid waste management should be undertaken.Waste segregation at the source should be adopted to avoid a mixing or pollution of the different waste fractions, which could be an obstacle to easy recycling.

Recommendation:

- **Energy :**

1. Avoid usage of air conditioners in the evening hours & favourable climatic conditions.
2. Installation of energy saver for each AC.
3. Maximize the use of natural light and turn on lights only when there is inadequate lighting.
4. Promote CFL, LED lamps instead of incandescent bulbs.

- **Water :**

1. Installation of rain water harvesting system.
2. Replacement of high flow rate faucets.
3. Adopting some common methods and techniques to reduce water usage.
4. Identification and replacement of leaking water fixtures.

- **Solid waste**:

1. Waste segregation at the source should be adopted to avoid a mixing or pollution of the different waste fractions, which could be an obstacle to easy recycling.
2. Waste sorting / segregation at source ensure and promoting recycling and reuse of segregated materials also helps to minimize the waste (dry non recyclables) that needs to be disposed in landfills and thus reduce the environmental impact of disposal sites.
3. Biodegradable waste can be composted and reused.
4. With proper installation and management, canteen kitchen waste can be used for generation of energy.

REFERENCE:

1. http://www.greenaudit.org/about/
2. Madhuri Pandit, Prof. Subhash B. Magar, 2015,Green Audit a case study of Art's, Science & Commerce College, Manmad, e-ISSN: 2319-2402,p- ISSN: 2319-2399.Volume 9, Issue 8, PP 105-108
3. http://www.indiainfoline.com/article/news /the-green-audit-5514165195_1.html
4. http://www.spectro.in/green-audit.html
5. Ramya.L.N, M.A.Femina, April 2014, energy auditing – A walk-through survey, vol. 3, ISSN (print): 2320 – 3765, pp406-411.
6. Sreedevi s., January 2015 international research journal of environment sciences vol. 4(1),ISSN 2319–1414,pp 90-93

ACKNOWLEDGEMENT

I thank Principal Prof. Koel Roy Choudhary who permitted me to carry out the project as well as Prof. Pooja Desai. Secondly I would also like to thank Real Estate Manager Sandeep Jadhav Sir, electrician Perumal Sir and all the teaching, non-teaching staff and housekeeping staff.

Rehash of Industrial Effluent By Using Environmental Friendly Phycoremediation Method And Production of Sustainable Biofertilizer

***[a] Ashily Rajendran, [b] Gitika Singh, [c] Suprita Rao**

*Corresponding author: Ashily Rajendran ; Email id: ashilyr32@gmail.com;
Mobile no:8600079488

Abstract:

Expansion of industrial areas increased the industrial sewerage discharge which leads to the environmental health and water pollution issues. Wastewater treatment is having much importance in recent years with the intension of reusing it. Presently with upcoming technologies in developing countries for treating wastewater is not sufficient and cost effective solution. A novel advanced method of algal culture offers an effective solution for wastewater treatment coupled with the production of potentially valuable biomass and utile water which can be used for different purposes. This invention uses cheap and efficient, ecologically safe hybrid photobioreactor for the simultaneous detoxification of effluent and advantage of this result with no pollution of hazardous substances and lesser sludge production. The present study demonstrates that the algae growth merged on effluent without sterilization in presence of sunlight and the percent elimination of nitrate (99.55%), phosphate (90.83%), B.O.D (78.32%), C.O.D (80.45%) with 95.41% increasing efficiency of D.O were evaluated. Algal biomass with high nutrients is used as a biofertilizers which provides an effective and non-polluting approach in improving the productivity of crop by both nitrogen fixation and photosynthesis. This paper is briefly underlining the environment friendly way to utilize effluent and usage of algal biofertilzer which will be applicable on laboratory and large scale treatment for ecology betterment.

Keywords:

Industrial Sewerage, algae culture, photobioreactor, detoxification, biofertilizer.

1. Introduction:

Fertilizer manufacturing industries on process operations discharge sewerage containing ammonical nitrogen, nitrate, phosphate, BOD, COD and total dissolved solids. Conventional technology has been widely applied in treatment of sewerage. The process removes most of the organic contaminants, nitrogen (N) and phosphorus (P) in the wastewater. However, the secondary effluent still contains high concentration level of N and P, which leads to eutrophication, ecosystem damage and cause various health problems in humans. The negative effects of such nutrients overloading of receiver aquatic systems include undesirable pH, low dissolved oxygen concentrations and effects marine aquatic life [1] [2].

The presence of these impurities in water affects to the water resource on the earth and cause high level of water environment damage. In other hand, due to the high demand on the fresh or clean water for daily use and due to water shortage, new technologies of treating the wastewater has to be introduced and worked out for the society to provide good quality of treated water that can be used for

daily activities and to have recycle in industry process itself [3]. Compared to physical and chemical treatment processes, biopurification of effluent is of the major importance to the environment, as this technology may be in process to develop an efficient, low cost and environment friendly process which may lead for removal of excess wastes efficiently at minimal cost and the feasible cheapest technology for the treatment of sewerage is phycoremediation using photobioreactor [1] [4].

The use of macro algae or microalgae for effective removal or biotransformation of Pollutants, including nutrients and xenobiotics from wastewater and CO2 from waste air called phycoremediation [5]. Wastewater treatment in Waste Stabilization Ponds (WSPs) is "green treatment" achieved by the mutualistic growth of microalgae and heterotrophic bacteria and shallow mixed open high rate stabilized photobioreactor unit provides efficient wastewater treatment than conventional oxidation ponds [4] [5].

Algae are sustainable sources of food, feed and essential for their growth are light, CO_2 and inorganic nutrients like nitrogen and phosphorus. Algae has an important role in self- purification of organic matter due to this apply the algal system as secondary rather than tertiary treatment [4]. They generally comsumes nitrate, phosphorus, BOD, COD, total dissolved solids which are available in varying amounts (concentration) in the fertilizer industrial effluent which having growth of 20-30 times faster than food crops within a short period [3]. Algae support aerobic bacterial oxidation of organic matter producing oxygen through photosynthesis while release carbon dioxide in aerobic oxidation used for algal biomass [5]. The oxygen and pH variation induced by algal photosynthesis help to reduce coliform and other pathogenic bacteria in the effluent [4].

The algal biomass could be used as an ideal feedstock for the production of biofertilizer [1]. A continuous increasing demand of food crops and decrease in the productivity due to continuous use of chemical fertilizer has not only resulted in decline of crop yield, loss of fertility and degradation of soil, but which has also led us one step back in achieving sustainable agriculture. With the growing realization that chemical based agriculture is unsuitable and is slowly leading to ecological imbalance, the latter part of the last century witnessed the emergence of the concept of "organic agriculture" advocating minimum use of chemical fertilizers and increasing dependence on biological inputs like biofertilizers, compost, farmyard manure and green manure [6].

Biofertilizers are the natural fertilizer that contains bacterial, fangal or algal strains and enhance the productivity of soil by fixing atmospheric nitrogen or by solubilizing soil phosphate or by stimulating plant growth for synthesis of growth promoting substances by increasing the availability of primary nutrients and improve the health of the soil in eco-friendly manner [7]. Among the array of biofertilizers developed algal biomass constitutes the most important inputs for nutrients management in plants. Culturing algae using inorganic media is relatively expensive because of the need to provide full complement of nutrients [8] [9]. Low cost alternative such as nutrient rich effluent as a natural medium has been evaluated as a more cost effective method of algal biomass cultivation [6]. Algae are simple in operation and easy in adaptability for Indian farmers. India being one of the largest producer and consumer of pulses requires abundant amount of pulse production to fulfill the demands of growing populations which can also be achieved by using this cost effective fertilizers.

The benefits of treated effluent reuse derived mainly from savings in freshwater supply and

a reduction in generation of waste. Cooling systems are major water consumers in many industries and therefore using treated effluent for this purpose may bring considerable saving in freshwater consumption. Concrete industry is consuming annually 1 billion tons of mixing water in the world and large quantity of freshwater are used for curing of concrete and hence recycle of treated wastewater to make fresh concrete.

The main key point of the present research has been made to explore the possibility of cultivation of mixed culture algae from domestic sewerage source using nutrient fulfill effluent as a growth medium, from which treated effluent as a growth medium, from which treated effluent as a growth medium, from which treated effluent can be recycled and utilized in industry to overcome the water shortage problem and production of biofertilizers as a byproduct which is nature friendly.

2. Methodology:

2.1. Algal Sampling

Sample of merge algae was collected from domestic sewage treatment tank of effluent treatment plant of RCF, Thal Unit, Alibag.

Fig.1: Algal source from Domestic Sewage Treatment Tank

2.2. Nitrate Effluent Collection

The Nitrate effluent used in this study was collected after secondary treatment i.e, deammonification process from ETP plant containing nitrate, phosphate, BOD, COD, total dissolved solids and small amount of other elements such as calcium, magnesium, chloride, iron etc.

Fig.2: Deammonified Effluent collection

2.3. Physico-chemical analysis of Nitrate effluent

The analyses carried out for effluent are pH, nitrate, phosphate, BOD, COD, total suspended solids, turbidity, total hardness,

calcium hardness, magnesium hardness, M-alkalinity, Conductivity, iron, Free Ammonia and TAN respectively.

2.4. Phycoremediation Technology

Algae cultivation was initiated in bioreactor from 1000 ml of beaker containing 500 ml of effluent.

Fig.3: Photobioreactor with Nitrate Effluent

The experiment was conducted without sterilization of effluent in presence of sunlight with open air. In order to compare growth of algae in effluent and synthetic medium, an artificial medium was synthesized in the following way: 12.5 g of sodium nitrate ($NaNO_3$) and potassium dihydrogen phosphate (KH_2PO_4) in 500 ml of distilled water.

Fig.4: Photobioreactor with Synthetic Media

2.5. Determination of algal growth

Growth of algae was determined by using spectrophotometer.

*2.5.1. Optical density***:**

For the comparison of the growth of algae in synthetic medium and effluent, equal quantity of algal culture was inoculated in measured quantity of both the medium (1 liter) under same climatic condition. Optical density of samples, taken for consecutive 7 days from both media, was measured by spectrophotometer at 680 nm of wavelength. The growth rate (GR) was determined by fitting the optical density (OD_{680}) in the following formula:

$$GR = (\ln OD_t - \ln OD_0)/t$$

Where OD_0 is the optical density at the initial day, OD_t is the optical density measured on day t. Each recorded OD_t was corrected by taking away that of the corresponding blank sample [3].

2.6. Biomass Harvesting

Biomass was harvested by using filtration method with whatmann filter paper No.1.The filtrate was used for different processes. After harvesting, the biomass was dried in shadow open air. Then, the dried algae were ground to fine powder by using mortar and pestle. The algae were applied as biofertilizer for the soil treatment at the rate of 1 grams powdered

algae/kg soil, seven days before planting and twice water daily.

2.7. Nutrient analysis of algal biomass

2.7.1. Organic Carbon

The organic carbon content in the dried biomass was checked by using the complete combustion of the biomass

2.7.2. Nitrate and Phosphate

Nutrients from the algal biomass were extracted using various solvents such as 1:1 HCl, ethanol and acetone. For the extraction process, 1 gram of biomass is dissolved in 100 ml of each solvents and heat for 5 minutes on hot plate. Then the solution was filtered through whatman filter paper no.1. The nitrate and phosphate content of biomass was determined using standard methods after heating with the 1:100 dilutions for biofertilizer and combusted biofertilizer.

3. Results and Discussion:

3.1. Physicochemical characteristics of water

Different water samples were collected from effluent treatment plant for the feasibility study of various parameters as shown in **Table.1**.

Table.1: Comparison of pollution load before and after treatment in Nitrate effluent with Raw water using merged Algae.

Parameters	Raw water	Nitrate wastewater	Phycoremediated water	% change	
				%Increase	%Decrease
Physical					
Color	Transparent	Light Green	Dark Green	-	-
Odour	No odour	Muddy	Manure	-	-
pH	7.2	6	8.63	30.47	-
TSS	15	584	52	-	91.09
Chemical					
Free ammonia (ppm)	0.1	22	N.T	-	-
TAN (ppm)	0	0.074	N.T	-	-
Nitrate(ppm)	1	3122	14	-	99.55
M-Alkalinity (ppm)	18	20	120	83.33	-
Turbidity (NTU)	0.8	60	18	-	70
Conductivity (µs or ms)	93 µs	3.56 ms	4.8 ms	25.83	-
Total Hardness (ppm)	30	305	196	-	35.73
Ca-Hardness (ppm)	17	186	152	-	18.27
Mg-Hardness (ppm)	16	124	75	-	39.51

Dissolved Oxygen (ppm)	5	0.335	7.3	95.41	-
B.O.D (ppm)	4	286	62	-	78.32
C.O.D (ppm)	8	655	128	-	80.45
Phosphate (ppm)	0	15.884	1.4561	-	90.83
Iron (ppm)	0.08	1.183	0.561	-	52.57

Phycoremediation of Nitrate waste water increased pH and Dissolved Oxygen by 30.47% and 95.41% while retarded Nitrate, Phosphate, B.O.D, C.O.D and TSS respectively.

Comparision of parameters for Nitrate and Phycoremediated water was done for further experimental study as shown in **Fig.5**

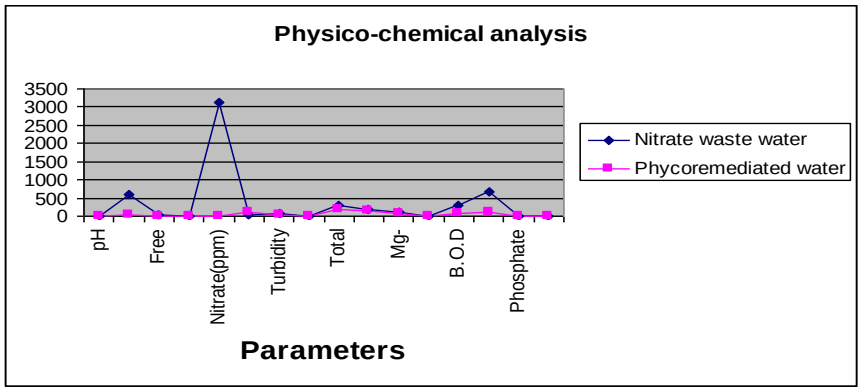


Fig.5: Comparative study of Nitrate and Phycoremediated water.

3.2. Algal Growth curve for effluent and synthetic media:

Chlorophyll content reached up to the maximum value of absorbance i.e. 0.328 nm in Nitrate effluent while 0.281 nm was recorded for synthetic media after 7 days incubation period under sunlight (**Table.2**). Growth rate and curve of Algae in terms of absorbance in both nutrient media is as shown in **Table.3** and **Fig.6**.

Table.2: Absorbance of Algae cultivated in Nitrate effluent and Synthetic media.

Days	Chlorophyll content (Absorbance)	
	Nitrate Effluent	Synthetic media
1	0.144	0.008
2	0.185	0.013
3	0.197	0.015
4	0.254	0.134
5	0.289	0.171

6	0.316	0.231
7	0.328	0.281

Table.3: Algal Growth Rate determination

Days	Growth Rate (GR)	
	Nitrate Effluent	Synthetic media
1	0	0
2	0.2505	0.4855
3	0.0628	0.1431
4	0.2541	2.1897
5	0.1290	0.2438
6	0.0893	0.3007
7	0.0372	0.1959

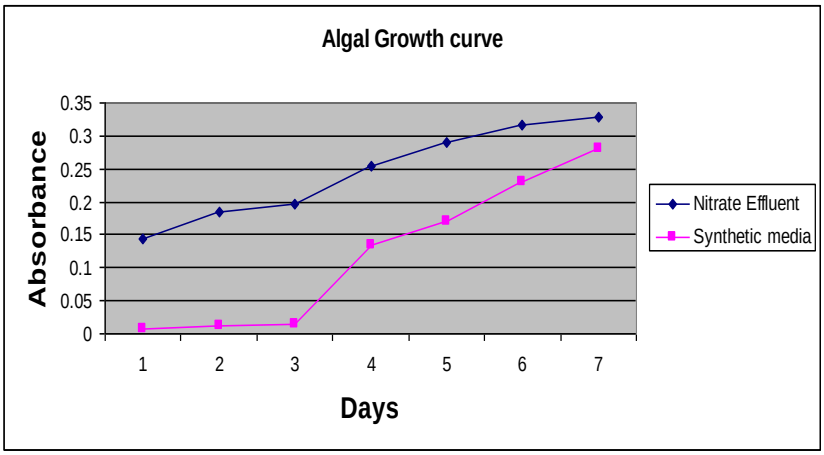


Fig.6: Growth Rate Curve of Algae in Nutrient Effluent and Synthetic media.

The growth curve revealed that Nitrate waste water acted as a stimulatory agent for algal growth, this may be due to the presence of available nitrogenous compounds, organic matter and phosphates.

3.3. Efficiency of algae for absorption of pollutants in nitrate waste water.

As the day's increases, the removal efficiency of various pollutants also increases.

3.3.1. Nitrate and Phosphate Removal.

Data in **Table.4** showed that the maximum removal efficiency of Nitrate Nitrogen and Phosphate was achieved by 99.55% and 90.83% at the end of incubation period (30 days). Significant reduction in Nitrate and Phosphate indicates that algae consumed Nitrogen in the form of Nitrate and also Phosphate as its food source.

Table.4: Percentage Removal of Nitrate and Phosphate in Wastewater after 30 days of treatment.

Days	Nitrate (ppm)		Phosphate (ppm)	
	Concentration (ppm)	% Removal	Concentration (ppm)	% Removal
1	3122	0	15.884	0
2	2455	21.36	15.6219	1.65
3	2001	35.90	14.0091	11.80
4	1631	47.75	14	11.86
5	1128	63.86	13.921	12.35
6	988	68.35	13.6215	14.24
7	933	70.11	12.1253	23.66
8	858	72.51	12.0067	24.41
9	743	76.20	11.0056	30.71
10	717	77.03	10.9821	30.86
11	662	78.79	10.2252	35.62
12	522	83.27	10.1073	36.36
13	389	87.54	9.8976	37.68
14	292	90.64	8.6966	45.24
15	231	92.60	8.1005	49.00
16	175	94.39	7.885	50.35
17	118	96.22	7.7749	51.05
18	85	97.27	7.1231	55.15
19	72	97.69	6.0023	62.21
20	61	98.04	6.0011	62.21
21	47	98.49	5.9919	62.27
22	33	98.94	5.7912	63.54
23	30	99.03	4.4523	71.96

24	28	99.10	4.0021	74.80
25	25	99.19	3.929	75.26
26	21	99.32	3.634	77.12
27	18	99.42	3.2222	79.71
28	17	99.45	2.959	81.37
29	15	99.51	2.5671	83.83
30	14	99.55	1.4561	90.83

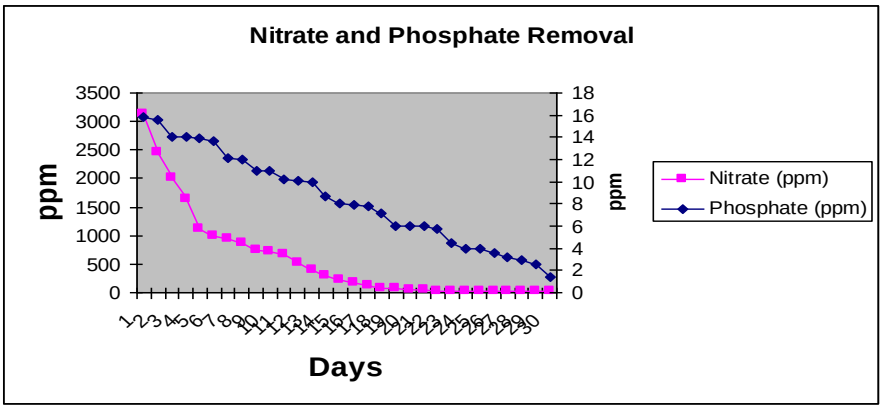


Fig.7: Nitrate and Phosphate removal efficiency.

3.3.2. Reduction of B.O.D and C.O.D with increase in D.O.

Initial D.O level was 0.335 ppm and it increased to 2.75 ppm. B.O.D and C.O.D was recorded 286 ppm and 655 ppm respectively before treatment, after treatment it was reduced by 78.32% and 80.45% respectively was found to be 62 ppm and 128 ppm (**Table.5**).

Table.5: Removal of B.O.D and C.O.D with changes in D.O

Days	B.O.D		C.O.D		D.O	
	Concentration (ppm)	% Removal	Concentration (ppm)	% Removal	Concentration (ppm)	% Increase
2	286	0	655	0	0.335	0
4	261	8.74	571	12.82	0.85	60.58
6	244	14.68	508	22.44	1.27	73.62
8	230	19.58	485	25.95	2.9	88.44

10	225	21.32	411	37.25	3.03	88.94
12	215	24.82	363	44.58	3.76	91.09
14	198	30.76	301	54.04	4.55	92.63
16	185	35.31	258	60.61	4.98	93.27
18	171	40.20	221	66.25	5.22	93.58
20	153	46.50	202	69.16	5.67	94.09
22	130	54.54	188	71.29	6.04	94.45
24	107	62.58	172	73.74	6.34	94.71
26	83	70.97	158	75.87	6.88	95.13
28	70	75.52	139	78.77	7.09	95.27
30	62	78.32	128	80.45	7.3	95.41

As per the **Fig.8**, Algae photosynthesis produces a very high oxygen concentration in the water which increases the biodegradation of organic matter and release of CO_2 is consumed by algae for their growth as a carbon source .

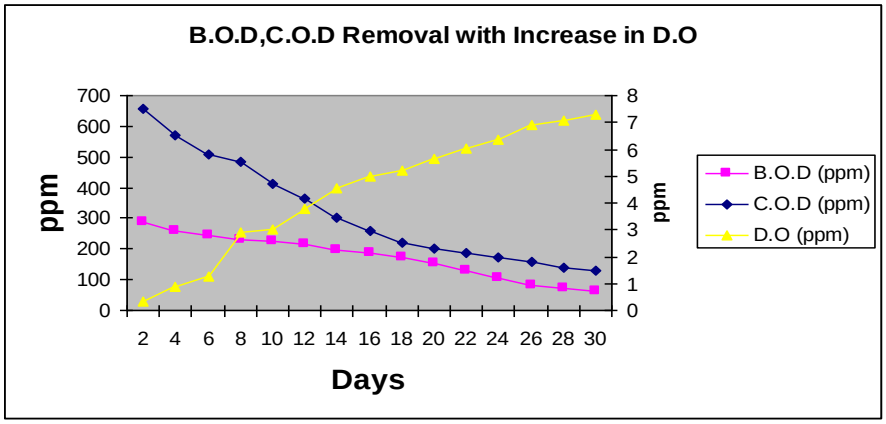


Fig.8: B.O.D, C.O.D Reduction with D.O Increment

3.3.3. Relationship between Turbidity and TSS.

Turbidity is closely related to TSS and is most often used to estimate the TSS (ppm). High concentration of suspended solids can lower water quality by absorbing light. Turbidity in water is caused by suspended matter such as clay, slit, organic matter and other microscopic organisms that interfere with the passages of light through the water.

Table.6: Comparative relation of Turbidity and TSS.

Days	Turbidity (NTU)	TSS (ppm)
1	60	584
2	51	408
3	42.1	363
4	35	240
5	27.1	153
6	22.3	91
7	18	52

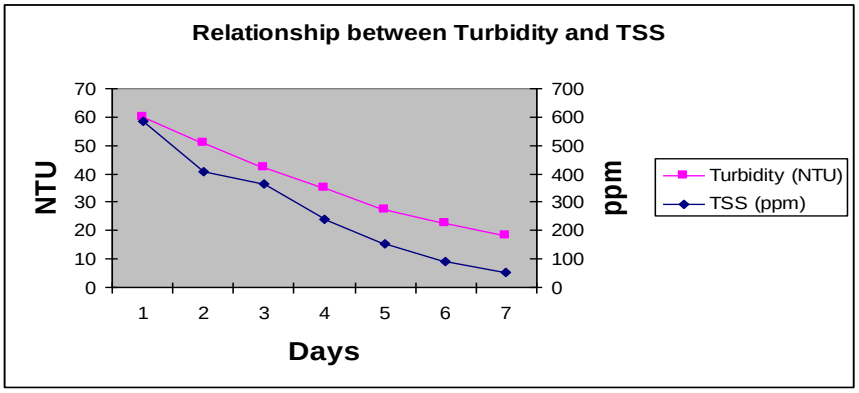


Fig.9: Relationship between Turbidity and TSS

3.3.4. Variations in pH and M-Alkalinity.

pH range for Nitrate containing water is 6.5-7.5 (Acidic) and algal biomass increases due to Nitrate consumption which leads to basic condition i.e. pH up to 8.63 and in turn M-Alkalinity increases as shown in **Fig.10**

Table.7: Change in pH during 7 days of treatment

Days	pH	M-Alkalinity
1	6.75	20
2	6.98	37
3	7.2	49
4	7.5	64
5	8.01	85
6	8.22	93
7	8.63	120

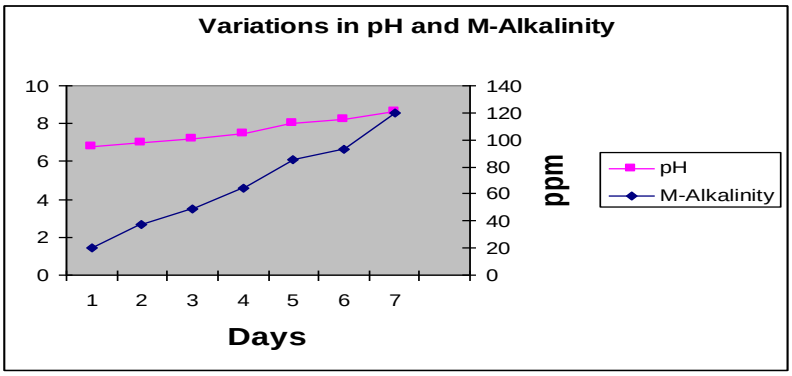


Fig.10: Variations in pH and M-Alkalinity

3.4 Biomass Processing:

Algal biomass was dried under shadow condition after harvesting and were packed into polythene bags for further nutrient analysis test.

Fig.11: Algal Biomass grown on Nitrate Wastewater

Table 8: Species Identification in the Nitrate Sample

Sr.No	Parameters	Results	Limit	Method
1	Coliform Test	< 1.8 MPN/100 ml	< 1.8 MPN/100ml	< 1.8 MPN/100ml
2	Species Identification Test	Chlorella Vulgaris algae	NA	As per the Medical Microbiological Techniques- 1 st Edition

Table 9: Species Identification in the Biomass Sample

Sr.No	Parameters	Results	Limit	Method
1	Coliform Test	130 MPN/100 ml	<1.8 MPN/100 ml	22 nd Edition APHA (9221.C) 2012
2	Species Identification Test	Pinnularia viridis Algae	NA	As per the Medical Microbiological Techniques- 1 st
		Chlorella Vulgaris algae	NA	

		Cynobacteria Oscillateria	NA	
		Cynobacteria microcystis	NA	

Wet Biomass **Dried Biomass**

Fig.12: Processing of Biomass

3.5. Nutrient Analysis:

3.5.1. Organic Carbon:

Carbon content= weight before combustion – weight after combustion

= (1-0.774) grams

=0.226-gram C-content/ 1 gram of Biofertilizer

Thus, 22.6 grams of organic carbon was found in 100 grams of Biofertlizer.

3.5.2. Nitrate and Phosphate:

Presently algae biomass is rich in nutrients, as the algae consumed nutrients such as Nitrate, Phosphate from deammonified effluent. Extraction of these nutrients was possible using different solvents for the confirmation of N and P contents required for plant growth. The high amount of N and P was extracted by using 1:1 HCl i.e. 2270000 ppm and 2989 ppm respectively.

Table.10: Nutrient Analysis Test

Biofertilizer Sample	**Nitrate content (ppm)**	**Phosphate content (ppm)**
Biofertilizer dissolved in 1:1 HCl (Set 1)	2270000	2984
Biofertilizer dissolved in 1:1 HCl (Set 2)	524000	10000

Percentage calculation:

Set 1

Nitrate = 227%, Phosphate = 0.2984 %, Organic Matter (Carbon)=22.6 %

Set 2

Nitrate = 52.4%, Phosphate = 1%, Organic Matter (Carbon) =46.6%

3.6. Effect of the physicochemical parameters on cooling tower and on concrete:

3.6.1. Impacts of effluent on cooling tower:

The pH of the water used for the cooling tower should be neutral. If it is alkaline then carbonate and bicarbonate are formed, it becomes hard water. It solubility decreases and gets deposited. In case of the acidic effluent the sulphate is formed and it causes corrosion. Temperature of the effluent should be normal. High concentration of total dissolved solids (T-hard, Mg-hard, Ca-hard, conductivity, PO_4^{2-}) increases the conductivity. Inorganic salts dissolved in water may increase the possibility of the corrosion. If nitrate content is more in water, then the acidity of water increases and pH decreases which results into the corrosion. Higher rate of BOD in water causes biological fouling that is the biofilm formation which leads to MIC (Microbiologically Influenced Corrosion). Deposition of organic matter occurs due to COD and causes fouling and corrosion. Higher PO_4^{2-} concentration in water helps the algal growth and may damage wood and tower.

3.6.2. Impacts of effluent on concrete:

BOD, COD and total suspended solids basically affects hydration process of the concrete. The effect of BOD on concrete compressive strength and tensile strength is during hydration process. It basically effects the chemical reaction of the main cement constituents such as Di-calcium Silicate (C_2S), Tri-calcium Silicate (C_3S), Tri-calcium Aluminate (C_3A), Tetra-calcium Alumino-ferrite (C_4AF). Also this leads to the formation of pores in concrete matrix which forms the weaker bond between aggregate and cement paste, thus decreasing the durability and resistance of the concrete. Aslo the COD and TSS decreases the strength of the cement.

3.6.3. Utilization of Treated water for Cooling Tower and Concrete Mixing:

Treated waste water overcomes all the above limitations of different parameters and contents which basically meet the raw water standards. (**Table 1**)

4. Conclusion:

The present study can open an opportunity to fully utilize the advanced waste water based algal biofertilizer production technology as a dual purpose of removing pollutants and producing biofertilizer at an economically viable feedstock. The estimated 22.6 grams of organic carbon may influence nutrient holding capacity, nutrient turnover and improves soil stability by binding of microorganisms and therefore, facilitates healthier plant life preventing water pollution as well as eliminating the need of synthetic fertilizers. The analyzed amount of nitrate and phosphate can be better nutrients supplements for the plant growth in proportional N: P ratio (3:2). On the other hand, this Phycoremediation technology has proved its importance in Industrial Wastewater Treatment as per the Maharashtra Pollution Control Board (MPCB) limits which can be reutilized in industry to overcome water shortage.

5. Discussion:

In upcoming future, Wastewater purification through algae will prove itself, because this treatment costs less for the removal of pollutants and toxicity purification from waste water that prevents the pollution as compared to different chemical waste water purification. The water purified by using phycoremediation

and the algal biofertilizer can viably used by farmers to solve the problems faced by the farmers nowadays. The algal purified water can be used as their raw material for manufacturing in industries such as concrete, fermentation. Combining algae for waste water remediation with biofuel production, methane, ethane forming industries, electricity generation as a renewable energy source that can also be one of the additional benefits of the wastewater treatment and feed for animal and fish which may be economically feasible processes. The waste water treatment plants are an invaluable source of algae as a feedstock which may be in use for various purposes.

The phycoremediated water can also be utilized in various purposes and the cultivated algal biomass can be supplied as a suplementary of Biofertilizer for the crops as this will be cost effective. Being cheap and cost effectiveness biofertiizer can easily be adopted by farmers as well as common people because it requires inexpensive technique for production process and therefore may be preferable. Considering all this ability of algae to purify polluted water, It is worthwhile to emphasize that algal technology in waste water treatment system are expected to be even more common to use in near future.

References:

1. S. Mobin and F. Alam (**2014**), Biofuel Production from Algae Utilizing Wastewater 19th **Australasian Fluid Mechanics Conference Melbourne**, Australia 8-11 December 2014

2. Rawiwan Boonchai, Gyu Tae Seo, Da Rang Park, and Chung Yeol Seong (**2012**), Microalgae Photobioreactor for Nitrogen and Phosphorus Removal from Wastewater of Sewage Treatment Plant, International **Journal of Bioscience, Biochemistry and Bioinformatics**, Vol. 2, No. 6, November 2012.

3. Shinoona Mohamed Al-Aisari, Integrated Treatment of Industrial and Domestic Wastewater Using Chlorella Microalgae, Proc. of Int. **Conf. on Emerging Trends in Engineering and Technology.**

4. Ghanshyam Paswan and Kumar Nikhil (**April 2014**),Biopurification of Waste Water Through Algae – A Review , **International Journal of Engineering and Technical Research (IJETR)** ISSN: 2321-0869, Volume-2, Issue-4.

5. Hammouda, O, Abdel-Raouf, N, Shaaban, M, and Kamal **(2015**), Treatment of Mixed Domestic-industrial Wastewater Using Microalgae Chlorella sp, M. **Journal of American Science** ;11(12)

6. Vijaya Tartte and Chandra Mouli Kalla (**2010**), Standardization of an Eco-friendly and Low Cost Technique for Production of Biofertilizers from Wastewater for the Sustainable Environment, Special issue, Vol. 1; Paper presented **in International Conference on Environment,** Energy and Development (from Stockholm to Copenhagen and beyond).

7. Vyomendra Chaturvedi, Kumar Nikhil, Vyomendra Chaturvedi (**2016**), Effect of Algal Bio-fertilizer on the Vigna radiata: A Critical Review, **Int. Journal of Engineering Research and Applications**, ISSN: 2248-9622, Vol. 6, Issue 2, (Part - 1) February 2016, pp.85-94.

8. Safinaz, A. F. and Ragaa, A. H (**2013**), The Effect of some red marine algae as biofertilizers on growth of maize (Zea mayz L.) Plant, **International Food Research** Journal 20(4): 1629-1632 (2013).

9. S. Sujanya and S. Chandra (**2011**), Effect of part replacement of chemical fertilizers with organic and bio-organic agents in ground nut ,Arachis hypogea, **Journal of Algal Biomass utilization**, ISSN :2229-6905

De-Ammonification of the Industrial Effluent Using Dregs Microflora

***[a] Ashily Rajendran, [b] Gitika Singh, [c] Suprita Rao**

*[a] (M.Tech) D.Y Patil University; [b](M.Sc) Amravati University; [c](M.Sc) Mumbai University
*Corresponding author: Ashily Rajendran ; Email id: ashilyr32@gmail.com;
Mobile no:8600079488

Abstract:

Effluents released from industries are the day-to-day firm for environment especially marine aquatic life. The removal of ammonical nitrogen from effluent has become an important role of the treatment process due to its significant impacts on the environment, human health and the stringent legislation on waste water discharges. Because of the wide range of technologies and their drawbacks, the novel and cost effective biological treatment processes takes the advantages of the ability of micro-organisms to use diverse waste water constituents to provide the energy for microbial metabolism and building blocks for cell synthesis. The study emphasize is focused to removal of ammonical nitrogen using dregs nitrifying microflora and improve the waste water quality. There are numerous natural sources that contain nitrifying bacteria that will facilitate the conversion of toxic ammonia to non-toxic nitrate. The experimental system used is based on aerobic ammonia oxidation and system treated real industrial waste water for 6 hours cycle for 15 days within every sequential batch process. The high strength ammonia was brought upto the limit within 18 hours of bacterial activity. During this period, it showed the capacity for oxidizing all ammonium at a rate of 99.97% with the Nitrification efficiency of 95.22%. This paper will benefit researchers and industrialists in planning and designing an appropriate enrichment of nitrifying microflora and widen its application in biological ammonia removal system for nitrogenous effluent.

Keywords: *ammonical nitrogen, dregs nitrifying microflora, aerobic ammonia oxidation, nitrogenous effluent.*

1. Introduction:

Effluents generated by industrial process activities are a major concern in most countries. Industrial effluents often contain nitrogenous compounds (ammonia, nitrite, nitrate) and phosphorous, which cause environmental deterioration at high concentration [1]. The excess amount of ammonia in a fertilizer manufacturing effluent is a potential hazard to the environment. The discharge of untreated waste water with a high ammonia concentration in the receiving water can harm aquatic life because the presence of the substance may lead to serious problems including oxygen depletion, eutrophication and red tidal phenomena. Many waste water treatment plants are subject to discharge permits, which limit the amount of ammonia that can be lawfully discharged. Government permits and regulations influence levels of ammonia and nitrite that may be discharged into streams [2] [3]. The discharge of ammonia or nitrite into a stream, lake or river may cause oxygen to be consumed thereby lowering the dissolved oxygen concentration and endangering the aquatic ecosystem [1].

Ammonia (NH_3) is the product of fish respiration and decomposition of excess pf organic matter.

Chemoautotrophic bacteria (Nitrosomonas and Nitrobacter) tend to oxidize ammonium ions (NH_4^+) to nitrite (NO_2^-) and nitrate (NO_3^-) ions [4] [5]. Nevertheless, these ions are removed by aquatic plants, algae and bacteria, since they assimilate them as a source of nitrogen. These nitrogen compounds are nutrients for generating eutrophication which disrupt aquatic ecosystem in a severe manner as shown in **Fig.1.** [1]

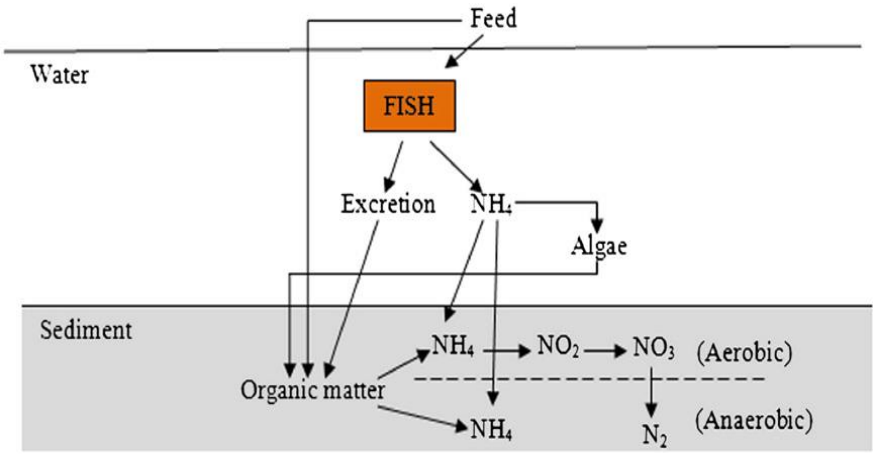


Fig.1: Nitrogen transformation in fishpond [1]

Several studies have been conducted on the toxicity of nitrate on aquatic animals and results indicate that nitrate reacts with haemoglobin causing shortage of oxygen in their body (methaemoglobin) and finally death. When nitrate enters human intestines, it is also converted into nitrite under anaerobic conditions and these may lead to methaemoglobinaemia in infants. Besides that, formation of nitrosamines from nitrite can give rise to cancers of the digestive tract, since nitrosamines are the most efficacious carcinogens in mammals. Therefore, World Health Organization (WHO) established the limit for nitrate in drinking water to 10 mg NO_3-N/L. So, treating waste water by removing ammonia is considered to be an environmentally crucial step before the water can be safely discharged [2] [3].

There are few methods for the ammonical nitrogen removal which are chemical, physical and biological treatment like adsorption, chemical precipitation, membrane filtration, reverse osmosis, ion-exchange, air stripping, breakpoint chlorination and biological nitrification and de-nitrification [6]. However, chemical and physical methods of treatment produced secondary pollutants which are form through chemical and photochemical reactions and toxic to humans. Waste water is added to sequencing batch bioreactor to remove undesirable components, prior to discharge. This reactor works by loads repeating sequences such as filling, aeration, recycling and emptying in a set time period. Each treatment length and both sequences depend on the type of water to be treated and the organic matter or nutrient wanted to be removed.

Nitrification is the biological oxidation of ammonia with oxygen into nitrite followed by the oxidation of these nitrites into nitrates. Nitrification is an important step in the nitrogen cycle. The oxidation of ammonia into

nitrite, and the subsequent oxidation to nitrate is performed by two different bacteria. The first step is done by bacteria of (amongst others) the genus Nitrosomonas. The second step (oxidation of nitrite into nitrate) is (mainly) done by bacteria of the genus Nitrobacter. All organisms are autotroph, which means that they take carbon dioxide as their carbon source for growth. Nitrification also plays an important role in the removal of nitrogen from industrial wastewater. In most environments both organisms are found together, yielding nitrate as the final product. Nitrification is a process of nitrogen compound reduction:

$NH_3 + O_2 \xrightarrow{\text{Nitrosomonas}} NO_2^- + 3H^+ + 2e^-$

$NO_2^- + H_2O \xrightarrow{\text{Nitrobacter}} NO_3^- + 2H^+ + 2e^-$

Nitrifying bacteria are classified as obligate chemolithotrophs. This simply means that they must use inorganic salts as an energy source and generally cannot utilize organic materials. They must oxidize ammonia and nitrites for their energy needs and fix inorganic carbon dioxide (CO_2) to fulfill their carbon requirements. They are largely non-motile and must colonize a surface (gravel, sand, synthetic bio-media, etc.) for optimum growth. They secrete a sticky slime matrix which they use to attach themselves. Species of Nitrosomonas and Nitrobacter are gram negative, mostly rod shaped, microbes ranging between 0.6-4.0 microns in length. They are obligate aerobes and cannot multiply or convert ammonia or nitrites in the absence of oxygen. The temperature for optimum growth of nitrifying bacteria is between 25-30°C while the pH is between 6.5 and 8.5. Maximum nitrification rates will exist if dissolved oxygen levels exceed 80% Saturation. Nitrification will not occur if dissolved oxygen concentrations drop to 2.0 mg/l (ppm) or less [2].

Thus, many studies have focused on developing techniques for culturing the bacteria with the shorter startup period to establish a successful nitrification culture. The duration of the startup period of the aerobic ammonia oxidation process is influenced by the proper selection of sludge, reactor type and optimal operational conditions [7].

The present study aimed for removal of ammonical nitrogen of fertilizer manufacturing discharge effluent containing high concentration of ammonical nitrogen by nitrification process and improves the quality of water discharge to the sea for betterment of aquatic life.

2. Methodology:

2.1. Source of Microflora

Natural Mangrove sediment (Mangrove roots) containing nitrifying bacteria that facilitate the conversion of toxic ammonia to non-toxic nitrate was collected from green belt plantations within the premises of natural marshy wetlands.

Fig.2: Microflora collection from green belt

2.2. Feasibility study of Industrial and Synthetic waste water

The high-strength ammonium waste water (N-wastewater) was prepared which meets similar characterstics to that of Efluent Treatment Plant (ETP) of R.C.F Ltd, Thal. In order to investigate this effect of ammonium, 1000 mg/L of synthetic waste water was prepared using NH_4Cl which is same with fertilizer manufacturing industrial wastewater in terms of high concentration of ammonical nitrogen.

2.3. Analysis of synthetic effluent

Various physicochemical parameters were evaluated daily after every 24 hours such as pH, Free ammonia, Total Ammonical Nitrogen(TAN), Total Kejadal Nitrogen (TKN), Nitrate, Total Suspended Solids, M-Alkalinity, Turbidity, Conductivity, Total Hardness, Ca-Hardness, Mg-Hardness, Iron, Phosphate, etc.

2.4. Experimental setup and its operational strategy

The Sequencing Batch Reactor (SBR) was filled with high concentrated ammonium waste water, inoculated with culture of nitrifying organisms and was operated batchwise with aeration and mixing. The reactor operation was carried out within 30 days for 24 hours' aerobic process. The process of nitrification was carried out by the microorganisms in the SBR and resulted in oxidation of ammonical nitrogen and generation of nitrate. Some volume of this nitrate containing water was fed to further phycoremediation process while rest was recycled.

Top View

Front View

Fig.4: **Sequencing Batch Reactor (SBR)**

2.5. Determination of Nitrifying bacteria

Samples were taken during aeration to determine the population density (O.D) of nitrifying bacteria present in the reactor. Growth curve for nitrifying bacteria was detected by using nitrate analyzer. Also, morphological characterization of bacteria was done using gram staining technique. Finally, Bactaslyde analyses involved the determination of Total Bacterial Count (TBC) using Microbe Detection device.

2.6. Hydroponic Analysis

Epipremnum aureum (Money plant) were hydroponically grown on 3 different samples of industrial waste water in a round bottom flask. The ammonia waste water was labeled W1, nitrate water as W2 and diluted nitrate water was labeled as W3. Thus, the

wastewater with hydroponic system were labeled and samples were taken before and after for analysis.

3. Results and Discussion

3.1. Factors affecting optimum growth of Microflora.

Various parameters required for successful nitrification process was checked for leguminous sediment containing roots.

Table.1: pH, Temperature, Dissolved Oxygen compared with Optimum Range.

Parameters	Values	Optimum Range
pH	7.5	6.5-8.5
Temperature	28ºC	25-30ºC
Dissolved Oxygen	4 ppm	Not less than 2 ppm

*3.2. Comparision of Synthetic wastewater with prepared N-Industrial waste water***.**

The feasibility study of synthetic wastewater along with N-wastewater produced the following applicable parameters.

Table.2: Comparative Study of Synthetic and prepared N-Industrial waste water.

Parameters	Synthetic waste water	Prepared N-Industrial waste water
Free ammonia	1000	1440
pH	8.7	9.31
Nitrate	35	21.7
Phosphate	0.041	0.069

Fig.5: Comparison of Prepared N-Industrial waste water and Synthetic Waste water.

3.3. Physico-chemical analysis before and after 24 hours of treatment.

Table.3 shows some of the physico-chemical characteristics of raw prepared N-Industrial waste water and treated wastewater under experimental study, at Effluent Treatment Plant of R.C.F. Thal Unit.

Table.3: Physico-chemical analysis of Raw Prepared N-Industrial waste water and treated wastewater.

Parameters (units)	Raw Prepared N-Industrial waste water	Treated waste water	% change	
			% Increase	% Decrease
pH	9.3	6	-	35.48
Free ammonia (ppm)	1440	22	-	98.47
TAN (ppm)	303	0.074	-	99.97
Nitrate (ppm)	149	3122	95.22	-
M-Alkalinity (ppm)	1100	20	-	98.18
Turbidity (NTU)	68	60	-	11.76
Conductivity(µs or ms)	2.85 ms	3.56 ms	19.94	-
Total Hardness (ppm)	100	305	67.21	-
Ca-hardness (ppm)	60	186	67.74	-
Mg-hardness(ppm)	40	124	67.74	-
Iron (ppm)	0.052	1.183	95.60	-
Phosphate (ppm)	2.8	15.884	82.37	-

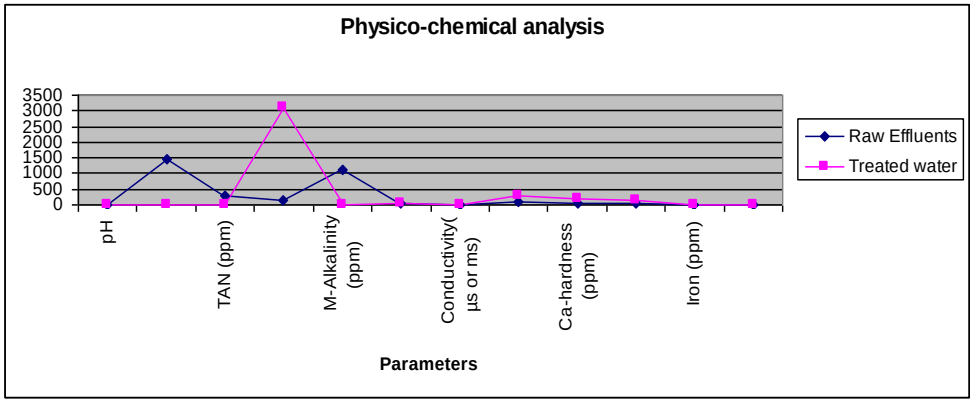


Fig.6: Comparison of various physico-chemical parameters.

3.4. Ammonia removal, pH reduction and Nitrifying bacteria growth curve in SBR for 48 hours.

Ammonia removal and growth of nitrifying bacteria have been determined using SBR. The influent ammonia concentration in prepared industrial and synthetic waste water was initially 1440 ppm and 1000 ppm respectively. The high strength ammonia was brought within the limit within 18 hours of bacterial activity (the prescribed MPCB limit for ammonia is 100 ppm). In 48 hours, the concentration of ammonia was reduced to a range between 22-28 ppm with decreasing pH upto 6. The graph obtained is shown in **Fig.7, 8**

Table.4: High efficiency of Ammonia Removal with Nitrifying bacteria for Prepared Industrial Effluent

Time (Hrs)	Prepared Industrial Effluent			Nitrate (ppm)	% Nitrification efficiency
	Total ammonia (ppm)	% Removal of Ammonia	pH		
0	1440	0	9.31	149	10.34
6	802	44.30	8.5	268	33.41
12	361	74.93	8	385	106.64
18	87	93.95	7.2	504	579.31
24	70	95.13	7	725	1035.71
30	52	96.38	6.8	1641	3155.76
36	40	97.22	6.5	1983	4957.5
42	35	97.56	6.2	2027	5791.42
48	22	98.47	6	3122	14190.90

Table.5: High efficiency of Ammonia Removal with Nitrifying bacteria for Synthetic waste water

Time (Hrs)	Synthetic wastewater (Ammonium Chloride)			Nitrate (ppm)	% Nitrification efficiency
	Total ammonia (ppm)	% Removal of Ammonia	pH		
0	1000	0	8.7	98	9.8
6	720	28	8.5	189	26.25
12	511	48.9	8.2	246	48.14
18	381	61.9	7.5	383	100.52
24	175	82.5	7.2	501	286.28

30	98	90.2	7	673	686.73
36	66	93.4	6.8	891	1350
42	43	95.7	6.5	1052	2446.51
48	28	97.2	6.2	1788	6385.71

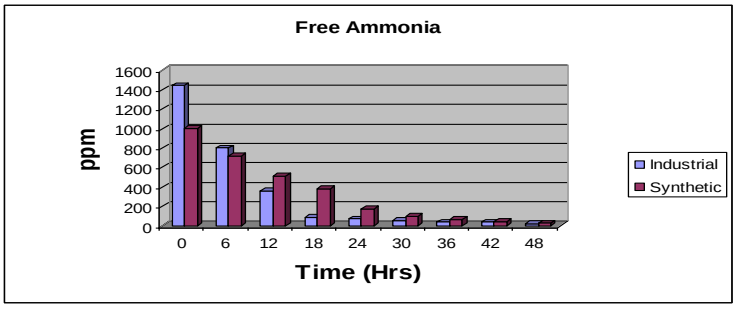


Fig.7: Ammonia removal efficiency in Industrial and Synthetic waste water.

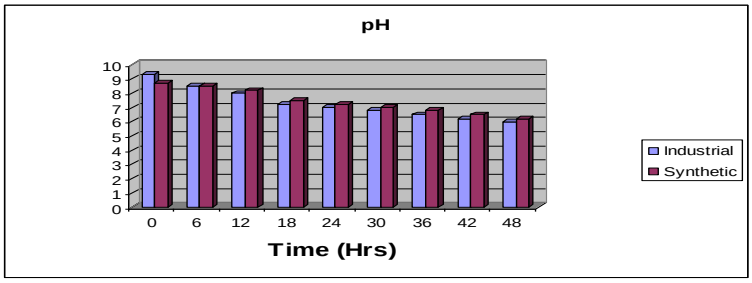


Fig.8: pH reduction in Industrial and Synthetic waste water.

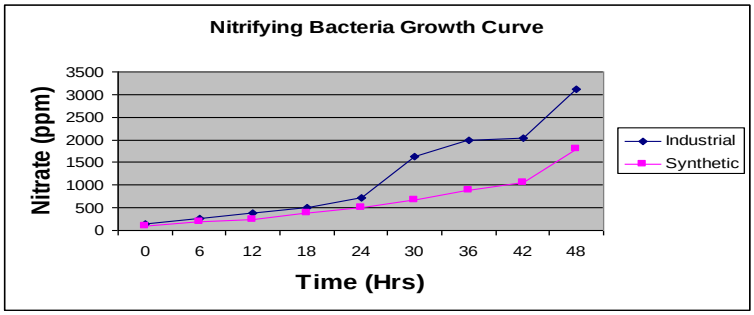
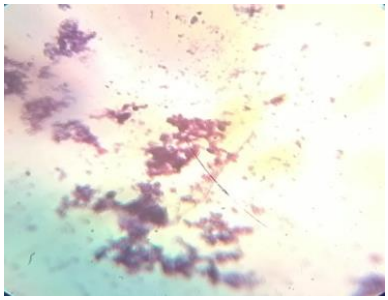


Fig.9: Nitrifying Bacteria Growth Curve.

The % Nitrification efficiency was found to be 95.22% which shows that average nitrification rate is very high (**Fig.9**).

3.5. Total Bacterial Count and Morphological characterization of Microflora



Total Bacterial Count (TBC) **Gram Staining**

Fig.10: Morphological Characterization

Fig.10 Confirms Nitrifying Bacteria as Gram negative with Gram Staining test and Brown Colonies on Total Bacterial Count.

Table 6: Morphological characterization of Microflora

Sr. No	Parameters	Results
a	**Colony Characteristics**	
1	Shape	Rhizoid,Irregular
2	Size	0.5-0.8*1.0-2.0 mm
3	Colony Color	White and Cream Color
4	Colony Texture	Smooth , Milky
5	Margin	Filamentous, Curled Lobete
6	Elevation	Flat
7	Opacity	Tranlucent
8	Gram Nature	Gram Negative, Pleomorphic, Rod Shape
b	**Biochemical Test**	
1	Oxidase Test	Positive Test
2	Catalase Test	Positive Test
3	Motility Test	Motile
4	Sporulation Test	No Sporulation
5	Capsulation Test	No Capsultion
6	Flagella Test	Polar to Lateral
7	Nitrate Reductase	Positive Test

The above Observation Concludes that the Species Present in sediment is Nitrobacter Vulgaris

3.6. NH_4-N concentration / Cell density profile for 15 days of March.

The removal of NH_4-N was found due to the growth of nitrifying bacteria and thus

nitrification step was carried out quickly and efficiently without inhibition and accumulation in any stage (**NH_4** to NO_2^- and NO_2^- to NO_3^-).

The density of bacteria as shown in **Fig.10** has a direct proportional relationship to the remaining of NH_4-N. The NH_4-N removal rate was found to be 99.97 %. This showed that when the density of bacteria increased; the remaining NH_4-N drastically decreased from 303 ppm to 99.67 ppm and then eventually lowered to 0.074 ppm, which means the reduction of Ammonical Nitrogen increased. This is because a large population of nitrifying bacteria transforms NH_4-N to NO_2-N faster. The results of ammonical removal and density of bacteria down to the balance between these two parameters are adequate to promote the growth of nitrifying bacteria, thus achieving efficient removal of ammoniacal nitrogen

.**Table.7: Relation of Percent Ammonical Nitrogen with Cell density.**

Days	NH_4-N concentration	% Removal of NH_4-N	Cell density (O.D)
1	303	0	2.8
2	99.67	67.10	9.881
3	74.1	75.54	22.221
4	51	83.16	28.5413
5	40.3	86.69	32.5264
6	32	89.43	35.9112
7	18	94.05	36.005
8	13.8	95.44	38.1712
9	9.09	97	39.952
10	5.89	98.05	40.313
11	2.75	99.09	40.989
12	0.873	99.71	42.4143
13	0.397	99.86	43.119
14	0.105	99.96	45.5264
15	0.074	99.97	48.826

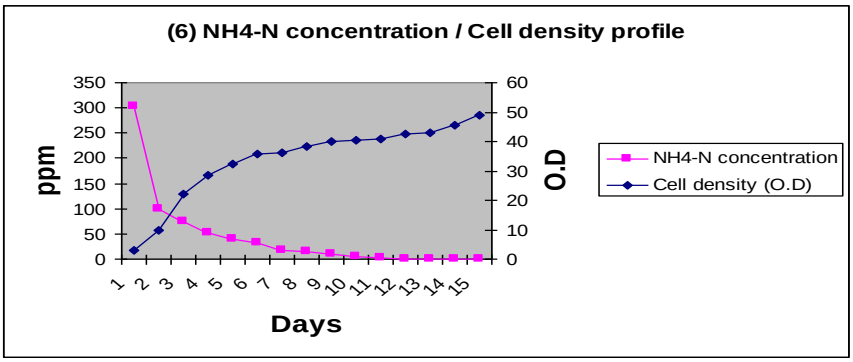


Fig.10: Ammonical Nitrogen Concentration/ Cell density Profile

3.7. Impact of untreated and treated prepared N-Industrial waste water on plant.

Day 1

Day 3

Day 6

Day 8

Fig.25: Hydroponic Analysis

Epipremnum aureum (Money Plant) survived in Nitrate wastewater (W2) till Eighth day of experiment as compared to ammonia wastewater (W1) and Diluted Nitrate water (W3).

4. Conclusion:

The biological treatment for the fertilizer manufacturing industrial waste water is one of the Best methods to treat the industrial effluent. This method concerns with biological oxidation using Nitrifying Bacteria which is responsible for reduction of ammonia in nitrification step. The effluent Treatment by Physic-Chemical methods is energy and cost intensive, often resulting in secondary pollutants. Thus, SBR proved to be the Best Alternative for removal of ammonical Nitrogen from Waste water. Complete nitrification can be achieved in the SBR within a period of 18 hours provided with alkaline condition and the effluent will be free of ammonia but rich in nitrate. This natural

system reduced ammonia by 99.97% with percent nitrification efficiency of 95.22% respectively.

5. Discussion:

Effluents coming from various plants contain high concentrated ammonia which is needed to be treated before it is discharged to the sea, because the high strength Ammonia not only affects marine aquatic life but also the entire ecosystem. For this reason, De-ammonification using Biological method such as nitrification process where biological oxidation of Ammonia takes place along with oxygen into nitrite and then by oxidation process into nitrates. Biotechnological method is a process to have gain very much importance to mitigate in environmental pollution faced by various industries having the process for the Ammonia removal which is carried out in industries such as Dilution with raw water and with Homegenization process by Aeration with the use of floating surface aerators which helps in two way process D.O level malignance and proper mixing of different types of Effluents of high concentration to the level of limited lower concentration. Nowadays many Industries requires lots of Raw water for production and dilution purposes, thus are facing through consequent water shortage problems. These problems can be overcome by using this eco-friendly biological treatment method.

Deammonified water containing large concentration of nitrates can be used in Hydroponics cultivation without soil and can be applicable for cultivation purpose in cities where Agricultural land is not ample. In draught areas, this type of treated water available can be used for Agriculture.

Biological Treatment of ammonical waste water is not only cost effective but also environmental friendly particularly for aquatic life. This Reaserch work will benefit industrialists and farmers in effective treatment of waste water and to utilize it in order to overcome water shortage problem.

References:

1. W.T. Mook ,M.H. Chakrabarti , M.K. Aroua , G.M.A. Khan, B.S. Ali , M.S. Islam , M.A. Abu Hassan (**2012**)Removal of total ammonia nitrogen (TAN), nitrate and total organic carbon (TOC) from aquaculture wastewater using electrochemical technology, Desalination 285 (2012), 1–13.

2. Alaa Eldean Kabbarry Ramadan, (**2007**) Removal of Ammonia and Phenol from Industrial Wastewater, Eleventh **International Water Technology Conference,** IWTC11 2007 Sharm El-Sheikh, Egypt.

3. Matias B. Vanotti and Patrick G. Hunt ,Ammonia Removal from Swine Wastewater using Immobilized Nitrifiers, **Water and Plant Research Center**,2611 W Lucas.St, Florence SC. 29501,USA.

4. S.R.M. Kutty, M.H. Isa and L.C. Leong , Malaysia (**2011**), Removal of Ammonia-Nitrogen (NH_3-N) and Nitrate (NO_3-N) by Modified Conventional Activated-Sludge System to Meet New D.O.E Regulations**, International Conference on Environment and Industrial Innovation** IPCBEE vol.12.

5. Florante A. Magnaye, Pag-asa D. Gaspillo, Joseph L. Auresenia (**2009**) Biological Nitrogen and COD Removal of Nutrient-Rich Wastewater Using Aerobic and Anaerobic Reactors , **J. Water Resource and Protection,** 2009, 1, 376-380.

6. Nur Farehah Z. A, Norli I, Siti Norfariha M. N., Siti Aisyah I, and Renuka R **(2014)** ,Ammoniacal Nitrogen Removal in Semiconductor Wastewater by Sequence Batch Reactor Using Bacteria Inoculum from WormTea ,**Journal of Medical and Bioengineering** Vol. 3, No. 4, December 2014.

7. Sudarsan.J.S, Renganathan.K, Ann Christy (**2011**), Cost effective method for ammoniacal Nitrogen removal using SBR coupled photobioreactor, **International journal of environmental sciences ,**Volume 2, No 1, 2011

To study the Kumbhargaon Ecotourism as a key to protect bird biodiversity near pune, Maharashtra

Mrs. Meghana A. Joshi

*Assistant professor, Department of Environmental Studies, Model College, Dombivli

Abstract

Tourism is a vital source of economic generation for many areas and countries. Nature and biodiversity also contribute in development of tourism in India. From last couple of years increasing urbanization and human activities are taking toll of nature. In this scenario a need arises to conserve this asset of biodiversity. Various efforts are made for conservation through protected area network. Maharashtra has up to 15,732 sq km reserve forest which is about 5.02 per cent of the State"s geographical area. Maharashtra is rich with varied biodiversity ranging from forests, wetland, and grassland to coast and evergreen forest. Natural site, Kaas in Western Ghats has been included in the World Heritage Site list by UNESCO.

Ecotourism is the key to conserve the endangered species because it is referred to as sustainable nature based tourism. It provides awareness within the tourist about biodiversity, its importance and impact of their activities on biodiversity. Ecotourism also help in providing economic benefits to the local communities living in close association with the environment.

This paper is based on the field visit to the nature based site of kumbhargaon bird sanctuary. This paper focuses on the biodiversity, conservation efforts, local participation, government initiative and revenue generation as the key areas of ecotourism. The study was based on visit to the area in 2015 and 2016. During the visit the interview was taken of local villagers and activist to understand the status and changes in the biodiversity of the area.

Introduction

Maharashtra, the third largest state is one of the most industrialized and urbanized states of India. It is located on the west coastline. The Maharashtra state is blessed with the diversity in natural beauty. Sahyadri hilly region, several water reservoirs, unique kokan coastal zone, evergreen forest of western ghat, vast forest patches from vidarbha and it hosts many national parks and wildlife sanctuaries. Unique diversity of Maharashtra also reflects through Kaleidoscope of races, languages, customs and traditions.

The state has recognized tourism as a major thrust area for economic growth. Maharashtra ranks 5th in domestic tourist arrivals in year 2011 with 6.50 % total tourist visits. It ranks second in foreign tourist visits with a share of 24.70% (4815421) tourists in year 2011. As per the tourism survey report of Maharashtra state published by MTDC the total number of tourist arrival in 2014-15 is around 16,58,51,249 (pg. No. 18 report on Tourism Survey for the State of Maharashtra April 2014 to March 2015) and hence there is remarkable increase in budgetary allocation for promotion of tourism in the state.

Eco-tourism focuses visiting natural areas featuring fragile, pristine and relatively undisturbed environment. It involves travel to the destination where flora, fauna and cultural heritage are prime attractions. It is aimed to offer insight into the impact of human beings on the environment and also to foster a greater appreciation of natural habitat along with

educating travellers to provide funds for ecological conservation.

The World Conservation Union (IUCN) defines ecotourism as " environmentally responsible travel and visitation to relatively undisturbed natural areas, in order to appreciate nature(any accompanying cultural features – both past and present) that promotes conservation , has low negative impact; and provides for beneficially active socio-economic involvement of local population" (IUCN,1996).

World Tourism Organization (UNWTO), an apex body for development of tourism in the world, defines ecotourism as a tourism that involves travelling to relatively undisturbed natural areas with the specified objective of studying, admiring and enjoying the scenery and its wild plants and animals, as well as existing cultural aspects (both the past and the present) found in these areas. As per UNWTO, Ecotourism is considered as the fastest growing market. Overall tourism has been growing at an annual rate of 4%; nature travel is increasing at an annual rate between 10% and 30%. According to World Travel and Tourism Council approximately 7% of international tourism sales are spends on nature tourism. (Richards & Hall 2000, Holden 2000).

Aims and Objectives

- To find out the importance of ecotourism in biodiversity conservation.
- To study the impact of human activities on the biodiversity
- To highlight how the physiographic base can be an attraction for tourists
- To evaluate the status of existing facilities and needs including community participation and future requirements
- To identify the various aspects of ecotourism in study area

Material and Methods

To understand the problem at hand a good perception of the local conditions is required. Much of the data required for this research is obtained from both primary and secondary sources. Data was collected from field visit and referring journals, articles, research and government reports and websites. The paper focuses on the Kumbhargaon birding place as the case study example ideal to explain the ecotourism practices can be applied in Maharashtra.

The study carried out by visiting the place in January 2016 and 2017.

Identification of the bird species were done by referring field guides "Birds of the Indian Subcontinent" by Richard Grimmett and "The book of Indian Birds" by Salim Ali. For identification the binocular (Olympus andcelestron) and the digital camera (Canon SX 130) was used.

Study Area

With the aim to protect and conserve the rich diversity of the region Wild Life Sanctuaries, National Parks and Project tiger reserves have been created in Maharashtra. There are 6 National Parks, 35 Wild Life Sanctuaries and 4 tiger reserves. Following table offers insight into special features of biodiversity which give rise to unique tourist attractions. Bhigwan is one such attraction developing now a day for bird lovers. This unique site harbors several residential and migratory birds.

Bhigwan (Kumbhargaon), also known as mini Bharatpur, is known as a birdwatcher's paradise, especially flamingos. Bhigwan is a small town on the border of Pune and Solapur on the backwaters of Ujani dam. It is located on the Pune-Solapur Highway around 105 km from Pune It is a favorite spot for migratory birds, with more than 230 species.

Fig. 1: Map of Kumbhargaon

Observations

Biodiversity perspective:

A table showing list of bird species recorded from the study area

Sr no.	Common name	Category	Status
1	Greater flamingo	M	C
2	Little cormorant	R	C
3	Painted stork	M	UC
4	Purple swamphen	R	C
5	Little grebe	M	Uc
6	Spotbill duck	R	C
7	Ruddy shelduck	M	C
8	Bar headed goose	M	UC
9	Garganey	M	UC
10	Northern shoveler	M	C
11	Grey heron	M	UC
12	Wooly necked stork	M	C
13	Asian openbill	M	UC
14	Common kingfisher	R	C
15	pied kingfisher	R	UC

16	Eurasian coot	M	UC
17	Brown headed gull	R	C
18	Cattle egret	R	C
19	Purple heron	R	UC
20	Indian pond heron	R	C
21	Little egret	R	C
22	Northern pintail	M	UC
23	Knob billed duck	M	UC
24	Black winged stilt	R	C
25	Glossy ibis	R	C
26	black ibis	R	C
27	Osprey	M	UC
28	Brahmany kite	R	C
29	White wagtail	WM	C
30	Citrine wagtail	WM	UC
31	Yellow wagtail	WM	C
32	Green bee eater	R	C
33	Marsh harrier	M	UC
34	Sand piper	M	C
35	Wood sandpiper	M	C
36	Marsh sandpiper	M	UC

Conservation perspective:

To conserve the bird diversity at Kumbhargaon near Bhigwan several efforts are made by local organizations, NGO's and local residents. After communicating with the local villagers i came across the efforts of "Nisargsamajik Sanghatan" and "Spandan" NGO. These organizations are working hard towards protecting this unique habitat suitable for migratory birds travelling several miles from Siberia and other parts of the world. These organizations are working from 17 years for conserving the painted stork especially. With the sincere efforts of "Spandan" in last 17 years more than 20000 birds have survived in this area.

Government of Maharashtra has declared this area as Kumbhargaon bird sanctuary.

Local Participation and local benefits:

"Kranti flamingo point" and "Agnipankh birds group" are two local groups involving in the conservation and awareness campaign voluntarily. Local residents Mr. SandipNagare and Mr. DattaNagare are with their entire team of young activist are working with these organisations by giving hand in hand.

After the rehabilitation of Kumbhargaon because of ujani dam the local people lost their productive agricultural land. This has in turn lost their means of livelihood from agriculture. These local young inspirators and activist are now utilising ecotourism as a source of generating livelihood for entire village. For which they have established the " Agnipankh ecotourism destination. In which they offer boating for birding purpose, accommodation and food facilities for visiting tourist to Kumbhargaon. Through this accommodation and food facilities many villagers are getting income generation.

These birders group arrange self-driven boat rides for tourist and provide them the entire information about the birds.

Impact on bird diversity:

The human activities are changing the climatic and natural balance not only in India but in the entire world. Ever increasing deforestation, industrial pollution, urbanization, excessive burning of fossil fuels etcare leading to the effects of global warming. This is bringing remarkable change in the climate conditions.

In past decade India has experienced such changes in rainfall received. In 2015 rainfall received in the ujni dam area has affected the arrival of migratory birds including flamingoes. In 2015 the number has declined to 200 instead of 1000-2000 compared to earlier year. Because of this there are mud flats which are exposed. But the rivers ran dry sooner, so the land is also drier than usual.

Also recently reports and studies claimed that this impact on numbers may not be a result only of low water levels. "The local fishermen know the spots where they can venture. However, there are also fishermen from other locations such as Andhra Pradesh, who go fishing in the Bhigwan catchment area, especially for freshwater prawns. They even wade through the water at times, thus disturbing the birds. Moreover, considering that water levels are lower, the pollution concentration is also higher which also may have had some impact on bird population.

Conclusion

The observations revealed that the kumbhargaoan, an area near bhigwan located at the backwaters of ujani dam harbours diverse bird population both resident and migratory birds. But recently the birds in the area are facing serious threats because of increasing fishing activity and pollution from nearby industries. The pollution result in lowering the quantity of algae and fishes which are the food of these birds. Also the excessive pressure on the water bodies is creating negative impact on the nesting of many migratory birds. The climate change outcomes like drought in 2015 have severely reduced the arrival of migratory birds to kumbhargaon. Reduction in water content make large area of backwater exposed to sun and dryness also it concentrates the pollution level which is harming the survival of these birds. But due to the local villagers sincere contribution with NGO's is helping maintaining the balance of nature. Also through the activities of tourism awareness is generating a sense of responsibility towards nature. Due to large number of tourist arrivals from all over India and also foreign countries the government in future will take steps by implementing policies and laws for conservation of such a unique treasure of Maharashtra.

Ecotourism a form of sustainable tourism involves activities that minimize adverse effects of traditional tourism on natural environment to

enhance the cultural integrity of local people. This responsible form of tourism encourages going back to natural areas making very little harm to nature and encouraging protection of wildlife and habitat.

Kumbhargaon is proved to be one of the ideal case of ecotourism development in Maharashtra.

Suggestions

From the above conclusion it was observed that necessary conservation actions should be taken in the given area. Here are some of the suggestions:

- Government should control the development of urbanization in the area.
- Certain conservation practices should be implemented by formulating the policy and laws for conservation.
- Development of the area as nature interpretation centers whch can be designed to cater to the needs of special interest group like students, nature lovers and environmentalists.
- Conduct activities in the study Centre regarding creating awareness about biodiversity within the population.
- Under the Government of Maharashtra's formulated "Eco-tourism Policy" in the year 2008 promotional campaigns, training programs, nature trails should be organise to spread the awareness.
- The tourism promotional strategies designed should match environment quality, social equality, community empowerment, cultural integrity and economic efficiency
- There is need for long term research on issues and investigation of other sites experiencing tourist pressure.

References

1. BirdLife International. 2010. IUCN Red List for birds.
2. http://www.birdlife.org/
3. Grimmett, R., Inskipp, C. and Inskipp, T. 1998. Birds of the Indian Subcontinent. Oxford University Press, Delhi.
4. Karmakar, M. 2011. Ecotourism and its impact on the regional economy
5. National Wetland Conservation Programme. 2009. Guidelines for conservation and management of wetlands in India. Conservation and Survey Division, Ministry of Environment and Forests,Government of India, New Delhi.
6. Chace, J. F. and Walsh, J. J., Urban effects on native avifauna:a review Landsc. Urban Plann., 2006
7. Ali, S. and D. Ripley, 1989.A Pictorial guide to the Birds of Indian Subcontinent. Oxford University Press, Bombay.
8. Mukherji, M., 2002. Degradation of Creeks and Mangroves and its impact on Urban environment – A case study of Mumbai.
9. Eco-Tourism – A Key to Protect the Biodiversity in Maharashtra Dr. Vandana M. Joshi International Journal of Innovative Research in Science, Engineering and Technology Vol. 3, Issue 8, August 2014
10. Report on Tourism Survey for the State of Maharashtra April 2014 to March 2015

enhance the cultural integrity of local people. This responsible form of tourism encourages going back to natural areas making very little harm to nature and encouraging protection of wildlife and habitat.

Kumbhargaon is proved to be one of the ideal case of ecotourism development in Maharashtra.

Suggestions

From the above conclusion it was observed that necessary conservation actions should be taken in the given area. Here are some of the suggestions:

- Government should control the development of urbanization in the area.
- Certain conservation practices should be implemented by formulating the policy and laws for conservation.
- Development of the area as nature interpretation centers whch can be designed to cater to the needs of special interest group like students, nature lovers and environmentalists.
- Conduct activities in the study Centre regarding creating awareness about biodiversity within the population.
- Under the Government of Maharashtra's formulated "Eco-tourism Policy" in the year 2008 promotional campaigns, training programs, nature trails should be organise to spread the awareness.
- The tourism promotional strategies designed should match environment quality, social equality, community empowerment, cultural integrity and economic efficiency
- There is need for long term research on issues and investigation of other sites experiencing tourist pressure.

References

1. BirdLife International. 2010. IUCN Red List for birds.
2. http://www.birdlife.org/
3. Grimmett, R., Inskipp, C. and Inskipp, T. 1998. Birds of the Indian Subcontinent. Oxford University Press, Delhi.
4. Karmakar, M. 2011. Ecotourism and its impact on the regional economy
5. National Wetland Conservation Programme. 2009. Guidelines for conservation and management of wetlands in India. Conservation and Survey Division, Ministry of Environment and Forests,Government of India, New Delhi.
6. Chace, J. F. and Walsh, J. J., Urban effects on native avifauna:a review Landsc. Urban Plann., 2006
7. Ali, S. and D. Ripley, 1989.A Pictorial guide to the Birds of Indian Subcontinent. Oxford University Press, Bombay.
8. Mukherji, M., 2002. Degradation of Creeks and Mangroves and its impact on Urban environment – A case study of Mumbai.
9. Eco-Tourism – A Key to Protect the Biodiversity in Maharashtra Dr. Vandana M. Joshi International Journal of Innovative Research in Science, Engineering and Technology Vol. 3, Issue 8, August 2014
10. Report on Tourism Survey for the State of Maharashtra April 2014 to March 2015

Study of *Moringa Oleifera* (Drumstick) Seed as Natural Absorbent for Lake Water Treatment

Damini Chalke*[1], Dr. Jyoti Koliyar[2]
SIES (Nerul) College of Arts, Commerce and Science
Phone No. 8655761294
*chalkedamini4@gmail.com

Abstract:
Water is used for a variety of purposes like drinking, washing, bathing, recreation, as well as numerous other varied industrial applications. The present study is carried out to confirm the effectiveness of seed powder extracted from mature-dried Moringa oleifera seeds which are commonly available everywhere. The main objective of this work is to evaluate the efficiency of a natural absorbent from Moringa oleifera seeds in treating lake water. During this study, surface water samples were collected for treatment by Moringa seeds in powdered form, resulting in an effective natural clarification agent for highly turbid and untreated pathogenic water. Various doses of Moringa seed powder viz.100mg/l, 150 mg/l and 200 mg/l were taken and checked for the efficiency dose on raw water. After treatment of seed powder with water samples was analyze for different parameter like pH, Turbidity, Conductivity, Acidity, Alkalinity, Hardness, Chloride, TDS & Iron. Application of this low cost Moringa oleifera seeds is recommended for eco-friendly, nontoxic, simplified water treatment where rural and peri-urban people living in extreme poverty.

Keywords: *Moringa oleifera, Seed Extract, Lake Water Treatment, Natural Absorbent, Clarification*

Introduction:

Water is a major source for survival on this planet. Its conservation is therefore a priority. With the increase in demand, the supply needs to meet specific standards. Natural water contains impurities such as suspended and dissolved substances which can be from organic or inorganic sources. Naturally occurring coagulants are usually presumed safe for human health. The use of *Moringa oleifera* has an added advantage over the chemical treatment of water because it is biological and has been reported as edible. The active ingredients are dimeric proteins. The protein powder is stable and totally soluble in water. The coagulation mechanism of the *M. oleifera* coagulant protein has been explained in different ways. It has been described as adsorption and charge neutralization and interparticle bridging. Is a mainly characteristic of high molecular weight polyelectrolytes. Due to small size of the *M. oleifera* coagulant proteins, a bridging effect may not be considering as likely coagulation mechanism.

Aim & Objectives:

Use of *Moringa Oleifera (*Drumstick) seed as natural absorbent for Nerul lake and Juinagar lake water treatment.

- To remove color, objectionable taste and odour.
- To remove Dissolved and suspended impurities.
- To remove hardness of water.

Materials & Methods:

Water samples were collected from Nerul and Juinagar lake for the study purpose. The study was carried out during monsoon and winter season. *Moringa oleifera* (good quality dried drumstick) wings and coat from seeds were

removed. Fine powder was prepared by using mortar and pestle and this powder was directly used as coagulant. Treatment to water is given by directly using seed powder. The water quality parameters were checked before and after treatment. Doses of seed powder i.e., 100, 150 and 200 mg/l were selected for treatment.

The coagulant was mixed with drinking water sample and kept on the shaker for 45 min at 110-120 rpm. Well agitated collected water sample is filter through a filter paper. After filtration, supernatant of treated water was used for the test. pH was estimated using pH meter. Turbidity and conductivity was estimated using turbidity meter and conductivity meter respectively. TDS was estimated using evaporation method. Acidity, alkalinity, chloride and Hardness were estimated using titration method. Iron was estimated using volumetric method

.

Results and Discussion:

Table No. 1 - Juinagar Lake

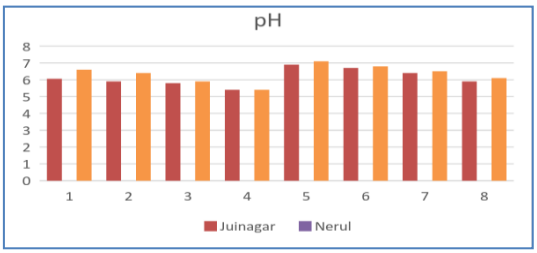
	Monsoon				**Winter**			
Dose of *Moringa oleifera* ⟶	Before	100 mg/l	150 mg/l	200 mg/l	Before	100 mg/l	150 mg/l	200 mg/l
pH	6.06	5.94	5.8	5.4	6.92	6.7	6.4	5.9
Turbidity	5	4.9	4.5	4.3	3.7	3.5	3.4	3.3
Conductivity	1.8	1.6	1.5	1.2	1.6	1.5	1.3	1.2
Acidity	50	44	42	36	56	50	44	42
Alkalinity	100	98	94	92	90	88	80	78
Chloride	5.25	4.9	4.5	4.4	5.6	5.2	4.5	4.2
Hardness	100	98	97	92	130	128	126	124
TDS	600	400	200	200	600	600	400	400
Iron	0.08	0.07	0.05	0.03	0.07	0.06	0.05	0.04

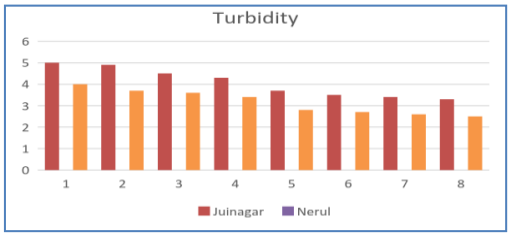
Table No. 2 - Nerul Lake

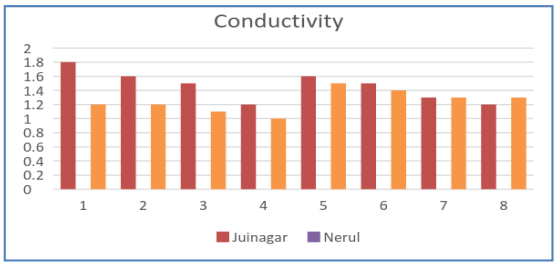
	Monsoon				**Winter**			
Dose of *Moringa oleifera* ⟶	Before	100 mg/l	150 mg/l	200 mg/l	Before	100 mg/l	150 mg/l	200 mg/l
pH	6.65	6.4	5.9	5.4	7.1	6.8	6.5	6.1
Turbidity	4.0	3.7	3.6	3.4	2.8	2.7	2.6	2.5
Conductivity	1.2	1.2	1.1	1.0	1.5	1.4	1.3	1.3
Acidity	60	58	54	50	54	50	48	46
Alkalinity	80	78	74	70	76	74	72	70
Chloride	4.2	4.1	3.8	3.2	4.5	4.4	4.1	3.4
Hardness	110	109	107	105	180	175	168	165
TDS	1200	1000	800	400	1000	800	600	400
Iron	0.07	0.05	0.03	0.01	0.05	0.04	0.03	0.01

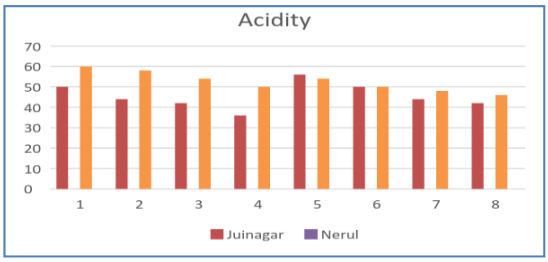
Table No. 3 - Indian Standards Specification for drinking water:

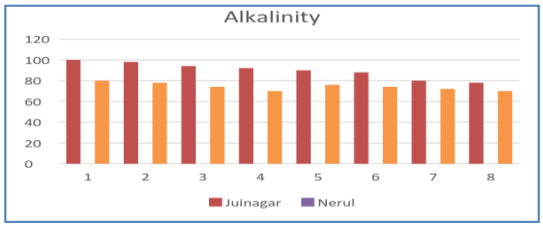
Parameters	Units	Desired Limits
pH	-	6.5
Turbidity	NTU	10
Conductivity	-	-
Acidity	mg/l	-
Alkalinity	mg/l	200 mg/l
Chloride	mg/l	250 mg/l
Hardness	mg/l	300 mg/l
TDS	-	-
Iron	Mg/l	0.3 mg/l

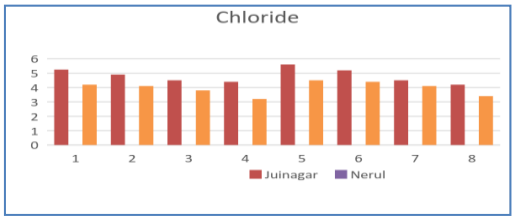


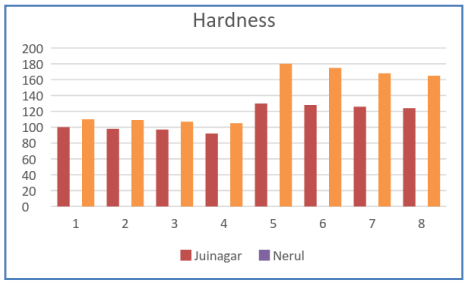


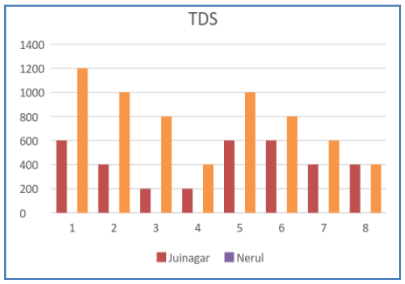


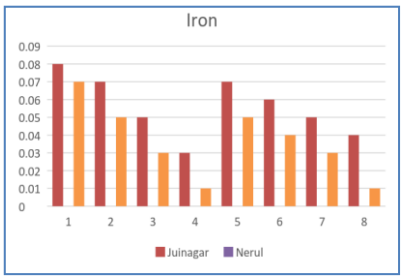












pH:

pH used to measure acidity & alkalinity of aqueous solution. The optimum pH in drinking water according to Indian standards specification is 6.5 – 8.5. The lowest value of

pH was recorded during monsoon season & the highest was recorded in winter season. Treatment of *Moringa oleifera* seed powder was given to lake water in different doses. The pH value was found to be decreased as the concentration of Moringa oleifera seed powder increases i.e., 100 mg/l, 150 mg/l & 200 mg/l. The pH value was found between 5.4 - 7.1 which states that it was within the standard permissible limit. The basic amino acids present in the protein of *Moringa* would accept a proton from water resulting the release of a hydroxyl group making the solution basic.

Turbidity:

Suspension of particles in water interfering with the passage of light is called turbidity. The highest value of turbidity was recorded during monsoon season & the lowest was recorded in winter season. It was observed that the initial turbidity was 2.5 - 5 NTU in the lake water sample. In the present study it was observed that the use of *Moringa oleifera* seed powder showed decreased turbidity with increased dose from 100, 150mg/l & 200 mg/l respectively. Due to this there was an improvement in the flock size and flock was settled rapidly. The overdosing resulted in the saturation of the polymer bridge sites and caused destabilization of the destabilized particles due to insufficient number of particles to form more inter-particle bridges. The high positive charge and small size suggest that the main destabilization mechanism may could be adsorption and charge neutralization. It was found that 90-99% of turbidity in treated water was removed by using *M.oleifera* seed powder. This study confirmed that the seeds are highly effective in removing suspended particles from water with medium to high levels of turbidity.

Conductivity:

Most dissolved inorganic substances in water are in ionizing form & hence contribute to conductance. In the both seasons conductivity of water sample were same. In the present study, it was observed that, the initial conductivity of lake water sample was found to be in the range 1.5 - 1.8. The conductivity value was reduced once the lake water sample was treated *Moringa oleifera* seed powder. The conductivity value was found between 1.2 - 1.5 & was standard permissible limit.

Acidity:

Acidity of water is depends upon pH of water. In the both seasons acidity of water samples were same. The acidity value of lake water sample was found between 60 - 50 mg/l. It was observed that the acidity value decreases as the concentration of Moringa oleifera seed powder increases. The acidity value of treated lake water sample with Moringa oleifera seed powder was found to be in range of 40 - 50 mg/l & was standard permissible limit. As the seeds of *M. oleifera* contain low molecular weight water-soluble proteins which carry a positive charge. When the seeds were crushed and added to water, the protein produces positive charges acting like magnets and attracting predominately negatively charged particles leading to maintain acidity within range.

Alkalinity:

The value of alkalinity provides idea of natural salts present in the water. The basic amino acids present would accept a proton from water resulting the release of a hydrogen group. The highest value of alkalinity found during monsoon season & lowest value found during winter season. At various doses of *Moringa oleifera* seed powder, it was observed that the initial alkalinity was 80 – 100 mg/l in the lake water sample. The alkalinity reduced after

the treatment at 100 mg/l, 150 mg/l and 200 mg/l. The alkalinity observed was in the range of 95-100 mg/l which was within the limit. The slight decreased in alkalinity value may be due to precipitation of insoluble *Moringa oleifera*. The *Moringa oleifera* seed extract appears to have natural buffering capacity. The precipitates (solids / flocks) were light and did not settle easily. The chemical constituent of the precipitate is however not known, but it was found that alkalinity reduction in the coagulation of water sources using *Moringa oleifera* seeds.

Chloride:

Chloride increases the electrical conductivity of water & thus increased its corrosivity. In the both seasons chloride value were found to be same. The chloride value of lake water sample found to be 4 - 5 mg/l. The chloride value of lake water sample without treatment of *Moringa oleifera* seed powder was found between 5.4 - 4.2 mg/l. But once treated with the seed powder it reduced in three fold. It is because cations from *Moringa* seed attract the negatively charged chloride ions present in water and neutralize the chlorides.

Hardness:

Hardness is caused due to presence of cations like ca^{+2}, mg^{+2}, Fe^{+2}, etc., this is the property of water to precipitate soap by formation of complex with calcium, magnesium present in water. The lowest values found were during monsoon season & highest values were found during winter season. Hardness ranges from 100-180 mg/l after treatment which is within the limits of WHO standards. A polyelectrolyte *Moringa* seed powder removes hardness in water through adsorption and inter-particle bridging. Secondly, with the observation that light and slow-settling solids/flocks were formed, precipitation reaction leads to the conversion of soluble hardness-causing ions to insoluble compounds would also be a good prediction of the reaction mechanism.

TDS:

TDS is a measure of total inorganic substances dissolved in water & it is the general nature of water quality or salinity. In the present study, it was observed that, in the both seasons TDS value were almost same. The initial TDS value was range of 1200-1000 mg/l for the lake water sample. Once the sample treated with *Moringa oleifera* seed powder the TDS value decreases which was in the range 400 - 600 mg/l & was found to be permissible limit.

Iron:

Iron is known as heavy metal. The high amount of iron causes so many problems. In the present study, it was observed that, in the both seasons iron value were almost same. The initial iron was in the range of 0.07-0.08 mg/l for the lake water sample. After the collected water sample the iron value 0.03 - 0.05 mg/l & was within the permissible limit.

Conclusion:

Moringa oleifera seeds acts as a natural coagulant, flocculent, absorbent, softener, disinfectant & for removing of heavy metal in drinking water treatment. The low cost treatment using *Moringa oleifera* seeds in the form of water soluble extract is suspension resulting in an effective clarification agent for highly turbid & untreated pathogenic water. It reduces the total hardness, alkalinity, turbidity, acidity, chloride, pH, Conductivity & TDS. In addition, the presence of excess iron concentration was also reduced by *Moringa* seed powder. This work concluded that application of seed powder can be applied for water purification in developing countries, where people are used to drink contaminated turbid water. *Moringa oleifera* seed is not giving any toxic effects. It is eco-friendly & cheaper method

for water treatment.

Recommendation:

In rural & undeveloped countries people living in extreme poverty are presently drinking highly turbid & microbiologically contaminated water. They cannot afford the costly chemical coagulants. Chemical coagulants are harmful & expensive materials. Therefore, *Moringa oleifera* seeds are harmless & less expensive one for the clarification of raw water for domestic & industrial uses.

Acknowledgment:

I am very thankful to prof. Dr. Jyoti Koliyar from SIES Nerul college of Arts, commerce & science for guiding me in my study and research work in my project.

References:

1. Journal of food, agriculture & environment vol.5, 2007
2. J. Nat. prod, plant resource, 2012
3. Research Journal of Recent Science, Vol. 1 (3), March (2012)
4. African study Monographs, 15(3), November 1994
5. International Journal of Life Sciences Biotechnology and Pharma Research ISSN 2250-3137, Vol.2, No.1, January 2013
6. Civil and Environmental Research ISSN 2224-5790 Vol.3, No.8, 2013
7. International Journal of Advanced Engineering Research and Studies ISAERS Vol.1. October-December 2011

Study of the Impact of Railway Noise Pollution along the Wadala-Kurla Railway Track Stretch and its Remedial Measures

Carol Pereira*[1], Jyoti Koliyar[2]

1, 2- SIES (Nerul) College of Arts, Science and Commerce.
Contact No.: +918082240169
***carolpereira865@gmail.com**

ABSTRACT:

Railways are one of the easiest means of transport, however, the impact it causes on the surrounding can often be disastrous and irreversible. In India, The Noise Pollution (Regulation and Control) Rules, 2000 was published in order to prevent noise-induced annoyance. Considering the sudden increase in the number of trains, rapid growth and ill effects due to noise pollution, there is a need to study noise pollution. Not only does it affect the people but also the flora and the fauna.

The study comprises of an assessment based on a detailed questionnaire to understand the ill-effects of railway noise pollution on the people living in the periphery of the railway line stretch from Wadala to Kurla. The variation in sound intensity was measured during different times of the day (peak hours and non-peak hours) and variations in sound intensity during day time and night time by monitoring of sound using a Sound Level Meter. The survey along with the monitoring was a 2 months long study. The study also includes the remedies which can be provided for minimizing the noise pollution.

At the end of the study, information was obtained about 1) The effect of noise and vibration on people and property. 2) Hours at which the disturbance is significant. 3) The influence of high noise levels on varying group of individuals ranging from children to the aged. 4) Insight about the noise intensities, the residents are exposed to.

KEY WORDS: *Noise, Railway, Kurla, Trains, Survey.*

INTRODUCTION:

Noise is found to be an inevitable part of everyday life. While mild noise can be annoying, excessive noise can cause destruction to a person's hearing ability. The slightest unwanted sound can cause irritation and become very annoying if it continues for any length of time. Railways are one of the major sources of noise. Railways contribute to noise pollution in a very less time period, which is very dangerous for human health...

The major factors that influence the generation of noise due to railways are the frequency of trains, speed of trains, nature of railway track, intensity of horn etc. (Anuraj V. Tiwari et al). Easy commuting and reliability increases the number of commuters travelling by railways. The frequency of trains travelling on a daily basis is found to be increasing in order to meet the needs of the increasing population. It is cost efficient and hence is preferred by people of all classes. In a metropolitan city like

Mumbai, railways are a boon to more than half of the population who have to travel long distances for work. While railways have their advantages, the number of problems caused by them is mostly faced by those living in the adjoining vicinity of the railway tracks. Due to the increasing population and migration to cities in search of jobs, this consists of people who are poverty stricken and those who cannot afford merely a decent standard of living. The railway tracks between Wadala and Kurla are surrounded by a large number of slums. People dwelling in the region are constantly exposed to different kinds of pollution arising from railways, most of all being that of noise pollution.

At the end of the study, it was found that noise and vibrations, both had a significant effect on the residents, especially senior citizens and children below the age of 5 years. Disturbance was caused at early hours of the day and late at night. Disturbance caused to the residents was in the form of severe headache, insomnia and deafness. The area being categorized under "Residential Area" according to National Ambient Air Quality Standards shows that the residents are exposed to noise levels higher than the permissible limit both during day time and night time.

The study will determine the impact of railway noise pollution and the relevant measures to remediate the noise pollution.

MATERIALS AND METHODS:

The method followed was as per Fig.1.

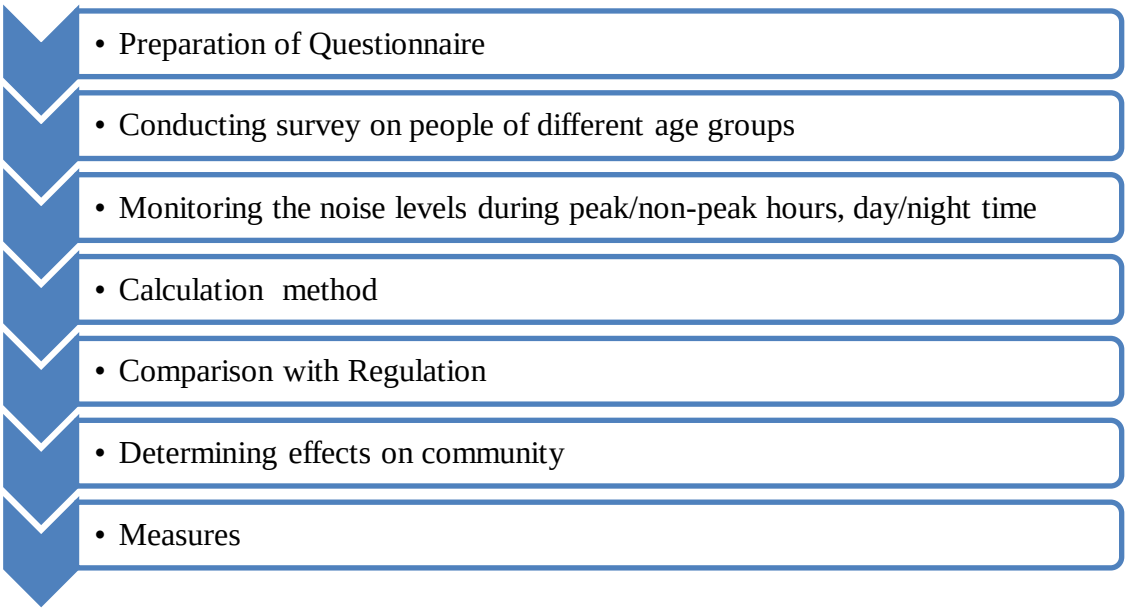


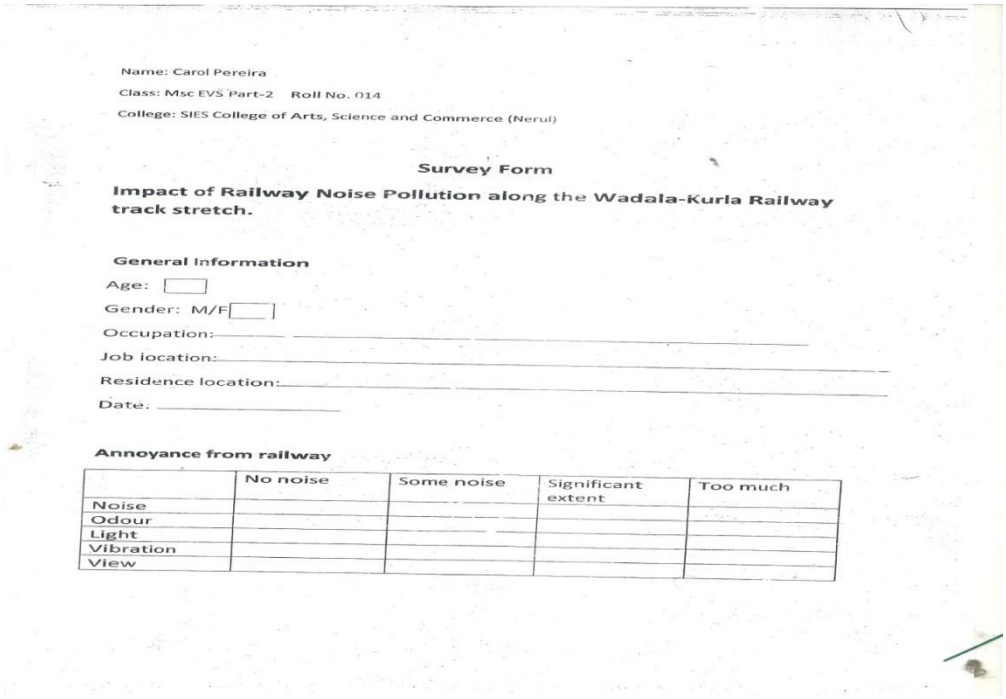
Fig. 1. Flow-sheet of the method followed in the study.

1. Monitoring of Noise Pollution

The instrument used to measure the noise intensity was the Sound Level Meter. Sound Level was measured at varying time scales i.e. during the morning, afternoon and at night. Sound level was also being measured during peak hours and non-peak hours. (Anuraj V. Tiwari et al, 2013)

2. Survey

Participants in various age groups and professions along the Wadala-Kurla railway track stretch were surveyed by asking some questions about their annoyances from noise. (Göksel Demir, Ayşe Kablan et al, 2016)



Name: Carol Pereira

Class: Msc EVS Part-2 Roll No. 014

College: SIES College of Arts, Science and Commerce (Nerul)

Survey Form

Impact of Railway Noise Pollution along the Wadala-Kurla Railway track stretch.

General Information

Age: [ ]

Gender: M/F[ ]

Occupation: _____

Job location: _____

Residence location: _____

Date: _____

Annoyance from railway

	No noise	Some noise	Significant extent	Too much
Noise				
Odour				
Light				
Vibration				
View				

In which time are you disturbed?

1hour	2hours	3 hours	4 hours	5 hours	6 hours
7 hours	8 hours	9 hours	10 hours	11 hours	12 hours
13 hours	14 hours	15 hours	16 hours	17 hours	18 hours
19 hours	20 hours	21 hours	22 hours	23 hours	24 hours

Construction damages in the last 1 year

Plaster cracking[ ]

Plaster loss:[ ]

Wall cracking:[ ]

Wall destruction[ ]

Other: _____

Disease/health problem caused

Deafness: [ ]

Migraine: [ ]

Death: [ ]

Other: _____

Fig. 2- Sample questionnaire

RESULTS AND DISCUSSION:

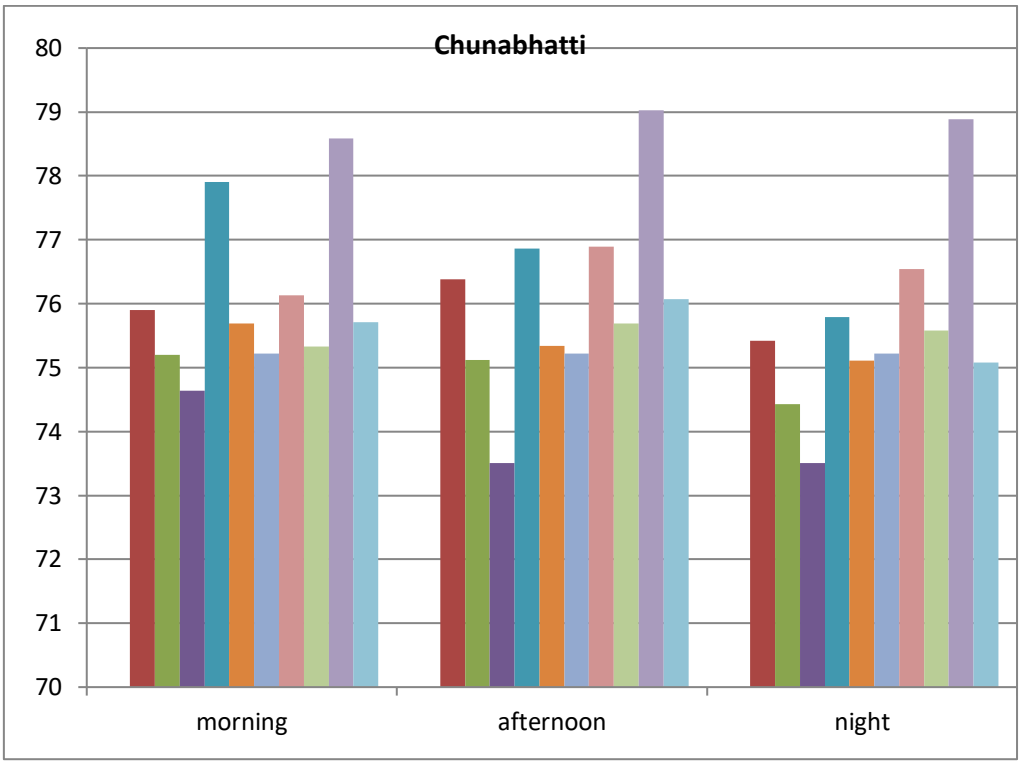
The survey was carried out over a period of one month along the Wadala-Kurla Railway track stretch. 50 candidates living in the area were asked about the annoyance from noise and the disease or health problems it caused. At the end of the survey, it was observed that the maximum effect of the disturbance was caused to senior citizens and children. Noise levels , although of the same intensity did not seem to effect the residents living along the Wadala stretch as much as it did to those living along GTB, Chunabhatti and Kurla. The maximum population surveyed was found to be unemployed and housewives, thus being exposed to the noise levels continuously. Noise resulting from railways was not found to impede light, view or odor to a significant extent. The high intensity arising from railways along with the surrounding noise was found to cause disturbance in the later part of the day. Physical damage to the infrastructure was also caused in the form of plaster cracking, wall cracking and wall destruction. This increases the expenditure of the household per annum. Health was also found to be affected as a result of noise accompanied with vibrations. Deafness and Migraine were commonly found to affect the older population. Academicians were found to be affected by the noise levels. Although the duration of noise is not prolonged, the short-lived noise is intense and thus found to cause loss of concentration and an impediment in speech.

The monitoring was carried out over a period of one month along the Wadala-Kurla Railway track stretch..The Digital Sound Level Meter was used to monitor the noise level. Monitoring of noise levels was done at different hours in the day i.e. Morning, Afternoon and Night. Peak hours like morning (7:30am to 9:30am) were found to have high sound intensity as compared to the non-peak hours of afternoon (2:30pm-4:30pm) and night (8:00pm-10:00pm). The average sound level at Chunabhatti, Wadala, GTB and Kurla in the morning (peak hour) was found to be 78.42dB, 73.30dB, 72.56dB and 75.54dB. During the day time, residents are thus exposed to noise levels almost 1.5 times greater than the standard level of exposure for residential areas i.e. 55dB. The average sound level at Chunabhatti, Wadala, GTB and Kurla in the night (non-peak hour) was found to be 67.40dB, 70.46dB, 64.05dB and 76.35dB respectively. Hence, it is seen that residents are exposed to noise levels that are 1.5times greater than the standard level of exposure for residential areas at night i.e. 45dB. Noise levels were higher at Wadala and Kurla as compared to that of GTB and Chunnabhatti. This is probably because they are the two main junctions. Thus, due to this the number of commuters is higher and the trains are more frequent in these hours.

Code	Area	Day time(dB)	Night time(dB)
A	Industrial area	75	70
B	Commercial area	65	55
C	Residential area	55	45
D	Silent zone	50	40

Table 1.1- Noise Standards as per Central Pollution Control Board (CPCB)

Table 2.1

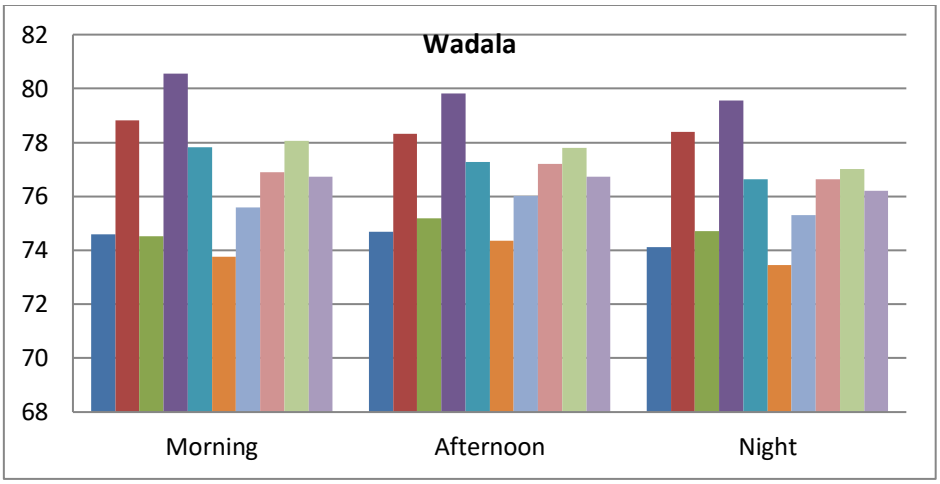


Morning* (7:30am-9:30am)	Afternoon* (2:30pm-4:30pm)	Night* (8:00pm-10:00pm)
75.58571	75.96429	74.83
75.2	75.11667	74.42333
74.1	73.41667	73.38333
77.9	76.86667	75.79333
74.97143	74.79894	74.34963
75.22	75.22	75.22
76.12857	76.8881	76.54333
75.32857	75.6881	75.58333

78.58571	79.03095	78.88333
75.71429	76.06905	75.07667

*= Noise level measured in Decibels (dB) at a Range (80~130)

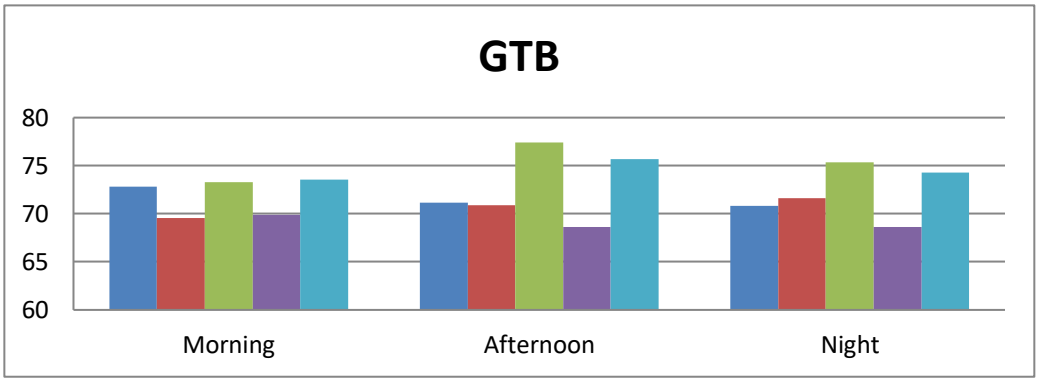
Table 2.2



Morning* (7:30am-9:30am)	Afternoon* (2:30pm-4:30pm)	Night* (8:00pm-10:00pm)
74.58571	74.68367	74.1242
78.81429	78.33061	78.39213
74.52857	75.1898	74.70262
80.55714	79.80816	79.55219
77.81429	77.27347	76.62682
73.75714	74.36531	73.44606
75.58571	76.01224	75.31399
76.88571	77.21224	76.64257
78.05714	77.79388	77.02157
76.73175	76.74104	76.20246

*= Noise level measured in Decibels (dB) at a Range (80~130)

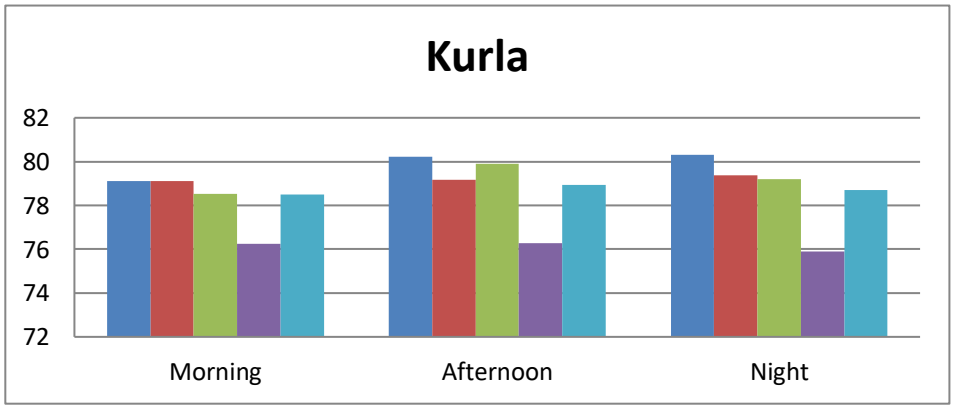
Table 2.3



Morning* **(7:30am-9:30am)**	**Afternoon*** **(2:30pm-4:30pm)**	**Night*** **(8:00pm-10:00pm)**
72.8	71.13333	70.8
69.58	70.89167	71.595
73.3	77.425	75.375
69.88	68.6	68.62
73.56	75.65833	74.315

*= Noise level measured in Decibels (dB) at a Range (80~130)

Table 2.4



Morning* (7:30am-9:30am)	Afternoon* (2:30pm-4:30pm)	Night* (8:00pm-10:00pm)
79.1	80.225	80.3

79.1	79.17	79.38
78.54	79.907	79.188
76.24	76.282	75.888
78.5	78.93278	78.70889

*= Noise level measured in Decibels (dB) at a Range (80~130)

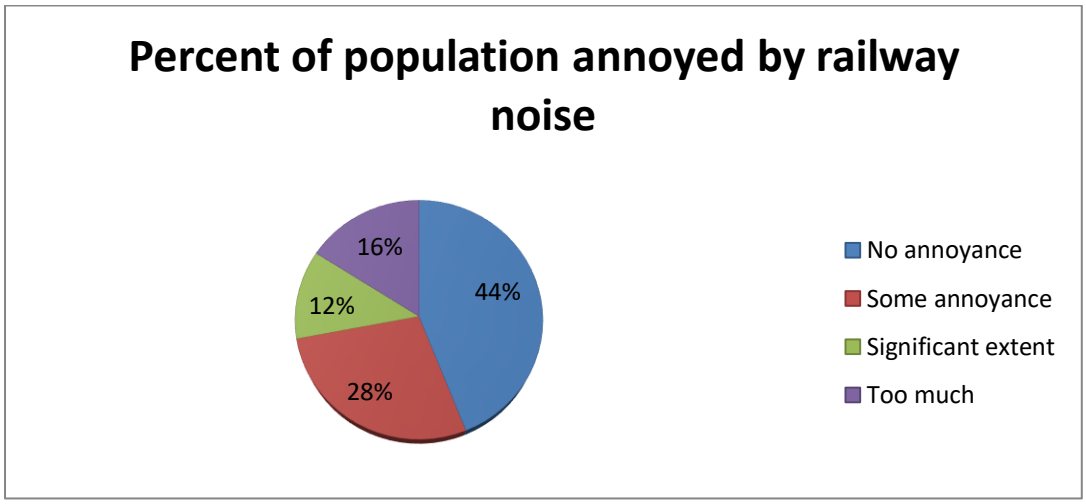


Fig. 3.0 - Pie-chart depicting the percent of population annoyed by railway noise.

CONCLUSION:

Noise generated by rail vehicles is not continuous but intermittent. However, the intensity of noise is high and this is the cause of nuisance in the surrounding region. Vibrations that are produced from railways also cause dust particles to be suspended in the air for a longer period of time thus causing air pollution as well as obstructing light rays. Noise induced illness can often be fatal if exposed to it for prolonged periods. Railway tracks are often found to be littered due to the absence of garbage bins in trains. This leads to the accumulation of dirt. Residents are exposed to the garbage as a result of which they suffer from illnesses arising from unhygienic conditions like dengue, cholera etc. which may be indirectly related to railway noise induced illness. Appropriate measures should be adopted by the concerned authorities, those that will cause less harm or damage to the life and property of people living along the railway tracks. Standards should be prescribed with respect to the minimum distance to be maintained between stations and the closest residential area. In a place like Mumbai that faces grave issues related to population explosion, government authorities must devise appropriate plans to organize the

increasing population in a city where space is a restriction. Noise levels should be monitored at regular intervals to check if they are within the limits. If not, the source of noise should be identified and remedies should be taken up to mitigate the noise.

ACKNOWLEDGEMENT

This research was supported by my guide, Mrs. Jyoti Koliyar. I thank her for providing insight and expertise that greatly assisted the research.

REFERENCES

1. Anurag V. Tiwari1, Prashant A. Kadu2, Ashish R. Mishra3, 2013, Study of Noise Pollution Due To Railway and Vehicular Traffic at Level Crossing and its Remedial Measures, AJER, Volume-2, Issue-4, pp-16-19.
2. Göksel Demir, Ayşe Kablan, Yaşar Avşar, Ümmügülsüm Alyüz, Hatice Eser Ökten, and Şenay Yalçın, 2016, Railway Noise Pollution Prevention in Terms of Regulations: Case Study of Istanbul, International Journal of Environmental Science and Development, Vol.7, No. 3
3. Keerthana1, Gobinath. R2, Neelima Singhvi3, Chitravel. V3, Saranya. S3, Kannan. T3, 2013, Evaluation of Urban Traffic Noise Pollution- A Case Study of Tirupur City, AJACER, Vol.1, Issue. 1, pp. 1-16
4. Małgorzata Szwarc Bożena Kostek Józef Kotus Maciej Szczodrak Andrzej Czyżewski, 2011, Problems of Railway Noise- A Case Study, JOSE, Vol.17, No. 3, 309-325.

Biometrics: Secured System Access

Sheetal R.Thakare[1], Anil E.Magare[2], K.V.Nimi[3], K.V.S.Ratnakumari[4]

Asst.Professor in Lokmanya Tilak College of Engineering, Koparkhairane-400709

[1]thakare.sheetal@gmail.com, [2]anilmagare@gmail.com,

[3]nimiajit@yahoo.com,[4]kratna158@gmail.com

Abstract-

Today as the large number of transactions take place with the help of electronic money, the question of security and reliability comes to mind. Password abuse and misuse, intentional and inadvertent is a gaping hole in network security. Amongst all this is the emerging technology of Biometrics. Biometrics is emerging as an automated fool proof system of personal identification and authentication which is the need of today's high tech world. One of the main advantages of using the biometric system for authentication is that each individual has their own physical characteristic traits which cannot be lost, stolen, shared or traded. Biometrics removes human error from the security equation. This paper will examine all the technological and practical application aspects of Biometrics. It also provides with various biometric methods of identifying the user.

Keywords- *Password, Network Security, Biometrics***.**

I. Introduction

Biometrics is something that is quantifiable it enables us to believe that there is some imperial way of quantifying biometrics as their use in different technologies for security [1]. It can consist of physiological detailing pertaining to something one is born with such as an iris or a fingerprint. Taking it one step further it can also consist of behavioral uniqueness such as an individual's walking patter or manner of speech. It can further be utilized to verify the identity of an individual person precisely to ascertain the fact that you are who you claim to be. It verifies the claimed identity of a person by the measurement of a unique biological feature, which maybe based on a physiological or behavioral characteristic.

II. Authentification and Identification

The process of authentication solely addresses the issue of "Is the individual someone he claims to be he is?" In order to that when any individual claims an identity, their biometric data is captured and the compared against the data which has already been stored on to the system. This will either match or confirm the identity of the individual thus authenticating his identity or come back as a mismatch. e.g. controlling physical access to military facilities where biometric systems are put in place [2].

As we have just read that in the authentication process the system addresses the issue of the individual of "Is the individual someone he claims to be he is?" the Identification system does not require an individual to claim their identity. In this method the individual's data is procured and then compared against the data in the system to find the closest matches which may possibly reveal the identity of the individual. The biometric identification is extensive used in large-scale system for surveillance [11].

III. Biometrics

Biometrics refers to the implementation of a system that authenticates the identification of an individual based on their physiological or behavioral characteristics. Biometric method is favored over the run of the mill and traditional method like token, passwords and pin numbers. There are various reasons for this. The traditional methods are not reliant

methods. Pin numbers, passwords and tokens can be forgotten, forged, lost or stolen.

They are dependent on the human mind, can be transferred or disclosed hence posing a great security risk. But such is not the case of biometrics. It obliterates the need to rely on memorizing passwords or carrying tokens. It emphasizes the individual to be physically present at the point of identification. Hence, potentially it is preventing any kind of counterfeit behavior and fraudulent access to secure information. By doing this Biometric system successfully secures applications on cellular phones, computer networks laptops, workstations, desktops, ATM machines, and smart phones. The most popular forms of biometric systems is the face recognition and finger print matching .However, there are various types being used. Some also make use of the iris and retinal scan, hand and speech geometry.

IV. Characteristics of Biometrics

Biometric technologies can be based on characteristics such as Appearance, bio dynamics, imposed physical characteristics, social behavior and natural physiography. To further elaborate this, in the case of appearance(still images) it would hold information of an individual's height, weight, skin, hair, gender, race, color of skin, etc which are normally used in passports. Bio dynamics entails the manner of signature, statistically analyzed voice distinctiveness, keystroke dynamics and predominantly login-id and password. Physical characteristics would include things like embedded micro-chips, bar-codes and other kinds of brands. Social behavior is the data of an individual's habituated body signs, general voice traits, distinctive manner of speech and any visible handicaps.

Natural Physiographic would include the utilization of data pertaining to the handprint sets, hand geometry, thumb print, retinal scans, DNA patterns, skull measurements, earlobe capillary patterns and teeth and skeletal injuries. Technologies that have been competent and are currently being put to practice to date are the embedded microchips in the case of livestock and pets and in the case of humans are iris scanning, thumb geometry, finger prints and anklets.

V. Type of Biometric Systems

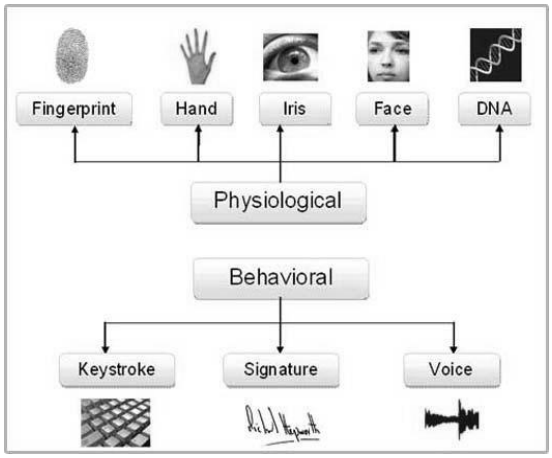


Fig.1 Biometric Chart Image [15]

Biometrics systems can be largely categorized based upon behavioral and physiological traits which are explained below.

A. Behavioral biometrics includes:

1) Speaker Recognition: This is based on the uniqueness of the individual's voice as no two voices can be the same and therefore it measures base tones, larynx vibrations, cadence, pitch, tone, frequency and duration. Hence making it secure as it obliterates the misuse use of recordings or reproductions being used to penetrate any voice based security systems.

2) Signature: It is one of the oldest biometric verification used It records the pen speed, shape, stroke order, timing and pen pressure. Since all these features cannot be replicated by anyone else apart from the original person it becomes a very accurate and cost effective way.

3) Keystroke*:* This method measures the time space of words that are typed. It is quite similar to a signature scan as it measures the

speed and keystroke intervals to create a template. Thus verifying the user's identity with speed of which he types his password.

4) Gait Recognition: This is based on an individual's rhythmic pattern pertaining to their walking style/stride. This is a very recent technology and is currently under development.

B**. Physiological biometrics includes:**

1) Facial Recognition*:* This method incorporates the measuring of facial characteristics. It's a fairly newer Technology being used for commercial use. Earlier it used two dimensional face recognition systems which were not very accurate but the newer three dimensional facial recognition system is significantly better and accurate. For example a computer that will only unlock when it identifies the user's face. Hence making it secures and preventing unauthorized access.

2) Fingerprint: This identifies fingertip patterns. It monitors and records the impressions made by the ridges on the fingertips. Fingertip ridges patterns are unique to each individual and can never be altered. No two fingerprints can be the same and therefore a very accurate means of personal identification.

Fig.2 Fingerprint [16]

3) Hand Geometry: This entails the measuring of the shape of the hand. It employs' the use of a camera which extracts the images of the length of the fingers and the shape of the hand and its attributes. It is user friendly and cost effective and widely used.

4) Bertillonage: This uses the measuring of body lengths but is no longer used. It goes back to the 19th century where multiple bodily measurements were taken and recorded by hand and stored and compared.

5) Retinal/Iris Scans: An Iris scan analyses the features of the colored ring of the eyes. They capture the oddities and unusual and distinct patterns of the human eye. Retinal and Iris scans are same yet different in terms of the focus of the scans, while the retinal focuses on the actual tissues the iris focuses on the blood vessels behind the eye.

6) Vascular pattern: This method analyses the vein patterns on an individual's face or hand. In order to verify the individual's identity it focuses on the thickness and location of the veins as they are believed to be unique to each individual. The most common form of doing this is by a user placing the hand on a curved bed infrared scanner and then a picture is created and compared to the database.

7) DNA Matching: This entails the analysis of the DNA sequence of the individual for authentication and identification but since it raises a lot of privacy concerns, is considered to be invasive and exposes the threat of the data being misused is therefore currently not automated.

8) Vein Identification: This is a new technology which uses the pattern of the veins in the back of an individual's hand for identification and authentication purposes. This technology is considered non intrusive for the user and has a potentially high rate of accuracy. It is currently being implemented in commercial products such as Veined.

VI. Major Components Of A Biometric System

- Data Collection
- Signal Processing
- Matching
- Decision
- Storage
- Transmission

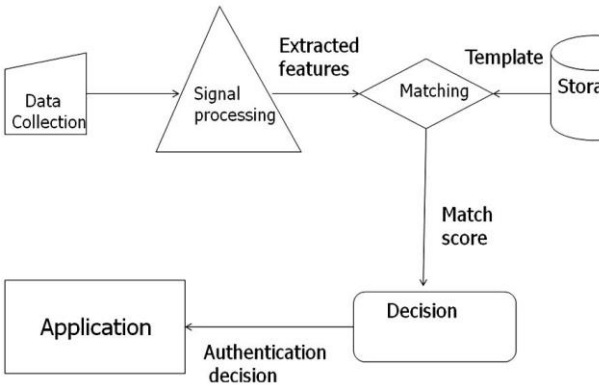


Fig.3 Biometric System Map [3]

A.

B. A. Data Collection

It is the acquisition of data through an input device or sensor that reads biometric information. It is then converted into an appropriate/suitable form for processing by the remainder of the system. It requires the sample biometric trait/characteristics to be similar to the ones that have been enrolled by the individual's earlier template. The individuals using this system need to be trained. Re-enrolment may be imperative to accommodate changes in physiological characteristics. It is important that the biometric system sensors must be similar so as to be consistent in their measurements. However, the biometric feature is susceptible to change in the form of the sensor of the biometric system or the performance.

B. Signal Processing

This process involves the extraction of features by receiving raw material from the database or data collection subsystem. Here the data is transformed and converted into a form that is required by the matching subsystem. Filtering process maybe applied here to remove any inadequacy's while extracting discriminating features from the raw material provided by the biometric system.

C. Matching

This plays a pivotal role in the biometric system. It receives data from signal processing Subsystem and subsequently receives biometric templates from the storage subsystem. It then measures and compares the similarity of the individual's sample to the reference templates resulting in a match score.

D. Decision

This involves the interpreting of the match scores obtained from the match subsystem. It defines a threshold and if the match score is above the defined threshold then it is a match and the authentication process is a match and if it is below the defined threshold then it is a mismatch. This process may require more than one sample and has a possibility where it could reject a genuine claimant and accept the impostor.

E. Storage

This subsystem basically stores and maintains the templates and data of the enrolled users. It could store more than one template for each individual who uses this system. These templates could be stores in a conventional database, as a smartcard or a physically protected storage which are within the biometric smart card.

F. Transmission

Because some subsystems are logically separate some of them may be physically integrated. Usually in the biometric system separate physical entities coexist. In this process the data is transmitted between the different physical entities. However it should be noted that the biometric data is very vulnerable in the process of transmission.

VII. Biometric System Architecture

A. Enrolment

This is the process of procuring raw biometric data. It captures the implemented technology being used be it a facial image or a finger print

[4].

B. Feature extraction

This is the next step after enrolment. Here the data which was earlier captured in the enrolment process is processed to encrypt the unique traits on which the system operates.

C. Template creation

This is a small file which is copied from the unique and distinctive features of the individual's biometric data. This is considered the foundation of the biometric system.

There are two forms of templates

1) Enrolment templates: This is formed and created during the first interaction of the individual with the system and stored there for future use.

2) Match templates: This is created when the individual attempts to be compared against enrolment templates for authorization and identification purposes. It is usually discarded after the matching process is complete

D. Biometric Matching

In this procedure the two templates are compared against one and another to determine the degree of connection during this process. The outcome of this process is a score which is compared against a threshold. If the score increase in relation to the threshold it's a match if not then its mismatch

VIII. Working of a Biometric System

As complicated as Biometric systems seem to appear they all operate on three fundamental steps and use the same three components. To begin with one of them is enrollment which is a system that records basic information about an individual and captures an image or recording of the individual's specific trait. Second is the storage of the data. Most systems do not store the whole image or recording it instead analyses an individual's trait and then translates it into a code or graph. In some cases data is recorded on to a smart card that an individual carries. Finally step is that of comparison where when the individual uses the system again, the system compares the trait presented by the individual to the information on the file, based on which the individuals identity is accepted or rejected. The authenticating three components entails the usage of a computer that reads and stores the information, a software that analyses the traits and translates the pattern into a code or graph and executes the actual comparison and a sensor that detects the characteristics being used by the individual as a source for identification.

XI. Biometric Applications

Biometric applications have existed longer than the people believe they have [5]. One of the oldest form of biometrics was installed in a university in Georgia in 1973 as for of a hand scanning system [6]. It was for the use of restricted entry into "all you can eat" dining halls. It was device that measured the length of the individual's hands and measured it with photoelectric cells (REF: Computer business review 1998). It is only in the recent 10 years that the biometric applications have caught up with the technology that has been around for 34 years. The internet era has boosted the need for biometrics along with the banking institutions. Fingerprint biometric system has been one of the most popular applications but now other applications are also making way into society. Escalating fraud and security breaches are bringing biometrics technology into the society. Biometric technology was considered fiction a few years ago but now it is in high demand as the application for biometric technologies are limitless.

A. **Identification Systems [7]**

There is an increasing need of integrating biometric system into large scale systems like car licensing, health and identity card, benefits issuance and surveillance. Singular identification and transaction verification is the emerging need of private and public sectors. Identification systems are some of the

most complex systems because of its detailed requirement for acquisition devices privacy sympathy design, fall back procedure, privacy sympathetic design and matching algorithms. Some of the forms of Identifications Systems Application are mentioned below:

- Image processing and optimization
- Smart-card integration
- Multiple device integration
- Privacy sympathetic system design
- Vendor neutral system
- Creating a unique identity number for every resident in India.[11]

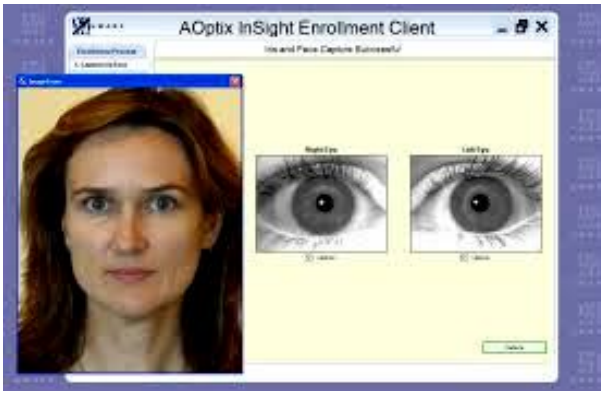


Fig.4 Unique Identity[15]

B. IT/Network Security [5]

The availability of more and more valuable data to employees brings with it the risk of unauthorised access to sensitive data. Protecting the network with password is highly tricky as the passwords can be forgotten, lost, shared or compromised. Here is where the biometric system comes in. Whether the biometric system is driven by its cost reduction, security or convenience, it is becoming the effective solution for IT/Network solutions. However, applying biometrics in this field brings forward a big challenge of accuracy and performance amongst other.

Some of the biometric applications in the field of IT/Network Security:

- Match decisions and biometric data encryptions
- Custom reporting and auditing systems
- Vendor strengths and weaknesses customized
- Application development
- Vendor independent system design customized

C. E-commerce and Internet

E-commerce is beginning to look at biometric as being a solution for their internet security which is designed to prevent unauthorised access to sensitive data or even execute transactions that are unauthorised. When it comes to using this in government or commercial organisations, building effective and competent e-commerce and internet solutions is complicated [5]. Nevertheless if combine with customising the system with vendor independence and real world understanding of requirements of performance and security one can come up with a robust system. In order to authenticate customers, vendors, students, employees, etc the organisations must consider certain factors. Few of them are mentioned below.

- Biometric information and transmission made secure
- Managing of biometric accounts/transaction by auditing and administrative functionality
- Defining accuracy needs for biometric systems
- Location of biometric data storage and processing for maximum availability
- Existing interfaces being created by integrating biometric acquisition processes
- Biometric match decisions being integrated into payment and clearance system
- Initial identity claim verification procedures
- Fall back procedures for individuals that need to be accommodated to enrol successfully

D. Access Control [5]

Biometrics ensures that only authorised individuals can access secure areas and hence proved to be a competent solution for high security access control. However they require more than replacing the existing systems. Biometrics need to have a monitoring process that is very sensitive to security settings in order to ensure that the risk of unauthorised entry is kept at a low. It requires a controlled and accurate enrolment process and also interfaces that are well designed to make certain speedy acquisition and matching. A system that does not look and deal with these inadequacies comes up with a poor system design and hence the implementation can be slow when it comes to the authenticating process thus exposing it to new vulnerabilities.

Independent expertise is required for complex access control installations to ascertain that the security levels, ingress/egress procedures and the system administration capabilities meet the user's expectations. Some of the primary technologies used such as hand geometry, fingerprint, iris/retina scans, implement large scale control solutions for the employee applications.

E. Smart Cards[5]

Since biometric technology is an authenticating technology, smart cards can be storage, processing and authenticating technology. Being similar puts these two technologies up in competition against each other. For example an organisation may deploy smart cards for access control instead of biometrics or vice versa. But the trend of using the two technologies in conjunction with one another is rapidly growing as together they strengthen each other's capabilities. Characteristically, biometric data is stored on a smart card .Once the matching has taken place on a local pc server or the reader with the smart cards memory it results in a match or a mismatch. If it is a match the protected area of the card can be accessed which possesses secure information such as account information or even a card based pin to an external application.

Some of the smart card platforms and key standard/ infrastructure issues:

- Cryptographic cards: Visa cash, Mondex, Proton
  Schlumberger
- Java cards, Multos
- EMV, Mondex
- Match on card architecture
- SAM implementation and design
- Middleware and management card systems
- Lifecycles and card issuances
- PC/SC OCF

F. Android Applications

A new application for Android Smartphone allows users to secure their phones using facial biometrics, the Visiclan Applock application which is currently available for free, locks the user's app until then identity is verified using facial biometrics. [12]

On 11th September, 2013 Apple launched its new Iphone5S. It is notable for containing a fingerprint scanner which will erase the need to type in a password to unlock the device. It contains "Touch ID" which reads the user's fingerprint in order to unlock the phone. The sensor is situated on the home button at the bottom of the Iphone5S. [13]

On 16th September, 2013 HTC One Max launched upcoming phablet. It have rear maintained finger print reader. [14]

Fig.2 I-Phone5S [17]

X. Advantages of Biometric Applications

The key advantage of this method is that of the individual authentication. It validates the individual's identity. It authenticates the identity as it uses the real human behavioural and physiological traits which are of a permanent nature and some are impossible to alter. For example the individual's finger prints or iris scans etc[10]. Hence this obliterates fraudulent use and identity theft. They cannot be stolen or lost as in the case of passwords, tokens or cards used for authentication purposes. It cannot be passed on to other individuals as easily as individuals do with their cards or password. The biometric system does not rely on the memory of the individual as in the case for passwords or pin numbers and hence becomes convenient .It can also be used and applied with other authenticating systems such as the smart card or Public key infrastructure. It is an easy and time and cost effective technology and has the ability to deal with present and future number of individuals. It not only provides accurate discrimination amongst individuals but also is capable of dealing with as much individual variability as possible. It is socially accepted as people are happy to use it due to its environmental robustness and security protection against potential attackers.

XI. Disadvantages of Biometric Applications

Nothing is perfect as we know and therefore the biometric system also has its pit falls and shortcomings. This system needs to improve with relation to its accuracy and speed and so it is not something one can ideally use as yet. These biometric systems with a low rejection rate are still rare. Though some of the systems are fast yet the false acceptance rate in them are too high. It also poses problems with the enrol rate system as this cannot be used by all individuals. Physically challenged people who do not have hands are unable to use the hand based or fingerprint systems. Visually impaired people make the iris and retina scans very difficult. Hence there is not a single specific biometric system that can be followed by all. The biometric system must be extended to deal with individuals falling into the FTE category. This can result in the system being more complicated, less secure and expensive. It can even be annoying for the enrolled users as the FTE rate will inform as to how many of the input samples are of insufficient quality hence leading for more data input. Also the fact though an individual's data cannot be passed on or stolen as in the case of cards and passwords it can be stolen from the computers. Some biometric sensors also have a limited lifetime unlike a magnetic card [1].

The biometric system can also violate an individual's privacy by divulging details of their illnesses etc. This system can also be associated with loss of anonymity as it can sometimes link all individual actions to a single identity whereas the individual can have multiple identities as far authenticating methods are based. These systems can be intrusive or invasive for certain cultures and religions where some individuals do not like being photographed as their faces are completely covered.

XII. Future of Biometrics

There is an increasing need for deploying security systems for government bodies and large firms. The technology used by biometrics will soon be adapted by e-commerce applications to provide that extra security during checkouts on various websites. It will also see a future in cell phones and cars guarding against fraudulent use and unauthorised access. There is an immense

amount of public awareness to this technology. It is a fact that it is becoming a way of life for people. It is a cheaper, faster and an accurate system hence making it popular. In the future fixed biometric guides will be placed for vendors and developers in the areas of interfaces, applications and system performances. It can be combined with other security and authenticating systems, e.g.: smart card. In the future the biometric technology is looking to develop a 3d infrared facial recognition system along with a facial recognition passive surveillance and visitor management access system. This fusion of multiple biometrics makes the system very secure to use. These sophisticated systems will make security breaching nearly infallible and invincible. Strengthening and expansion of the existing standards will make the biometric system more accurate and the usage will be widespread. As the consumer confidence increases the system will come out with more innovative ideas and systems which will take the future of biometrics from strength to strength.

XIV. References

1. Understanding Biometric Technology, International Biometric Industry Association (IBIA), September 9, 2005.

2. Biometrics and Privacy, Roger Clarke, April 15, 2001.

3. Study Report on Biometrics in E-Authentication", International Committee for Information Technology Standards, USA, March 30,2007.

4. Biometric Authentication, Uwe Bubeck , Dina Sanchez, 2003, page 4.

5. Biometric Applications , Independent Biometric Group

6. Biometric Applications, Fingerprint Identification Technology, 2005.

7. Finger print solutions, IBT Inc website.

XIII. Conclusion

Thus it has been seen that biometrics technology has a great potential and is very promising. They can be very attractive for use along with single sign-on systems as both benefits from this. Biometrics systems are going to get more and more common in everyday applications due to the fact that new technologies are rapidly developing and the price and size of the hardware is constantly dropping. When it comes to mobile applications, one could expect to find systems for fingerprint verification and voice recognition in mobile phones in the very near future. Also signature verification is a strong candidate for future mobile applications. After studying the biometric for keystrokes, authentication and identification, all these methods have shown that biometric system being used for identification/verification purposes are a hot topic for research with scope for tremendous innovation and growth. One thing that has been made very clear is that biometrics is a great way of authenticating users.

8. Biometrics for Computer Security and Cryptography, Alper Kanak, June 3rd, 2004.

9. Biometrics for Recognition, Paulo Lobato Correia , 2007.

10. Biometric Authentication- Security and Usability , Vaclav Matyas and Zdenek Riha ,Faculty of Informatics, Masaryk University Brno, Czech Republic,2004.

11. Creating s unique identical number for every resident in India,UIDIA .http: //uidai.gov.in

12. www.homelandsecuritynewswire.com

13. Apple-Press info-Apple announce IPhone-5S, www.apple.com/10Apple-Announces-iphone-5S

14. www.hindustantimes.com/Personsl Tech-Updates/HTC-jumps-on the biometrics-bandwagon/SP- Article-1122839.aspx

15. www.engineersgarage.com

16. www.pctechmg.com

17. www.bankinfoSecurity.com

Encryption: A Key Technique in Internet Security

Anil E.Magare[1], Sheetal R.Thakare[2], K.V.Nimi[3], K.V.S.Ratnakumari[4]

Asst.Professor in Lokmanya Tilak College of Engineering, Koparkhairane-400709

[1]anilmagare@gmail.com, [2]thakare.sheetal@gmail.com,
[3]nimiajit@yahoo.com,[4]kratna158@gmail.com

Abstract:

In today's world the networking plays a very important role in our life. Most of the activities occur through the internet. For safe and secured exchange of data & information network uses proper security. The encryption has very wide applications for securing data. Latest authentication deals with biometric application such as finger print and retina scan. The different strategies of encryptions and their strength are discussed

Keywords: *Encryption, Network Security, Authentication, Biometric*

1. Introduction

Today's global village concept has brought the many unknown people together via electronic media and information technology. Most of the people in today's world are familiar with internet, World Wide Web applications, out of these people 40% [1] of them are still uses the unsafe browsing facility. As we talk about global village, there are many transactions happening each and every second of time, between people & to secure this transacted data using encrypted strategy for security. The concepts of Encryption is very old, as Greek General use to send his message from one place to other place through his messengers using **scytale**, a thin cylinder made out of wood[2], message will written on the parchment, if someone tries to read the message will appear nonsense. But if the other General receives the parchment he has to wrap it on the similar scytale to read the message. Now a days the encrypted technology convert message into decrypted form and maintain security

Why we really worry about our transactions? Do we do it in secure way all the time? Because the internet has so many vast connections, as we do not have control over the activities such as hacking, sniffing, breach of conduct, etc. So what is our solution to this problem? For this, we really need to come up with robust system, the system which is difficult to break!

The birth of Modern Cryptography has taken place in 1970's. "Cryptographic systems are characterized along three independent dimensions, the type of operations used transforming plaintext to cipher-text, the number of keys used and the way in which the plaintext is processed" [3].

On the other hand we have two methods to analyze the cryptography, one is Cryptanalysis and second one is Brute-force attack. These are the independent technique to know which cryptography method is adopted.

2. What is Encryption?

Encryption refers to set of algorithms which are used to convert the plain text to cipher text or the unreadable form of text and provides security to data or information. To decrypt the text the receiver performs reverse operation of the encrypted form.

It has been the old method of securing the data which is very important for the military and the government operations. Now it has stepped into the civilian's day to day life too. The online transactions of banks, the data transfer via networks, exchange of vital personal

information etc. which requires the application of encryption for security reasons.

Whether we really understand what the encryption does in our day-to-day life, but we uses often. As now most of the business completely depended upon the internet for to buy, sell, and transfer money over e-banking system, organize, teleconference, provide various services all need the encryption for safe connection and privacy.

3. Basic Model of Network Security

It requires the some basic structure like,

An algorithm which transforms the important security related activity, A secret data which is used in the algorithm, Building of methods for sharing and distribution of secret data From block diagram shows the network security of original message from third party.

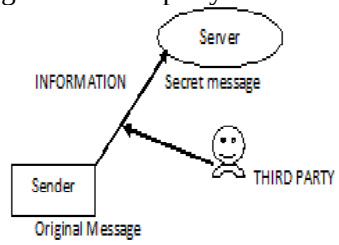


Fig. 1 .Block Dig. of Information security

4. Classification of Encryption

Sending data from source to destination to secure this data using various encrypted key as follows

4.1 Symmetric Key: This key is also defined as single key, it works in encryption as well as decryption strategy.

Types of algorithms for Symmetric Key:

***Stream Cipher*:**
In this case plain text are encrypted one at a time, each bits of plain text are converted into successive varying digits.
Example:

"we are spartans" is written as "ZH DUE VSDUWDQV"

Plain	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
cipher	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C

Fig.2. Caser Cipher

***Block Cipher*:**
Block of plain texts are encrypted, each block has fixed length and unvarying digits.

Example:
"we are spartans" is written as " 25 51 11 24 51 34 53 11 24 44 11 33 34 "

	1	2	3	4	5
1	A	B	C	D	E
2	F	G	H	I/J	K
3	L	M	N	O	P
4	Q	R	S	T	U
5	V	W	X	Y	Z

Fig.3 Block Cipher

4.2 Asymmetric Key

It uses the two different keys for encryption and decryption, public key is used for the encryption and private key is used for decryption. As the symmetric key encryption does not provide much of the security, the importance of the Asymmetric key is more. It s also known as Public key encryption. It has the combination of public key and private key, private key is only known by your computer while the public key is given to other computers with which it wants to communicate securely. As everyone has the public key, but to decode the message one has to use the private key. The combination key is based on the prime numbers, thus it makes highly secure. As many as prime numbers are there, that many keys are available. Pretty Good Privacy (PGP) is one of most public key encryption program.[5]

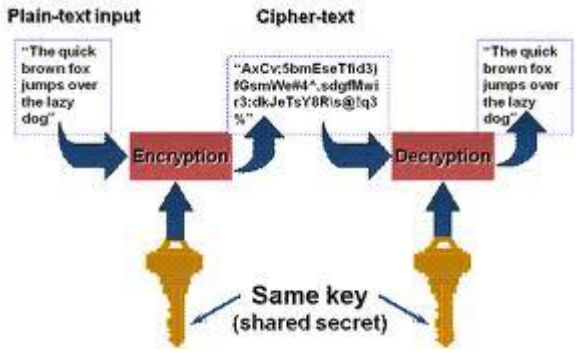


Fig.4 Public Key Encryption Model

Public key encryption can be adopted in large scale, such as for web server and the application to be secure. The Digital Certificate or digital signature gives the authentication between the users. These certificates can be obtained by the Certificate Authority, which plays the role as a middleman for both the users.

4.2.1 Public Key Infrastructure (PKI)

To make most out of the encryption, the public keys must be built to create, maintain, use and distribute, we need the organization known as Public Key Infrastructure.

4.2.2 Certificate Authority (CA)

Without the CA one cannot issue the Digital Certificate, which contains both the public and private key for encrypt and decrypt the data. Depending upon the volume of the identity verification, Certificate Authority can issue Digital Certificate for different level of trust. CA adopts identifying individual rather going by company. To verify individual CA can ask for Driver License as proof of identity. This is only applicable for initial level of trust. For high level trust it can go for biometric information like fingerprint [6].

4.2.3 Registration Authorities (RAs)

It has similar to CAs but RAs are one down to the level of hierarchy. This will work under the CA, mainly to reduce the work load of Certificate Authority. The RA can issue the temporary digital certificates. The temporary digital certificates have limited validity, and not fully trusted, unless CA verifies them completely.[6]

4.2.4 Digital Certificates

These certificates are used to verify the identity of a person or a company through CA. It can also be used to retrieve rights and authority. Some of them have limited access such as encrypt and decrypt. These Digital Certificates can be issued for particular laptops, computers, routers etc. Computers and web browsers have the facility to store these certificates in particular memory.[6]

4.2.5 RSA

It most recognized asymmetric algorithm, the RSA stands for the last names of the inventors Ron Rivest, Adi **S**hamir, and Leonard **A**dleman. They developed this algorithm in 1978, since then it is widely used.

There are other algorithms used to generate the asymmetric keys, such as ElGamel and Rabin, but not popular as RSA, because a large corporation RSA Data Security stands behinds it.

5. Secure Sockets Layer (Ssl) and Transport Layer Security (Tsl)[7]

The encryption is properly adopted for Secure Sockets Layer, it has been first developed by Netscape, SSL is basically meant for internet security protocol used by the web servers and browsers. It became the main part of security known as Transport Layer Security.

SSL and TSL make use of CA (Certificate Authority), whenever browser retrieves secure web page there will an additional ‘s’ after the ‘http’. The browser checks three things while sending the public key and certificate

1. Is that the certificate is valid,
2. Is that the certificate comes from trusted party and
3. The certificate has the proper relation with web site which it is coming from server. While

initiating a secured connection between the two computers, one will generate the symmetric key and sends to other using public key encryption. Then the two computers can have safe communication using symmetric key encryption. Once the session is over, each will discard the symmetric key used for that particular session.

6. Security Attacks [8]

More is the benefits more the risk always. As the more people benefits from the internet, networking the more will be the security attacks too. The attacks may have the proper intention, such as stealing the user names, passwords, credit card details, social security numbers, personal identification numbers, or any others details which can be used and have the benefits and services.
There are mainly two types:
1. Passive attack and
2. Active attack

6.1 Passive attack

It has no harm on system resources, but it tries to learn and makes use of system information. An unauthorized party or a person gain access to the system but eventually cannot modify the content or the data. The pattern of communication is observed and makes use of this information for attack. It is also known as Traffic analysis.

6.2 Active attack

It tries to alter the system resources and also has the adverse effects on their operation. In this attack the unauthorized person successfully gets into the system and has the ability to modify the message, data stream or a file. The attacks may of any kind, replay, masquerading, message modification and denial of service (DoS).

7. Encryption Standards [9]

7.1 Data Encryption Standards(DES)

The most commonly used encryption programs are based on the Data Encryption Standard, which is implemented in 1977 by National Bureau of Standards (NBS), now it is known as Institute of Standards and Technology (NIST). The algorithm which is used for the data is known as Data Encryption Algorithm. It has the key length of 56 bit. It takes the 64bit block data and encrypts using the 56bit key. The possible combination for the 2^{56} is over 72,000,000,000,000,000 keys. It is considered as secured, but as the time passed the speed of the computers increased tremendously. To break this key today's computer can take very short time.

Different versions of DES are Federal Information Processing Standard (FIPS PUB 46), FIPS PUB 46-2, and 3. FIPS PUB 46-3 is revised version and introduced in 1997. The strength of DES depends upon the two things, one is the Key Length and second thing is depended on the nature of the algorithm used.

7.2 Advanced Encryption Standards (AES)

Because of the small key length the DES is no longer considered as safe for today's applications. AES come up with key length 128bit using the symmetric block cipher. It has also different key size as 192bits and 256bits. Rijndael is the algorithm which is adopted in AES.

This AES algorithm is developed by Vincent Rijmen and Joan Daeman. This is chosen over 15 contestants, the contest is organized by NIST (National Institute of Standards and Technology) in 1997, and it took three years to come-up with final winner which survived all the tests. The possible key combination for this algorithm will be 2^{128} is over $3.4x10^{38}$ keys, which is much stronger as compared to DES. To crack the code time taken by the computer will be in years.

8. How The Encrypted Text Look Like?

Below is the sample of encrypted text:

oT8Hj8uA7inuG2tq5YjID5mESlm2F7exsc0X
3fnZRFZhk8YCEpbnDLtOfSAGdK9+cO7/D
b3MFlPJwJCc
AzlCJMElczhvsf2qVAcTDmsMEt3TVQFqol
ayND7cj4ldksCL3JDu83wup6wuYZnw05Qek
Q3MGd3heMpq
k4Yx3211yfV7SEQQoUAlz3Y6TwyzC5UWe
hb0a2dIWils1v6ZGZ1aVzih3AmrK53+JVQ0
pBMj6wbRq/LR
tZvoPNA2qLUZE4o4UTKH5G9ElnqrnxBvt3
WukDcm1BxdwEtTCY9K/7Qq6X8=

Actual Plain Text:

"Encryption refers to set of algorithms which are used to convert the plain text to code or the unreadable form of text and provides privacy. To decrypt the text the receiver uses the "key" for the encrypted text". [10]

9. Applications of Encryption

9.1 Data Protection

The wide application of encryption is in the field of data protection. The data which is there in the computers is invaluable for the person or the company which owns it. Encryption is necessary for safeguarding the data or the information. The common application of encryption is such as files and email encryption. Encryption
protects the stored data on hard disk, the situation like theft of a computer or the attacker successfully hacks in into a system.
The managing the encryption becomes more difficult as the access to the system increases. If the people working in a particular company are more the sharing of the key will be more, hence it reduces the effectiveness of encryption.

9.2 Authentication

It means the proof of identification. As the user wants to login or sign-in, to the system using the user name or ID and password, the details are sent over network using the encryption. This can be verified as soon as the login page appears on the browser, an additional'**s**' will appear next the http. It means it's secured. Whenever we use the online banking for transactions we need to confirm, whether we secured or not by looking into the address bar and a padlock sign at the bottom or in the same address bar of the browser. See fig. 5

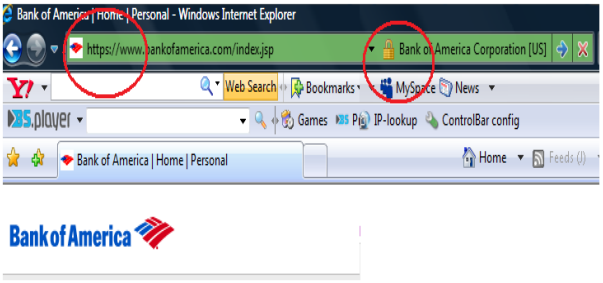


Fig. 5 HTTPS and PAD LOCK in address bar

10. Biometric Authentication [11]

Some of the advanced systems require the biometric authentication. For log in into the very sophisticated laptops it may have face recognition system or the fingerprint scanning. Some of the biometric authentications include,

1. Iris scan (Retina scan)
2. Face recognition
3. Voice recognition
4. Finger print

10.1 Biometric Encryption (BE)

Biometric encryption is the process that binds the PIN or key to biometric. It is not possible to get key or biometric from the stored master file / template. The key can be re-recreated only by producing the live biometric sample on the verification.

The digital key is randomly generated up on sign up; the user will not have the clue about it. The key is completely independent of the biometrics. Once the biometric is obtained the biometric algorithm will attach the key to the biometric securely, and stores as the private template. Once the registration is over both key and biometrics are discarded.

On verification applicant will provide a fresh biometric to retrieve the PIN when it is applied over a legitimate BE template. If the biometric is not correct, then they will not get the PIN for the further application or use. The BE algorithm itself provides the decryption key.

Advantages of Biometric Encryption:

1. No storage of personal data required.
2. No retention of biometric information or the template.
3. Multiple/ cancellable / revocable Identifier
4. No tempering
5. No substitution attacks
6. Improved authentication security

11. Future Scope of Encryption

In today's world the protection of sensitive data is one of the most critical concerns for organizations and their customers. This, coupled with growing regulatory pressures, is forcing businesses to protect the integrity, privacy and security of critical information. As a result cryptography is emerging as the foundation for enterprise data security and compliance, and quickly becoming the foundation of security best practice. Cryptography, once seen as a specialized, esoteric discipline of information security, is finally coming of age.

No one would argue that cryptography and encryption are new technologies. It was true decades ago and it is still true today – encryption is the most reliable way to secure data. National security agencies and major financial institutions have long protected their sensitive data using cryptography and encryption. Today the use of encryption is growing rapidly, being deployed in a much wider set of industry sectors and across an increasing range of applications and platforms. Put simply, cryptography and encryption have become one of the hottest technologies in the IT security industry – the challenge now is to ensure that IT organizations are equipped to handle this shift and are laying the groundwork today to satisfy their future needs [12].

11. Conclusion

The advantages of the networking is tremendous, the applications are vast. It saves the lot of time and energy. It has touched almost all fields, where you cannot say we don't need network anymore. Education, commercial to life saving telemedicine application everything is dependent on networking. To make it happen the services should be reliable and secured. The Encryption serves the purpose all time and every time.

13. References

1. Brian Krebs The Washington Post "Forty Percent of Web Users Surf with Unsafe Browsers" July 1, 2008; 7:00 AM ET
2. http://voices.washingtonpost.com/securityfix/2008/07/40_percent_of_web_users_surf_w_1.html

3. Jeff Tyson *How Encryption works: Introduction to How Encryption works* Available
4. http://computer.howstuffworks.com/encryption1.htm

5. William Stallings *Cryptography and Network Security: Principles and Practices*, 3rd ed. USA: Pearson Education, Inc and Dorling Kindersley Publishing Inc. p. 45, 2006

6. William Stallings *Cryptography and Network Security: Principles and Practices*, 3rd ed. USA: Pearson Education, Inc and Dorling Kindersley Publishing Inc. p. 32-33, 2006

7. Jon Callas *An Introduction to Cryptography* [PDF]. p. 20 Available HTTP: *www.afina-la.com/pdf/pgp/Intro-to-Crypto_F.pdf*

8. Chey Cobb *Cryptography for Dummies The PKI Primer* John Wiley and Sons, 2004

9. Jeff Tyson *How Encryption works: SSL and TSL* Available HTTP: http://computer.howstuffworks.com/encryption1.htm

10. William Stallings *Cryptography and Network Security: Principles and Practices*, 3rd ed. USA: Pearson

13.

Education, Inc and Dorling Kindersley Publishing Inc. p. 29, 2006

11. William Stallings, "*Cryptography and Network Security: Principles and Practices"*, 3rd ed. USA: Pearson Education, Inc and Dorling Kindersley Publishing Inc. pp. 90,150. 2006

12. www.google.com

Susceptibilities in E-Commerce Websites

Supritha Bhandary
Assistant Professor, M.L. Dahanukar College of Commerce
Suprithakr@Gmail.Com, 7208300924

Abstract

We live in a technological era, where E-commerce is inevitable. E-commerce is about conducting business online. Online shopping is drastically different from traditional shopping. The main aim of E-commerce is to make consumer life easier. But as a coin has two sides, E-commerce also has its own pros and cons. Enormous use of online transactions have accompanied by an equal rise in the number and the type of attacks against E-commerce websites. Attackers are using various gimmicks and techniques to find various susceptibilities in E-commerce websites. Common types of third party attacks on E-commerce websites include SQL injection and Ransomware. Latter is popular among hackers. This article discusses these susceptibilities and how to prevent this from reaching your E-commerce websites.

Keywords
E-commerce, Hackers, SQL injection, Ransomware, Susceptibilities

1 Introduction

In today's world setting up one's own website is not difficult but developing websites keeping security in mind is essential. Security has become one of the most important issues and significant concern for E-commerce that must be resolved. [1]

Reasons for susceptibilities in E-commerce websites are web developers do not give importance to secure programming techniques. Every developer wants to complete the website development process with in the deadline given to them and think of implementing the security later on. This lack of security measures lead to susceptibilities and customer will lose faith in e-business if its security is compromised.

2 Susceptibilities

Website security is always a top issue for web admin, but certain types of websites tend to be more susceptible to attacks than others. Because of the nature of their content and the way these websites have been developed without giving prominence to security. The best ways to prevent and combat these attacks are to know the common vulnerabilities that E-commerce systems have. [2]

3 Types of E-Commerce Attacks

There are several types of attacks that a hacker can choose. Some attacks aim at gaining specific information on individuals or companies to do harm. Other types can just shutdown the network so it is inoperable which could cause a business to lose on revenues. Some of these attacks are easily repairable and others can cause significant amount of damage to individuals and to companies.

3.1 Malicious code attack

Malicious code or rogue programming code is introduced into the server in order to gain

access to the system resources. Very often, the intention of malicious code attacks is to cause large scale damage to the E-commerce server.

Viruses

One of the most common types of malicious code attacks is called a virus. A virus is a form of malicious code that will attach itself to a legitimate program. Once that legitimate program is run then the virus can unload its own code, causing damage to the machine. This makes it hard to detect if you are about to download a virus because it is hidden inside of a legitimate program.

Worms

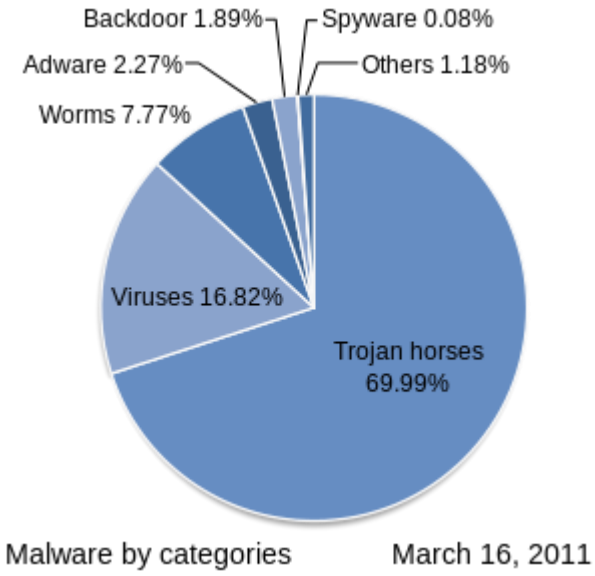
Another type of malicious code attack that can cause mass amounts of damage very quickly is called a worm. Unlike the virus that needs a host file to attach itself to, a worm can be independent and live on its own without a host file; this is what is called a stand-alone program. Also, unlike viruses a worm does not need any human intervention to infect itself onto the computer. It can simply just unload its malicious code when it finds a vulnerable machine. "...worms can shut down parts of the Internet or E-Commerce servers, because they can use up valuable resources of the Internet, as well as the memory and processing power of servers and other computers." Worms are very dangerous because they can copy themselves onto computers and servers all over the world in a short amount of time.

Trojan Horses

A Trojan horse is another piece of malicious code that will cause damage. A Trojan horse works by disguising itself by deleting a legitimate file and consuming that files name, making it hard to detect that you even have a Trojan horse. One type of Trojan horse is the Remote Access Trojans which will give the attacker remote access over the victims computer. Once the attacker gains remote access they are able to control the machine, sometimes without the actual owner of the machine even realizing that there machine has been compromised until it's too late

Logic Bombs

A logic bomb is essentially the same thing as a Trojan horse, however it is set to go off at a certain time or when a certain series of events has occurred. This means that the attacker can set the logic bomb up and have it go off at two totally different times. "Malware is sometimes confused with defective software, which is a legitimate resource unintentionally corrupted by harmful bugs prior to release and undetected by quality control."[3]



Source: International journal of Advanced Research in computer Engineering & Technology volume 2, Issue 2, February 2013

3.2 SQL Injection

SQL injection refers to the insertion of SQL meta-characters in user input, such that the attacker's queries are executed by the back-end database. Typically, attackers will first determine if a site is vulnerable to such an attack by sending in the single-quote (') character. The results from an SQL injection attack on a vulnerable site may range from a detailed error message, which discloses the back-end technology being used, or allowing the attacker to access restricted areas of the site because he manipulated the query to an always-true Boolean value, or it may even allow the execution of operating system commands.

SQL injection varies from database to database, for example in Oracle database, this is done by using the UNION keyword and is much more difficult than on the MS SQL Server, where multiple queries can be executed by separating them with the semi-colon. In its default configuration, MS SQL server runs with Local System privileges and has the 'xp_cmdshell' extended procedure, which allows execution of operating system commands.

3.3 Manipulating Price at Run Time

This is one of the most unique vulnerabilities seen in the online shopping carts and payment gateways. In this vulnerability the total payable price of the purchased goods is stored in a hidden HTML field of a dynamically generated web page.

An attacker can use a web application proxy such as Achilles to simply modify the amount that is payable, when this information flows from the user's browser to the web server the final payable price can be manipulated by the attacker to a value of his choice.

This information is eventually sent to the payment gateway with whom the online merchant has partnered. If the number of transactions is very high, the price manipulation may go completely unnoticed. Repeated attacks of this nature could destroy the number of users to the websites. [4]

3.4 Ransomware

Ransomware is characterized by malware that prevents users, typically through encryption, from accessing their system, file shares or files. After gaining access and control, threat actors hold the data for "ransom" until the user agrees to pay money to regain access to their data. For this reason, we consider data ransomware as a lethal data breach scenario. [5]

3.5 Phishing

Often posing as a request for data from a trusted third party, phishing attacks are sent via email and ask users to click on a link and enter their personal data. Phishing emails have gotten much more sophisticated in recent years, making it difficult for some people to discern a legitimate request for information from a false one. Phishing emails often fall into the same category as spam, but are more harmful than just a simple ad.

3.6 Password Attacks

A password attack is exactly what it sounds like: a third party trying to gain access to your systems by cracking a user's password. This type of attack does not usually require any type of malicious code or software to run on the system. There is software that attackers use to try and crack your password, but this software is typically run on their own system. Programs use many methods to access accounts, including brute force attacks made to guess passwords, as well as comparing various word combinations against a dictionary file.

3.7 Denial of Service (DoS)

A DoS attack focuses on disrupting the service to a network. Attackers send high volumes of data or traffic through the network (i.e. making lots of connection requests), until the network becomes overloaded and can no longer function. There are a few different ways attackers can achieve DoS attacks, but the most common is the distributed-denial-of-service (DDoS) attack. This involves the attacker using multiple computers to send the traffic or data that will overload the system. In many instances, a person may not even realize that his or her computer has been hijacked and is contributing to the DDoS attack. [6]

4 Defending Against E-Commerce Attacks

Enable your firewall:

Firewalls are the first line of cyber defence they block connections from suspicious traffic and keep out some types of viruses and hackers. Firewall acts as a security check point that all communication with your server has to cross through.

Use antivirus/malware software:

Prevent viruses from infecting your computer by installing and regularly updating
Antivirus software

Block spyware attacks:

Prevent spyware from infiltrating your computer by installing and updating antispyware software.

Install the latest operating system updates:

Keep your applications and operating system (e.g., Windows, Mac, and Linux) Current with the latest system updates. Turn on automatic updates to prevent potential attacks on older software.

Protect your data:

Use encryption for your most sensitive files such as health records, tax returns, and financial records. Make regular backups of all of your important data. [7]

Choose a secure ecommerce platform

Development teams and companies might usually decide to build an ecommerce solution from the ground up. Most of the time, this is a bad decision to take as it entails a lot of costs and security risks. Alternatively, when building an ecommerce website, it is faster, easier and less risky in terms of security to use

an existing ecommerce platform on which to base your own.

Request strong passwords from your users

Most of the time the website does not have a lot of control on what passwords a user chooses. Hackers are trained to guess this type of simple passwords through techniques known as social engineering. In order to tackle this problem, you can implement additional validation rules on your sign up forms asking your users to choose more sophisticated passwords that are harder to break. This can be done by getting them to use a combination of upper and lower case letters, numbers, and special characters.

Setup system alerts for suspicious activities

Tracking user activity is very important on any website for analyzing user behaviour, and security purposes. Setting up tracking on specific sections and user behaviours is especially important. For example, your ecommerce platform should be tracking anyone who goes to login or signup to your platform, looking at how frequent their trials are and where the origins of their IP address is. Tracking such information will allow you to detect attackers trying to do brute force attacks on your website such as SQL Injection.

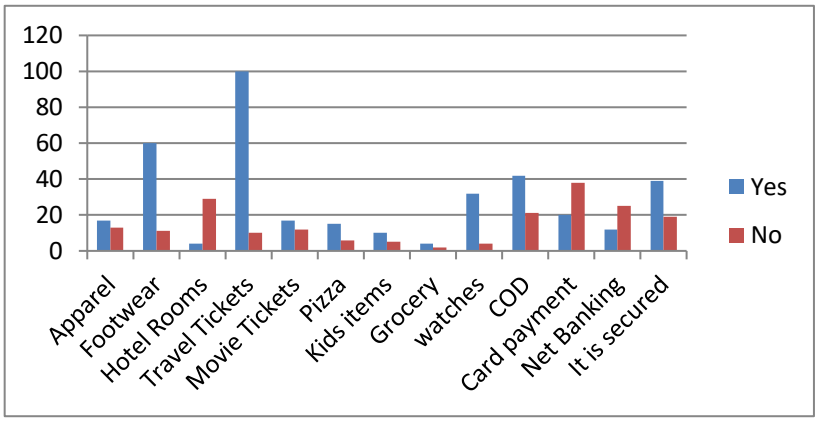
Use tracking numbers for all orders

When selling physical goods you should use tracking numbers for all orders that need to be shipped to customers on your site. It is very important to use a tracking code or number on all packages. This practice is beneficial for combating fraud and identifies theft. Knowing to whom, where and how the packages are being sent is an important step in securing and increasing user trust in your ecommerce website. The tracking of packages will allow you to better identify your customers by confirming their billing and shipping addresses. It also helps in preventing 'charge-back fraud' where a user might say they didn't receive an order, and then demand a refund, when actually they did get their item delivered.[8]

Educate employees. "Cyber attacks are becoming more and more sophisticated and it's easy to be fooled by emails, links and attachments that look like everyday business requests,"

Make sure your hosting company has your back. "Use only trusted providers for your site's hosting," says Troy Gill, manager, Security Research, AppRiver, which specializes in email and Web security. "Make sure they take security seriously. For example, do they use encryption?" [9]

5 Results/ Observations



Source: Bhandary, S, "Security in E-commerce and M-commerce", Millennium: Honouring the past, Treasuring the present and shaping the future, ISBN: 978-81-928786-5-2, pg-14

6 Conclusion

E-commerce has proven its great benefit for the shoppers and merchants by reducing the cost but E-commerce security is still a challenge and significant concern for everyone who is involved in E-commerce. We know that E-commerce business is all about trust and confidence but from the above observations it is evident that most of them feel E-commerce is secured but they are interested in Cash on Delivery than any other mode of payments. Because they feel revealing credit or debit card information is unsafe. Though most of them go for online shopping but they prefer Cash on Delivery. So developers of E-commerce website should consider security as a paramount importance in order to provide highest possible degree of assurance to their customers.

7 References

1. https://www.ukessays.com/essays/computer-science/study-of-attacks-on-e-commerce-systems-computer-science-essay.php
2. https://www.symantec.com/connect/articles/common-security-vulnerabilities-e-commerce-systems
3. https://www.iup.edu/WorkArea/DownloadAsset.aspx
4. http://www.smarte-commerce.com/e-commerce-security-measures/
5. blog.ozon.io/en/3-types-of-ecommere-attacks-you-should-know
6. http://quickbooks.intuit.com
7. https://www.ijarcsse.com/docs/papers/Volume_6/5_May2016/V6I5-0315.pdf
8. https://www.wamda.com/2015/12/7-ways-to-protect-your-ecommerce-site-from-security-threats
9. http://www.cio.com/article/3062336