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TECHNOLOGY, YMCA, FARIDABAD**

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**on Advances in Civil Engineering and Environmental Sciences  
(ACEES-2020)**

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**January 14-15, 2021**

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**Department of Civil Engineering and  
Department of Environmental Sciences**

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YMCA, Faridabad (Haryana)

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# **Advances in Civil Engineering and Environmental Sciences (ACEES-2021)**

*Editors*

**Dr. M. L. Aggarwal,**  
Professor

**Dr. Renuka Gupta,**  
Associate Professor

**Dr. Somvir Bajar,**  
Asth. Professor

**Dr. Vishal Puri,**  
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**Kripa Drishti Publications, Pune.**

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## About the National Conference Organizing Departments

The Department of Civil Engineering at JCBoseUST YMCA started in 2018 with an AICTE approval. The Department is committed to provide the quality education in the area of Civil Engineering to transform students into graduates with high professional values. The department has completed many projects and providing consultancy services to the construction sector. The goal of department is to produce high quality technical manpower to meet the engineering needs of the nation. At present the department is offering UG program and Ph.D. program in Civil Engineering besides assisting in PG program of Energy and Environment.

The Department of Environmental Sciences at JCBoseUST YMCA was established in 2018 by offering two years post-graduate program M.Sc. Environmental Sciences and Ph.D. program in Environmental Sciences. Since 2016, both the programs were part of Department of Humanities and Sciences. In addition to this, the department assists PG program of Energy and Environment and UG programs of Engineering and Humanities departments.

This National Conference on Advances in Civil Engineering and Environmental Sciences (ACEES-2020) sponsored by TEQIP-III, provides a platform of interaction among various researchers and sharing their views.



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## संदेश

मुझे यह जानकर अत्यंत प्रसन्नता हुई है कि जे.सी. बोस विज्ञान एवं प्रौद्योगिकी विश्वविद्यालय, वाईएमसीए, फरीदाबाद द्वारा सिविल इंजीनियरिंग तथा पर्यावरण विज्ञान के क्षेत्र में हुई प्रगति पर चर्चा के लिए 14-15 जनवरी, 2021 को ऑनलाइन राष्ट्रीय सम्मेलन का आयोजन किया जा रहा है। विश्वविद्यालय द्वारा इस सम्मेलन की कार्यवाही पुस्तिका जारी किया जाना सराहनीय कदम है।

सिविल इंजीनियरिंग तथा पर्यावरण विज्ञान आधुनिक समाज के सतत विकास को संचालित करने वाले दो महत्वपूर्ण विषय हैं। विगत समय में पर्यावरणीय तत्वों का मानव द्वारा अत्यधिक दोहन करने से अनेक पर्यावरणीय समस्याएं पैदा हुई हैं। चूंकि विकास समाज की एक सतत प्रक्रिया है, जिसे रोका नहीं जा सकता, लेकिन भविष्य की जटिलताओं को ध्यान में रखते हुए सही दिशा अवश्य प्रदान की जा सकती है। इसलिए यह मंथन करना आवश्यक है कि भावी पीढ़ी की आवश्यकताओं को ध्यान में रखते हुए प्राकृतिक संसाधनों का किस प्रकार उपयोग किया जाए ताकि आर्थिक विकास एवं पर्यावरण सुरक्षा के बीच एक संतुलन स्थापित हो सके।

आशा करता हूँ कि यह सम्मेलन शिक्षाविदों, शोधकर्ताओं, अनुसंधान विद्वानों और औद्योगिक क्षेत्र के विशेषज्ञों को परस्पर संवाद के लिए एक उपयुक्त मंच प्रदान करेगा तथा देश के सतत विकास को गति देने के लिए नये समाधान प्रस्तुत करेगा।

मैं विश्वविद्यालय द्वारा आयोजित इस राष्ट्रीय सम्मेलन के लिए पूरे विश्वविद्यालय परिवार को बधाई एवं शुभकामनाएं प्रदान करता हूँ। साथ ही साथ सम्मेलन की सफलता की कामना करता हूँ।

(सत्यदेव नारायण आर्य)

Web.-<http://haryanarajbhavan.gov.in>

# MESSAGE



It gives me immense pleasure to know that the Department of Civil Engineering and the Department of Environmental Sciences of J.C. Bose University of Science and Technology, YMCA, Faridabad, jointly organising a two-day TEQIP-III sponsored National Conference on 'Advances in Civil Engineering and Environmental Sciences' (ACEES-2021) January 14 and 15, 2021.

The theme of the Conference is very relevant as the integration of Civil Engineering and Environmental Sciences is emerging as the most prominent area of practice among young practitioner worldwide. Civil engineering focuses on the development of structural development while Environmental Sciences solve the environmental issues for sustainable development. The latest innovation and advances in the subject of Civil Engineering has made a drastic impact inside the construction industry which is the most significant factor in accelerating the development of any country.

The Conferences of such kind provide a platform for scholars, researchers and practitioners to discuss interdisciplinary research and practices in their related fields. Also, it encourages research and academic activities in the educational institutions. I am sure that the deliberations of the Conference will prove a step forward in inspiring the students to take more interest in Civil Engineering and Environmental Sciences.

I hope that the participation of eminent speakers from all over the country in the Conference will help the participants to have a meaningful interaction with an opportunity to update their knowledge. I am sure that delegates will find the proceedings highly informative.

I convey my best wishes for the success of the Conference.

**(Dinesh Kumar)**  
Vice Chancellor

# MESSAGE



I am glad to learn that the Department of Civil Engineering and Department of Environmental Sciences of J.C. Bose University of Science and Technology, YMCA, Faridabad, jointly organizing a TEQIP-III sponsored National Conference on Advances in Civil Engineering and Environmental Sciences (ACEES-2021) on January 14 and 15, 2021. The initiative to organise the Conference is indeed laudable as it will provide a platform for subject experts, researchers and industry persons to discuss developments and technological advances in the area of Civil Engineering and Environmental Sciences.

I am sure that the conference will be an ideal forum for engineers, architects, constructors, environmental scientists and managers who have a practical and scientific interest in building a sustainable future, and exchanging ideas and experiences from around the world.

I extend my good wishes for the National Conference and also for the publication of e-proceedings.

**(Sunil Kumar Garg)**  
Registrar



# MESSAGE



The construction sector is developing at a fast pace and the demand for civil engineers keeps on growing for sustainable developments in the industry. The National Conference on “Advances in Civil Engineering and Environmental Sciences (ACEES-2021) on 14-15 January 2020 will provide a platform for scientists, academicians, industry experts and students to present their valuable research outcomes and enhance their knowledge on the themes of this conference.

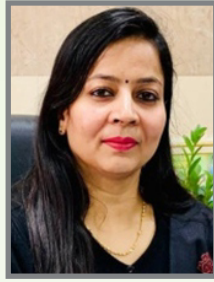
The conference hosts a wide spectrum of themes under Advances in Material and Characterisation, Infrastructure Development, Advances in Energy Efficiency and Conservation and Environmental issues. The exposure to this conference will help the engineers and scientists to discuss their ideas with industry experts and professionals.

I am thankful to everyone involved in making ACEES-2021 a success. I appreciate the contribution of all the speakers from industry and academia. I convey my heartiest congratulations to the organizing team to make this conference possible and successful.

I wish ACEES-2021 a great success

**Prof. M L Aggarwal**  
Dean FET and Chairperson  
Civil Engg. Department

# MESSAGE



It gives me immense pleasure and joy to welcome all distinguished dignitaries and delegates in Two days National Conference on “Advances in Civil Engineering and Environmental Sciences” (ACEES-2021) during 14th - 15th January 2021 at J.C. Bose University of Science and Technology YMCA Faridabad.

The key goal of the conference is to provide a platform for deliberations and exchange of views and ideas among professionals, researchers and students in areas such as Energy Efficiency and Conservation, Disaster Management, Pollution Monitoring and Control, Conservation of Natural Resources, Computational Techniques and Artificial Intelligence, the advances made during Pandemic Covid-19 and many more. I am sure that the conference would motivate the participants to initiate and introduce new research activities for the future technological world in a sustainable manner.

I convey my heartiest greetings to the resource persons and delegates. My sincere thanks to all those who have been associated directly and indirectly in the organisation of the conference.

We look forward to your whole-hearted support and participation to make this conference a success.

**Dr Renuka Gupta**  
Chairperson  
Environmental Sciences Department



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THEME-1

ADVANCES IN MATERIAL  
DESIGNING AND  
CHARACTERISATION



# SIGNIFICANCE OF QUALITY AND SKILL UP-GRADATION IN CONSTRUCTION INDUSTRY

Amarjeet Singh

Deputy General Manager-HSE, Ahluwalia Contracts (India) Ltd, Delhi

**Abstract:** The construction industry in india is the second largest employer after agriculture, providing employment to about 33 million people. intelligence and skill are the most sought-after work traits in this fast-growing industry. There is a need to complete projects at reduced cost, coupled with speed and safety. this in turn demands a drastic increase in productivity of men and machines, which can be achieved only by imparting intensive training to workmen and equipping them with the required knowledge and skills in construction.

qualitative delivery of end product has become challenging task now a day as this paper focuses on significance of quality and up-gradation of skill through workmen on the job training in construction industry.

**Keywords:** Skill, quality, construction, employment etc.

## 1.Introduction

Construction boom in the country with mega projects in housing, commercial and infrastructure development sector using:

- ✓ Modern technologies.
- ✓ Modern management techniques.
- ✓ Appropriate Mechanization.
- ✓ Professional supervision to ensure quality and prevent cost/time over runs.
- ✓ Competitive /major construction agencies
- ✓ Growing sophistication and complexities of works.
- ✓ Introduction of new materials in construction industry.
- ✓ Increased aspirations of the users.



## 2. Concept of Quality

We must understand the meaning/ concept of Quality. It is fitness of product or service to meet or exceed its intended use as required by the customer. Quality of design is stringent conditions that product or service must minimally possess to satisfy codal and stated requirement of customer. Optimum design is one which maximizes and optimizes the requirement of quality, economy and safety.

Quality of conformance implies that the finished product or service rendered meets the standard selected at the design stage. Encompasses the selection of quality materials, workmanship as per standards laid down and inspections / tests.

Quality of performance concerned with how well the product functions or service performs when put into use which indicates level of user's satisfaction

**Quality perception** is often confused with specifications and superior finishes. Structural stability and structural safety often ignored.

**Quality control** is necessitates fixing responsibility, charter of duties and fixing control points at stages of construction. It is continuous process & needs to be performed on day to day basis with aim to prevent rather than detect defects.

**Quality assurance** comprises laying down the quality policy, fixing the acceptance standards, analyzing the feedback and regular monitoring the quality. It is responsibility of all stake holders (client/construction agency) and also client should define the requirements clearly in well- defined terms.

### 2.1 Factors Affecting the Quality of Works

Quality to be visualized from project inception and seen through the execution/ completion of project. Totality of design, materials, construction techniques and **workmanship contribute to quality of end product**. Design to cater for Codal provisions, Seismic provisions, Local civil bye laws to ensure safe, strong and durable construction. Skilled manpower like site engineers / tradesman also important factors to considered. Quality of concrete design mix from reputed labs. Non-destructive testing facility (rebound hammer/ ultrasound pulse velocity test).

#### 2.1.1 Need of training

- The industry is today smarting under a nearly 30 per cent labour shortage. The domestic construction sector, including real estate, is estimated to require 33 million skilled and unskilled labourers per day, while the availability is hardly 23 million, as per Credai estimates. In the construction industry, particularly in a developing country like India, the workers play critical role, both, in terms of the impact on the process of construction and, by the virtue of the large number of workers employed, on the total employment scenario in the economy.
- Skilled Workers changing the Skyline of the Nation such trained technicians are deployed at various job sites across the country. They work along with their peers and attain expertise in respective trades over a period of time. Indeed these trained workers attain more than the required skill standards in the shortest time possible and contribute to changing the skyline of the nation. A widespread training

program that can successfully upgrade the skill levels and contribute to the personal development of worker, benefits everyone. The product sector of course benefits if its products are installed / used well; the consumer benefits because they get better value for the money; and the worker benefits because better skills can translate into, direct economic benefits as well as improved status in the society.

- A system to develop and support a category of workmen that are skilled in workmanship, are professionally capable and can ensure quality and efficiency, can contribute much to overall development and growth in the industry and of the nation
- Moreover, the effect of globalization has enabled the Construction industry adopt latest technologies in both the materials used and the methods of construction thereby resulting in a growing demand for world-class quality in workmanship.

### **2.1.2 Repository of All Technical Knowledge**

Keep abreast with the Pace of changes in construction Techniques/ Materials. Form Committees to draft Codes on a variety of issues in Built Environment on the lines of IRC/BIS Codes. Representatives are from Govt., PSUs, Contracting Firms, Academicians and Retired experts in the field. Publish & validate technical literature/books like the one on fire fighting - numbers should be at least one in every quarter to begin with.

### **2.1.3 Policy Maker**

Reach out to policy maker for recognition of the efforts. invite references to address / analyses typical construction problems / issues in practice.

## **3. Skill Upgradation Objectives**

- ✓ To train the construction workforce to meet the challenges and demand for world class construction skills in terms of safety, quality of workmanship and time.
- ✓ To identify the training needs of construction workforce and set standards to monitor their occupational competencies and the technical skills deployed in the industry.
- ✓ To disseminate knowledge and appropriate skill practices through recognized systems of training, testing and certification to validate competency levels.
- ✓ To facilitate training by setting up modular training schools with well-defined infrastructure and curriculum.
- ✓ To serve the social objective of the organization through channelizing the potential and strength of rural youth in India, for producing trained construction workforce who are capable of delivering world class standards

### **3.1 Career Progression Plan**

- ✓ Training Programme design using the modular approach allows for continuous assessment of achievement and recognition at each stage of training. Trade Competency Tests at all levels are conducted at periodical intervals to determine the knowledge and skill standards attained.

- ✓ Technicians who successfully complete the training to the standards required under the continuous assessment programme are awarded the respective trade certification.

### 3.2 Who needs to be trained?

We know that if any training / skills up-gradation program that is being implemented is to deliver results and address the concerns in reasonable time frame must plan to train for both –

#### A. Skilled / Semi Skilled

Workers already involved in trades / installation / use of products that require skills. The training programs for these will

- ✓ Stress on up-gradation of skill to minimum accepted standards
- ✓ Develop basic professional, interpersonal and behavioral skills.
- ✓ Be of short duration

#### B. Unskilled / Fresh

Workers that have no or little previous experience on construction trades that require skill. The program for these will

- ✓ Impart training on the basic trade
- ✓ Involve wider exposure to other related trades and practices in construction.
- ✓ Be more extensive

### 3.3 Initiative by Construction Companies

- ✓ ACIL understand and believes that Improved and consistent quality of workmanship in installation and use of construction products and equipment is essential. If the basic goals of ensuring the quality of the final delivered and installed products and improved overall efficiencies in the industry, are to be met, it is necessary that:
  - ✓ This is one of the initiatives that ACIL is unrolling to overcome the problem of shortage of skilled labour in the Indian construction industry.
  - ✓ The consumer is made available a category of workmen that are trained in workmanship, are professionally capable and can ensure quality and efficiency.
  - ✓ Make it possible for the user to distinguish the trained worker by certifying the worker and developing a Brand for the trained worker
  - ✓ We create the context that will sustain motivation in the trained worker; develop his interest in continuing to deliver quality; and benefit from working better.
  - ✓ We promote the correct use of quality products.

### 3.4 Training the Trainers

---

Experienced personnel from construction job sites in respective trades are drafted and professionally trained to deliver instructions, assisted by experienced workers to demonstrate field practices. Such trained persons are eventually posted to effectively impart trade training.

### Modalities

- ✓ The centers have Model rooms/space, Classrooms, Practical Training Area, QA/QC Labs & Safety Parks integrated at one location.
- ✓ On the job training on Masonry and Shuttering on the basis of DGET Syllabus being imparted.
- ✓ Comprehensive Training Manuals have been compiled (in Hindi & English) for training of Masons, Shuttering Carpenters and Supervisors.



### On the Job Training



### Classroom Training





#### 4. Conclusion

A common, nationwide accepted system for training and testing of skills is essential as the first step to break this cycle. An accepted system that is accepted by the industry and the users will make it possible to start country wide programs to train workers that will be recognized. Ultimately, only when it is possible for the common user to start recognizing and demanding a trained worker; the worker community to derive benefit and be willing to get trained, that wide spread improvements in the industry will be made possible. Considering the recent changes in the market and increasing user expectations, we believe that the environment is ready to accept the trained worker, provided we can setup a working system to address the above issue. We also propose that stress is equally laid on the first type of worker - skilled / semi -skilled, since this consists of an already existing large pool of workers with varying levels of skills. Bringing a greater degree of consistency in their working on various trades will yield faster results in the market and to the people's lives. In time, or as dedicated institutes are ready to take this on, more training programs for fresh workers can also be started. The idea of developing a brand for the trained worker seeks to address both the above issue in a manner that it creates value for all the stake holders:

- ✓ The common brand would help create wider awareness about the benefits of using trained worker and would enable the user to recognize and distinguish the trained worker.
- ✓ Create the context that will sustain motivation in the trained worker; develop his interest in continuing to deliver quality; and benefit from working better
- ✓ Bring together those that have an interest in training of construction worker and get them to train under the common identity.

# TECHNICAL SOLUTIONS FOR ENVIRONMENT PROTECTION AND SUSTAINABLE DEVELOPMENT

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## ABSTRACT

Anthropogenic activities like urbanization and industrialization result in tremendous loss to natural environment. Our everyday lifestyle affects the environment. It not only causes global warming but also depletion of natural resources and ecological imbalance. We have driven thousands of plants and animals species into extinction. Having ecosystems and keeping them intact is important not only for the organisms who live in them but also for us. This paper mentions technical solutions for enhancing environment protection and moving towards sustainable development. Many factors that deteriorate the environment are mentioned with possible solutions.

## INDEX TERMS

Internet of things (IOT), Artificial Intelligence (AI), environment, sustainable development, e-waste management, smart city.

## INTRODUCTION

We know that environment plays a very important role in human survival but we are continuously adding waste to it. E-waste is one of them which comes from useless electronic devices. Large quantity of e-waste containing lead and mercury is released in the name of technological upgradation. We switched from large sized desktops to small laptops and disposed desktops. Similarly tungsten bulbs were replaced by florescent bulbs which were again replaced by incandescent bulb. Such human activities deteriorate the environment. Construction activities too are hazardous for the environment. With latest technologies like IOT, AI we can help improve the environment. Keeping in mind our future generations, we must move towards sustainable development.

## LITERATURE REVIEW

Piotr Nowakowski, Krzysztof Szwarc, Urszula Boryczka, focussed on e-waste collection in order to maintain environmental hygiene by devising ways to effectively collect waste generated by electrical and electronics companies and residential areas by using software system that used route optimization using Harmony search algorithm which proved to be better than other AI based algorithms of that time. They presented a new design of constructing vehicle body to increase efficiency of waste parking and loading, hydraulic lift was used in rear side of vehicle which provided convenient loading of waste from both the sides of vehicles. This method was used in areas having time and space constraints with parking areas. Waste collection companies used mobile apps and internet applications to plan effective ordering facilitate



best waste pickups. They have mentioned the future works to categorize the e-waste to compare loading and handling times [1].

Authors of [2] used IoT and wireless sensor networks for effectively managing waste. Location was tracked in real time and continuous monitoring of bins was done that resulted in clean and green environment. Optimized path for garbage vehicle was calculated to minimize cost using ‘IoT based waste management for smart cities.’

Authors of [3] said that IoT is boom for construction industry as it not only minimizes time and resources but also the injuries. They used scientific mapping tools to find association of IoT and construction industries and rank various research areas in IoT to adopt IoT and digital technologies in construction. They analyzed techniques of many peer reviewed journals and found out that IoT can be used to build smart object and buildings and sustainable development was the main research focus. The advantages of IoT mentioned by them were: high reporting speed, complete process control, data explosion leading to deep data analysis, strict ethical and legal expectations. IoT proved helpful for research, government and construction companies.

Yi Yang, JieLi ,analyzed the direct and indirect effect of urbanization on PM2.5 concentration. Spatial durbin model, spatial lag model, entropy right model and spatial error model proved very effective to determine relation between the two. While social, land and ecological urbanization had negative impact on urbanization, economic urbanization had the most positive effect. This study was conducted in china, so they suggested some policy measures for china’s air governance and sustainable urban development [4].

Authors of [5] emphasized that AI techniques were used to detect and classify medical images of covid-19. They applied several filtering and scanning stages, then taxonomy was performed followed by deep analysis and critical review. They said that 3 future challenges will be encountered if evaluation and benchmarking will be conducted like multiple evaluation criteria within each classification task, tradeoff amongst criteria and importance of each criteria.

Authors of [6] explored the role of robotics in Sustainable development. Robotics having advantage of high precision and computing power optimizes energy and material resources which are limited. They have mentioned various ways in which robots can improve the environment:

1. Robots can detect the type of plastic in waste materials and recycle it.
2. Robots can minimize industrial and agricultural waste
3. Using robots in production methods results in less pollution by products.
4. Robots can repair malfunctioned electronic wastes.
5. Robots can monitor soil, plants and animals and can cultivate and harvest crops.
6. Robots are very useful in improving health by monitoring air and water quality.

Eunika Mercier-Laurent, worked on advantages of AI for making a balance between sustainability and development. They have emphasized that ICT helps in building smart cities by building integrated and reusable solutions for dealing with scarcity of raw materials. Sensors and embedded software are used as

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they increase interaction between objects contribute considerably towards the environment. AI is now combined with knowledge management to make intelligent techniques for reusable systems for city management. Knowledgebase is developed using experience from already built smart cities to avoid developing from scratch and thus save resources. They emphasized that principle of modularity, reusability, and genericity must be used combined with knowledge management approach to develop effective city management and save the environment in sustainable manner [7].

### **Harmful effects of anthropogenic activities on environment**

1. Deforestation: Trees are being cut recklessly which leads to loss of habitat of plants and animals. It reduces rainfall and ground water, leads to soil erosion, less fertility, lack of vegetation and desertification. It eventually causes global warming.

2. Pollution: industries and automobiles emit lot of pollution which is major cause of greenhouse effect which causes global warming and acid rain.

3. Depletion of fossil fuels: We have limited supply of coal, oil, petroleum, natural gas but its usage is indiscriminate. The day is not far behind when we will completely deplete these resources.

4. Climate change: global warming means rise in overall earth's temperature which causes climate change.

### **Harmful effects of construction on environment**

1. Materials: Construction materials like wood, steel, copper, glass, metals, polymers etc. come directly or indirectly from the environment, that too in huge quantities for which ecology gets disturbed and negatively impacts the environment.

2. Energy: To meet the energy requirements in construction we take the help of non-renewable energy resources like coal, petroleum, natural gas which not only depletes them but also causes pollution and thus, global warming.

### **Use of IoT in improving the environment**

1. Using IoT for efficient waste management: Thanx to wireless sensors we can know in real time the exact amount of waste in container, it's inexpensive and has no ecological footprints. Using proximusIoT, sensors battery can last upto 10 years. So, we can check exactly amount of waste in all containers in a city, and can optimize waste management by sending collection vehicles to only those places where it is absolute necessity. It will thus increase efficiency and reduce fuel use.

2. Applying IoT for agricultural sustainability: IoT devices are installed in farm fields where it measures temperature, rainfall, wind direction and speed, solar radiation, soil temperature, moisture, PH. It sends this data to cloud servers which analyses this data and sends back to the device which is also capable of doing suggested automations.

3. IoT for species protection: IoT is being used in forests of South-Africa for Rhino protection which are on the verge of extinction. IoT devices are installed in forests to track poachers and stop them.

4. IoT for cleaning air: IoT can help in making a proper air flow making it pure and thus, can curtail the spread of coronavirus through air. It can be implemented by making proper use of sensors.

5. IoT for water preservation: IoT system keeps track of water usage and notifies whenever there is water leakage. So, it is crucial for water harvesting.

### **Use of AI in improving the environment**

1. Better conservation of natural resources: Satellite imagery, sensors and machine learning can be combined to reduce water usage and determining soil health.

2. Earlier pollution detection: With the help of self-organizing mesh networks and machine learning we can predict pollution at earlier stages and take timely actions for betterment.

3. Accelerating sustainable options: By combining advanced forecasting models with cognitive self-learning capabilities, a Vermont-based power company is developing a more precise, automated renewable energy forecast for solar and wind power.

### **CONCLUSION**

As we are heading towards industrialization and urbanization, we are harming mother Earth which is going to have detrimental effect on mankind. It is we who have imperiled the environment, so only we must find out ways to conserve the nature. Thanks to the technology we can contribute towards goodness of the environment. So, it is high time to come together to find ways to protect the environment and preserve it. Activities that harm our environment and technical advancements that can curtail that harm have been presented in this paper. With the latest developments in the field of IoT, AI, sensors, computational devices we can upgrade our environment qualitatively and contribute towards well-being of mother Earth.

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# GREEN BUILDING AND SUSTAINABLE MATERIALS

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**Abstract:** Sustainability has become the most important challenge for the building and construction industry, not just for the present, but also for the decades to come. Scientifically-based solutions should drive technological innovations that enable compliance with the still-growing environmental constraints. Energy, constructed climate and warm buildings are intently inter-related. The uncommon development in building area because of development in populace and improved warm places principles prompts more essential energy utilization and subsequently expands the greenhouse gas (GHG) outflows to the climate. Research in this particular field of interest is advanced from the physical, chemical, biological, lifecycle assessment, engineering, and materials science perspective, often leading to synergistic approaches. Research on alternative binders, sustainable building materials, energy storage technologies, phase change materials, functional nanocomposites, recycling, reuse of industrial wastes and by-products, use of natural biomaterials, self-healing materials, CO<sub>2</sub> and energy reductions, etc defines the cornerstones of this particular field. In this study, the present-day green building initiatives, ratings and certification procedures in India is also discussed.

**Index Terms-** Green Building, Sustainability, energy consumption, ecosystem, GHG.

## 1. INTRODUCTION

Green building is an idea consolidating a wide range of arrangement and best practices. It is a result of plan reasoning which accentuates on ideal usage of assets and builds the productivity of asset use [2].

Green structure likewise alluded as supportable structure is the act of making structures and utilizing measures that are earth dependable and asset effective all through a structure's life-cycle: from sitting to plan, development, activity, upkeep, redesign, and deconstruction [2]. This training extends and supplements the traditional structure configuration worries of economy, utility, toughness and comfort. The fundamental goals of these types of structures are-

- Efficient usage of Energy,
- Controlled Water Resource requirement
- Reduction in waste, better waste management, pollution and environmental destruction
- Improvement of productivity of an employee, Protecting resident's health.

Conventional building materials produced using non-renewable assets are the fundamental wellspring of indoor air toxins, whose effect can stretch out from inside to outside. Given their

practical turn of events prospect, green structure materials with non-poisonous, common, and natural mixes can possibly diminish their general effects on ecological and human wellbeing [2]. The pervasive grey building in urban areas comprising of impenetrable structures, paving and different buildings contributes in general to the intensifying of the metropolitan atmosphere through an absence of versatility and adaptability. Accordingly, the significance of metropolitan green framework is identified with the improvement of social anxieties, which are interwoven with actual phenomena in urban communities [1]. Contemporary issues identified with grey framework incorporate its maturing and the requirement for support, alongside the overall acknowledgment that traditional foundation arrangements are frequently lacking and insufficient. The incorporation of Nature-based solution in new and creative systems can address such issues as water quality while at the same time conveying extra advantages. These advantages are indispensable to advance parts of practical improvement introduced in a 2018 United Nations report which expresses that '... upscaling (of) Nature-Built Solutions will be key to accomplishing the 2030 Agenda for Sustainable Development' (WWAP 2018) [3]. According to Langergraber et. Al. an ecosystem framework that targets limiting waste and benefiting as much as possible from resources. In this circular framework, asset input and waste, outflow, and energy spillage are limited by easing back, shutting, and narrowing energy and material circles in [4][3].

The environment built is liable for enormous negative environmental effects due to some extent to the huge measure of materials utilized in development. Simultaneously, development and destruction exercises bring about tremendous measures of materials being covered, consumed, and unloaded. It is basic consequently to dissect the effect of building materials obtaining, use, and change on the biological systems individuals possess and depend upon for prosperity [5]. Normally, this is analysed as far as material use, energy use, and emanation of poisons including ozone harming substances. The effects different materials have on unpredictable and interconnected organizations of environment administrations are once in a while thought of [5][6].

### **1.1 Green Buildings**

Green structure alludes to both a structure and the processes of application that are environmentally capable and asset effective all through a structure's life-cycle: from wanting to plan, development, activity, support, remodel, and destruction. Green structures have both substantial and insubstantial advantages [9]. Most significant advantages are decrease in energy and water utilization [1][2]. Green structure ventures empower the utilization of reused and recycled material in this way lowering the effect on climate. Green structures address the main public needs which incorporate water preservation, treatment of customer squander, energy protection, protection of assets like wood and lesser reliance on utilization of energy escalated constructing materials. These buildings energize utilization of water in a self-reasonable way. Green structure limits energy utilization through energy effective artificial lighting frameworks, cooling frameworks, engines, siphons and so on and utilizing sunshine. The utilization of energy productive machines prompts 20 - 30% generally energy sparing [2]. Wellbeing, prosperity and comfort are most significant part of green structure. Subsequently the green structures guarantee utilization of most extreme day lighting and



characteristic ventilation. The CII-Sohrabji Godrej Green Business Centre in Hyderabad in Fig. 1.1 was one of the first commercial buildings in India to have a green roof. There are more other green buildings in India such as ITC Green Centre, Gurgaon and ITC Maurya, New Delhi, etc.



Fig. 1.1 Sohrabji Godrej Green Business Centre



Fig. 1.2 ITC Green Centre, Gurgaon [21]

There are many sustainable technologies which are being adopted now-a-days. For example- (i) installation of Green Roofs, [7] (ii) Using Brownfields (In 1998, the EPA issued a report entitled “Characteristics of Sustainable Brownfield Projects,” focusing on the reuse of land as smart growth strategy.) [11][8], (iii) Xeriscaping (It focuses on native or naturalized vegetation with low water needs.) [12], (iv) Fenestration (It includes all intentional visual or actual openings in a building envelope, particularly in exterior walls, including doors and operable glass walls, etc.), (v) Trombe Walls (Used for passive solar gain for which wooden frame is added in the walls during construction) [10], (vi) Solar Chimneys (Used for improving the natural ventilation of buildings by using convection of air heated by passive solar energy). [13].

## 1.2 Green Building Ratings

Green structure rating or affirmation frameworks widen the concentration past the item to think about the venture in general. Rating frameworks are a kind of building affirmation framework that rates or rewards relative degrees of consistence or execution with explicit ecological objectives and necessities [14]. Rating certification systems and rating systems can be changed frequently. All green structure rating frameworks are intentional in nature. Despite the fact that energy productivity is a significant segment of planning a green structure, a few other essential manageability necessities likewise should be met prior to guaranteeing the structure is green.

Perceiving that waste management and energy productivity are significant issues in building area, National Housing and Habitat Policy was formulated by Government of India in 1998 [15]. In 2001, Indian Government instituted the Energy Conservation Act (EC 2001) to advance energy effectiveness and preservation. This demonstration prompts the development of Bureau of Energy Efficiency (BEE), under the Ministry of Power in 2002. The Act additionally approves BEE to set up an Energy Conservation Building Code (ECBC). The Bureau of Indian Standards (BIS) distributed National Building Code in 2005. It is basically centred around underlying wellbeing

and other plan issues of the structures. Be that as it may, it didn't cover the energy effectiveness issues of the structures. In 2007, BEE comes out with Energy Conservation Building Code (ECBC) in India. It is as of now intentional for private organizations however obligatory for government possessed structures.

### **1.1.1 Energy Conservation Building Code (ECBC)**

The Energy Conservation Building Code was developed by the Govt. of India for new commercial buildings on 27th May 2007. The purpose of Energy Conservation Building Code (ECBC) is to provide minimum requirements for energy-efficient design and construction of buildings and their systems. The building sector represents about 33% of electricity consumption in India, with commercial sector and residential sector accounting for 8% and 25% respectively. Estimates based on computer simulation models indicate that ECBC-compliant buildings can use 40 to 60% less energy than conventional buildings. It is estimated that the nationwide mandatory enforcement of the ECBC will yield annual savings of approximately 1.7 billion kWh. The ECBC is expected to overcome market barriers, which otherwise result in under-investment in building energy efficiency. The ECBC was developed as a first step towards promoting energy efficiency in the building sector. The ECBC is the result of extensive work by the Bureau of Energy Efficiency (BEE) and its Committee of Experts [16].

### **1.1.2 Green Rating for Integrated Habitant Assessment (GRIHA)**

This rating is developed by The Energy Resource Institute which is abbreviated as TERI and accepted by Ministry of New and Renewable Energy (MNRE), Government of India to advance and regulate green structures in India. GRIHA was received as the National Rating System for Green Buildings in India by MNRE in 2007 [18]. GRIHA assesses the ecological presentation of a structure comprehensively over its whole life cycle and its biological/ecological effect of structures and living space. GRIHA takes a shot at the hidden principle of "What gets estimated gets overseen" [17][18].

### **1.1.3 Bureau of Energy Efficiency (BEE)**

Recognizing the fact that efficient use of energy and its conservation is the least-cost option to meet the increasing energy demand, Government of India has enacted the Energy Conservation Act, 2001 and established the Bureau of Energy Efficiency in March, 2002 [15]. The Act provides for institutionalizing and strengthening delivery mechanism for energy efficiency services in the country and provides the much-needed coordination between the various entities [15].

### **1.1.4 Leadership in Energy and Environment Design (LEED)**

It is an internationally recognized green building certification system, providing third-party verification that a building or community was designed and built using strategies aimed at improving performance across all the metrics that matters the most [20]. Developed by the non-profit [U.S. Green Building Council](#) (USGBC) it includes a set of rating systems for the design,

construction, operation, and maintenance of [green buildings](#), homes, and neighborhoods which aims to help building owners and operators be [environmentally responsible](#) and use resources efficiently.

## CONCLUSION

Utilizing a biological system administrations way to deal with materials choice should be considered as one piece of a bunch of rules that remembers the effect of materials for wellbeing of human, carbon, the energy, and water in material, how the utilization of materials in explicit plan setups sway water, energy use, and greenhouse gas emanations during the life of the structure, waste and contamination suggestions, the shortage of the material or its constituents; and other lifecycle issues.

In this review we have covered green building designs which are sustainable in nature. They consume less energy and water during construction as well as when in use. Since they make use of solar energy, for that solar panels are installed. The cost of installing a solar panel may be very high but it gives minimal economical value annually.

Also, Trombe walls are very successful in extreme cold regions because they use such materials which costs low but their value is high. Apart from this the ratings of such buildings depends upon many factors such as environmental effects and its sustainable principles of design [19]. A building posing effects which are harmful for the surroundings can't get a certificate rating. The criteria must be matched in order to get rating certification. These ratings provide a standard for all the climatic areas of a country. They must have a socio-economic and socio-cultural regulations accompanied by the scope of the address to the climatic conditions of the country.

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# Comparative Study of Soil Properties Mixed with Groundnut Shell and Coconut Shell Powder: A Review

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**Abstract:** The soil below and around it must play an important role in ensuring that any foundation can perform its function effectively. Thus, the prior knowledge of the soil property and their behavioral factors is needed. The construction cost increases if the soil is used with poor properties. The properties of poor soil can be improved using the soil stabilization mechanism. Various methods of soil stabilization from ancient times to the present day have always been used since ancient times up to now are a very effective, economical and popular method for improving soil properties in construction. In India, about 16% to 20% of the ground area is covered by large-scale soil deposits. This paper provides the enhancement and better stability for the civil engineering structure can be obtained.

**Index Terms-** soil, properties, stabilization, effective, construction

## 1. INTRODUCTION

Soil stabilization is the change in the properties of soil in such a way so that enhanced and improved quality of soil can be obtained. The stabilization process can amplify the shear strength of a soil and also control the soil's shrinkage properties, thereby increasing its load capacity to support pavement and foundations. The stabilized soil can also be used in many cases that are not suitable for roads, parking areas, land development projects, airports, and sub-soils. Stabilization can be used to treat a variety of sub-types, ranging from wide-grained to granular materials. The process of stabilization is completed by using a variety of supplements, including lime, fly ash waste material powders and many more.

Soil stabilization aims to increase the strength of soil by adding water content that helps to attach soil particles to one another. The simplest way to stabilize soil is the compression and drainage as water drains out of the soil, it becomes stronger. The other process is to improve particle size and can be further improved by adding adhesive in weak soil. Soil stabilization can be accomplished in several ways.

## 2. LITERATURE REVIEW

**Oluwafemi et al. (2019)** have used coconut shell powder as a mixing agent to measure the soil properties of Ado Ekiti soil. The soil sample has been collected from borrow pits and later on treated with coconut shell powder in different percentage ranges from 0% to 10% in the gap of 2%. The tests such as specific gravity, consistency, CBR test compression test, distribution test, and permeability test have been performed on the soil sample. The results show that MDD and OMC have increased with the increase in the stabilizing agent and then decreases after 8% of coconut shell powder.

**K.Venkatraman et al. (2018)** have conducted a survey on different means of soil stabilization. Groundnut shell ash is mixed with the soil and acts as a soil stabilizing agent. The groundnut shell ash has been used



in different percents such as 5%, 10%, and 15% respectively in order to determine the effective percentage. From the test results, it has been determined that groundnut shell ash and cement provide the optimum moisture content. Also, a small decrease in the dry density as well as in the modulus of elasticity of soil has been examined.

**A. Parvathy Karthika (2018)** has conducted research on stabilizing soil using groundnut shell ash. The ash has been obtained by burning groundnut in an open environment for approximately 4 hours. The groundnut has been mixed in different percentages varies from 2%- 12% with a gap of 2% and hence analysed the optimum percentage of groundnut shell ash. The index properties such as liquid limit test, shrinkage test, free swell along with specific gravity have been performed. It has been concluded that after the addition of 6% of groundnut shell ash optimum soil stabilization has been obtained.

**A.T.Manikandan et al. (2017)** have used coconut shell powder along with bottom ash as a stabilizing material to increase the properties of soil. Optimum moisture content, dry density, and strength have been examined and it has been shown that the coconut shell powder with bottom ash enhances the soil properties.

**Kumar et al. (2018)** have experimented stabilization of “Black cotton soil” by adding marble dust and coconut shell in the form of powder. The percentage of adding marble dust has remained constant (10%) whereas the percentage of coconut sell powder has been changed and varied from 5 % to 20 % with an interval of 5 %. The performance of the soil has been measured in terms of UCC and has been observed after 5, 10 and 15 days. It has been observed that the UCC increases with an increase in the curing period.

**James et al. (2018)** have utilized waste materials such as Bagasse Ash and coconut shell powder, which is the waste product achieved from the sugar industry and oil extraction industry respectively. The stabilization procedure has been obtained by adding Bagasse ash and coconut shell powder in different percentages such as 0.25, 0.5 %, 1 %, and 2 % respectively. The tests such as UCS, swell shrink, plasticity and microstructure have been conducted on expansive soil. From the experiment, it has been analysed that Bagasse ash in addition to lime stabilization performed better compared to coconut shell powder while enhancing the above-defined soil features.

**Onyelowe (2017)** have used Coconut Shell- Husk Ash for the stabilization of soil by keeping ordinary Portland cement percentage constant. The soil has been collected from Nigeria and the test performed on it shows that the soil is quite brittle and has not been used as a base material. Therefore to improve its properties coconut shell husk has been added and observed that dry density has been increased from 0% - 8%.

**Manjurhussain et al. (2017)** have investigated that industrial, as well as agricultural waste treatment, is the main research topic because of economic, environmental and technical reasons. The construction, as well as the maintenance of the pavement, has been very complex specifically in those areas that consist of soft soil. In the rainy season, natural soft soil under the pavement becomes a severe problem; therefore, to enhance the strength of the subgrade soil is only a suitable solution. During this research, the researchers have tried to increase the soil strength by introducing coal ash as a stabilizing agent. To determine the percentage of adding coal ash in the soil a number of tests such as plasticity index, specific gravity, compression, CBR and UCS have been performed.

**Shwetha et al. (2017)** stated that land stabilization can be accomplished by applying mechanical work to increase soil density or add impurities and then compress it, which is a more economical solution to improve the lifetime of unstable soils. This results in increased cementation and decreasing moisture sensitivity. The traditional methods of soil stabilization such as adding cement, limestone and flying ash have been used to provide a solid foundation for various types of pavement areas, to improve ground conditions, and to stabilize weak soil for construction purposes such as ditches and linings for built-in land works. Researchers focused more on the use of local and agricultural waste to improve the properties of inadequate soils so that the requirements of inadequate soils and geotechnical engineering design can be met. This paper has focused on evaluating the effect of coconut shell ash on weak soil stabilization. A textured soil such as sandy and fertile sand soil has been considered and the effect of adding coconut shell ash on the soil strength has been assessed. Various tests have been carried out on the sample soil with the distinct percentage of coconut shell ash taken from the Indian ceviche crust. From the results there was an increase in dry density and OMC, of the sample soil has been found at 0.4% to 0.8% of coconut shell ash.

**Rashmi Bade et al. (2016)** have used an easily accessible and highly effective organic waste product named as nutshell, which is easily available in every home. Tests have shown that it effectively increases soil strength without affecting the foundation of the structure; Atterberg testing, proctor testing, and specific gravity testing have shown that the materials used for stabilization are highly suitable for the soil and are highly effective for civil engineers with large soil problems.

**J.RANJITHA et al. (2016)** have utilized cocooned shells in shredded form and have been added into the black cotton un-stabilized soil. The research has been conducted to enhance the soil strength of the weak upgraded soil used in the unpaved roads. The weak soil results in a disturbance in the road vehicles and required high maintenance costs. This confines the use of unstabilized soil for low volume traffic. The test results indicated that the CBR values of weaker Sub-grade soil have improved with the insertion of crushed Indian coconut shells.

**M Rupas Kumar et al. (2015)** have used crushed coconut shell waste with ground waste material, which is commonly used as waste material after oil extraction for soil stabilization on a large scale. Coconut shell pulp and groundnut shell pulp have been mixed with un-stabilized soil in different proportions to attain the best mixing rate required for soil stabilization. From the test results, it has been observed that the MDD and CBR values have been improved after the addition of impurities to the soil. The test such as Atterberg's limits, Compression Tests, and CBR tests have been conducted for both stabilized and unstabilized soil. The research mainly deals with the Black cotton soil, also termed as wide soil, which is more responsible for the foundation of the civil structure this is due to the occurrence of montmorillonite mineral, these results in large swelling and tensile strength. To cope with this, the characteristics of the soil must be improved by artificial means called Soil Stabilization. Here, coconut and groundnut shell in shredded form has been used as a stabilizing agent.

**Shukla et al (2015)** have used coconut coir fiber as a soil stabilizing agent. This waste material has different features such as easily available, environmental friendly and cheap. In this research, the stabilizing effect of the Indian coconut fiber on soil features has been investigated experimentally. Taking into account an experimental study, the locally available Indian coconut coir fiber is added on expensive soil with different percentages. Soil samples for CBR tests have been prepared at its MDD along with the OMC in the CBR samples using un-stabilized soil and with coconut coir fiber. The percentage ratio of coconut coir fiber added to dry weight of soil is obtained at the percentage of 0.25, 0.50, 0.75 and 1, also

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the CBR tests for each Coconut coir fiber content for soaked an Un-soaked sample has been examined in the laboratory. The results of the tests show that with the addition of the content of coconut coir fiber, the value of CBR for both un-soaked and soaked samples increased. The value of soaked CBR varies from 3.9% to 8.6%, and the value of un-soaked CBR increases from 1% to 8.2% mixed with Indian coconut coir fiber to 13.2%. The addition of the waste crust coconut coir fiber will cause the mixture to lessen the pavement floor due to increased CBRs, reducing construction costs and saving the construction of the highway.

**George et al. (2014)** have tested the engineering properties of Deltaic clay in Nigeria. This soil is extremely soft and hence needed some stabilizing agent so that can be utilized to form a strong foundation. In this research, the groundnut shell ash is used as a stabilizing material to enhance the properties of clay soil. After mixing the groundnut shell ash in the soil, the UCS test increased from 430 KN/m<sup>2</sup> – 450 KN/m<sup>2</sup>, at 3% and 5% of ground nutshell ash content. Also, the CBR test has been performed and analyzed that the soil strength has remained for a longer time.

**T.S. Ijimdiya et al. (2012)** have used groundnut shell ash as a soil stabilizing content to enhance the mechanical properties of black cotton soil. The results have indicated that the OMC has increased with the decrease in the MDD while performing a standard protector test. Also, the optimal value of CBR has been achieved at 6% and 8% of groundnut shell ash.

**Maha Hatem Nsaif (2013)** have demonstrated the use of plastic mixed with two different soils named as clay and sandy soil. The plastic material has been combined into the clay as well as the sandy soil in different percentages ranges from 0% to 8% in the gap of 2%. Direct shear test has been carried on both soils to measure their shear strength. Also, a number of compaction experiments have been conducted while clay soil is mixed with plastic waste material in distinct dosages. It has been analysed that the addition of plastic waste increases the internal friction of soil content and hence increase the soil stability. The friction in sandy soil is more than that of clay soil, the cohesion among the soil content has not been increased up to the desired level due to which the MDD decreases.

**Satyam Tiwari et al. (2016)** have highlighted the benefits of using fiber for soil stabilization. The shear strength of the unsaturated soil has been determined by performing tests on two soil samples with the addition of fiber in different percentages such as 0, 0.05, 0.15, and 0.25. The test results have shown that the specific gravity of soil has been improved by 0.003 % with the addition of fiber in 0.05%.

**Elias et al. (2016)** have utilized human hair to enhance the stability of the soil. After adding human hair in different percentages multiple samples have been prepared. To determine the engineering properties of soil tests such as UCS and shear strength has been performed. The strength of the soil has been increased with the addition of lime with hair.

### 3. RESEARCH ELABORATIONS

Initially, the sandy soil sample will be collected from the outside field near Chandigarh University Campus, Punjab, India. The sieve distribution will be performed on the soil to determine the type of soil. Liquid limit test as per the code IS: 2720 (Part 5) – 1985 will be performed to know the liquid behavior of soil. After that proctor test will be performed on 3 Kg of soil. This test will be carried out to measure



the MDD along with the optimum moisture content (OMC) value. Then using 5 Kg of soil sample CBR test will be performed under a certain density and humidity environment.

### 3.1 MATERIALS

To enhance the soil properties agriculture waste materials such as coconut shell powder and peanut shell powder will be used. A brief description of these materials has been provided in the following section.

#### 3.3.1 Soil

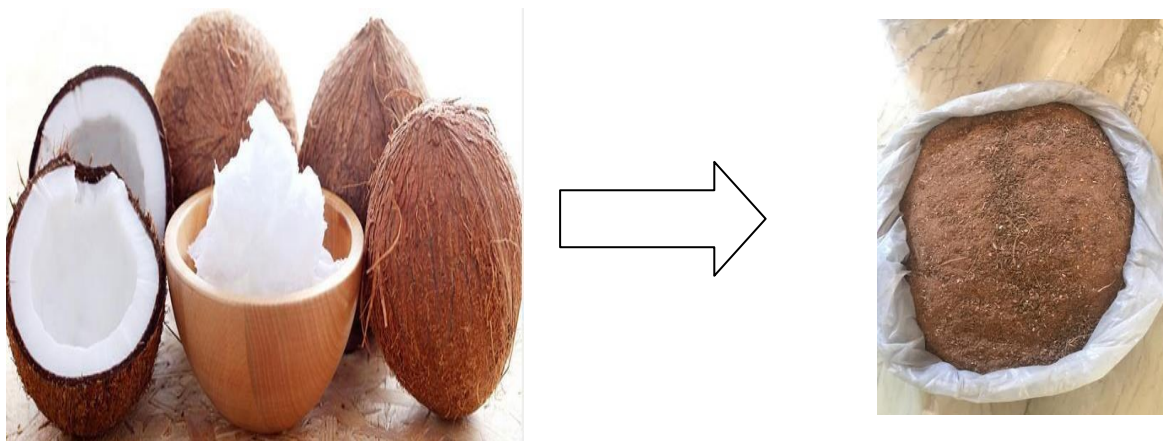
Sandy soil will be used in this research work, which will be collected from outside the Chandigarh University that is situated in Kharar, Punjab, India. The sample of the soil is shown in Figure 1. Sandy soil is also named as lightweight soil, which finds application in planting and cultivating. The management of this soil is difficult as these soils dry out quickly.



**Figure 3.1 Soil with GNSP Sample**

#### 3.3.2 Coconut Shell Powder (CNS)

Coconut shell powder is made up of the fully developed coconut shell. The coconut shell powder finds application in the commercial field such as used in plyboard and as filler in plyboard. The CNS was used in the form of powder and shredded form. The coconuts will be bring from the market situated in Punjab, India. The shell of coconut will be removed manually and then grinded in the flour mill. Later, mixed with soil in different percentages to enhance the property of sandy soil collected from Kharar, Punjab site. Avg. size varies from(~50-100 mesh).



**3.3.3** *Coconut Shell Powder (GNSP)* 1) *Figure 3.2 Coconut shell powder*

GNSP will be bring from in agent for sandy  
soil. Peanuts are generally called the nuts of poor man's. This plant is native to South America and has  
always been cultivated. It is commonly seen in tropical, subtropics and warm temperate zones.  
Groundnut shell waste is commonly obtained from groundnut mills. Avg. Size varies from 100-120 mesh  
(~125microns to 150 microns).



1) *Figure 3.3 GNSP*

**3.3.4** *Coconut shell in Shredded Form (CNSP)*

The shredded or the crushed form of coconut shell will be used in this research. The shell of thickness  
about 3 to 9 mm will be crushed manually using a hammer to obtained shell pieces of Avg. size  
(18×14×3) mm.

#### 4. CONCLUSION

A large number of waste products are generated from manufacturing units, industry, and municipal solid waste. Due to this, solid waste management has become one of the most essential parameters to be taken as a safeguard against the environment in the world. The use of waste products has emerged as a substitute for decontamination due to increased environmental awareness, low fill space and ever-increasing cost. In recent years, increased attention to the environment and energy security has led to increased demand for inexhaustible energy resources as well as changes in existing methods of energy production.

In existing sources, biomass (agricultural and forest waste) becomes a promising renewable energy source. In current energy production trends, biomass power plants have a stable renewable fuel supply and low operating costs. It is assumed that these fuel sources will be CO<sub>2</sub> (Greenhouse gas emissions) as a neutral energy source when fuel consumption is below growth rates. The excessive use of natural resources, the large number of waste generated at the factory, and the degradation of the environment require new options for renewable progress. To stabilize soil groundnut shell powder with coconut shell in grinding form will be used.

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# Utilization of Rice Straw Ash as Fine Aggregate in Mortar Mixes: A Review

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**ABSTRACT:** Now days, the cost of the materials are increased, so we need to look at a way to decrease the cost of construction materials and reduce agriculture wastages. To achieve this objective; sand can be replaced with RSA (Rice Straw Ash). RSA is agriculture wastages from rice cultivation and milling processes. An interconnecting mixture for interconnecting materials such as fine aggregate, cement and water is called mortar. This problem becomes even bigger with the improving and increasing of these losses. For solving of this challenge a lot of studies have been done and are being done to void lack of natural sand and growing of losses. It would be a great choice to substitute natural materials of mortar which is fine aggregate. Usage of agricultural loss materials as a replacement of natural material in construction mortars will bring three advantages: Saving of natural sources from ending, taking away of loss materials and keeping lands for different other usages. In this paper, usage of RSA as a part of FA of mortar can decrease environmental damage and cost of construction materials.

**KEYWORDS:** RSA, construction material, wastage, fine aggregate, mortar.

## INTRODUCTION

Rice straw ash is made after heating and burning a massive amount of it. It produces an environmental challenge and sometimes, this loss can be used in agricultural field, to decrease environmental loss, reducing the construction cost and conserve the natural resources, operating local natural loss and by producing materials to rectify the efficiency of construction materials. In the last 20 years in the world wide more country confronted of the consumption of used of natural river sand. Most of the world's population could not access to good performance and ability construction materials because of high cost. Comparing these high costed materials to rice straw ash, rice straw ash has low cost and also it can be find all over the world. When rice plant starting to grow it has a property that, it absorbs silica from the soil in which it grows and maintains the silica in his body and structure. Yet investigators requirement to focus more on effective usage of inexpensive and locally accessible materials.

## LITERATURE REVIEW



**Pandey Arunabh “et al.” (2019)** in this paper the performance of cement paste admixed with RSA, micro silica and RSA- micro silica combination are confident by partly replacing the cement paste with RSA and micro silica which are waste product from agriculture. Simulated RSA is replaced with six percentages (5%, 10%, 15%, 20%, 25%, 30% and 2.5%, 5%, 7.5%, 10%) of RSA and MS by weight of cement. RSA and MS modified the properties like physical (SEM, XRD, Specific gravity etc.) and chemical properties (XRF) of materials of used are properly analyzed. RSA and MS particles are finer than OPC particle their affinity towards moisture increase due to increased specific surface area. This was the key intention behind increase in the normal consistency of all the admixed samples as matched to control mix. Initial and final setting time extend. Because RSA particles are finer as matched to OPC particles thus required more moisture due to increased surface area. [5]

**El- Sayed- Taha A “et al.” (2019)** describe the study undertaken to evolve a recycled (RSA) and (WSA) as cement replacement materials in mortar to produce Nano Silica from RSA and WSA as agricultural residue by using chemical Acids. This paper addresses the use of the agricultural residue materials RSA and WSA to produce Nano Silica from the above waste materials in enhancing the strength properties of mortar. The study involves the replacement of binder with diverse percentages of RSA and WSA i.e. 5%, 10%, 15%, and 20% by the weight of binder. The various mix designs are subjected to the compression test, tensile strength test, workability was measured by the slump test. The pulse velocity and sorptivity are estimated. The laboratory results show that there is a tremendous improvement in compression strength test and tensile strength with accumulation of RSA and WSA at 15% replacement. And also the laboratory results exposed that it was possible to produce silica from WSA and RSA by chemical instigation methods. [6]

**Chouhan Singh Harshwardhan “et al.” (2019)**, this paper presented the study of useful consumption of dimensional lime stone residue as FA in cement mortar mixtures. Using waste dimensional lime stones in diverse proportions i.e. 0%, 20%, 40%, and 60% by weight of FA. The waste dimensional lime stones waste mortar is dealt with workability, compressive strength, flexural, adhesive and tensile bond strength, drying shrinkage, water absorption, porosity, density, ultra-pulse velocity and dynamic modulus of elasticity. According to the investigation show that utilize of dimensional lime stone waste gradually increase the strength up to 20% substitution level of FA by dimensional lime stone waste. A good result achieved from water absorption percentage, air voids, and density at 20% substitution in all mortar mixes. [7]

**Pandey Arunabh “et al.” (2019)** to study the effects of RSA and micro silica (MS) on durability composition of M40 grade pavement quality concrete. Several tests were performed. This paper presents the study of pavement quality concrete by replacing cement with RSA and MS in percentages of (5%, 10% RSA and 2.5%, 5%, 7.5%, 10% micro silica) the blends were subjected to water absorption and chloride ion penetration test. Final result of all the ten mixes used shows a significant change in water absorption rate and chloride penetration. It is found

that the effective decrease was detected in the water absorption and chloride ion penetration in concrete sample with an increase in the curing ages as well as with an increase in the proportion of micro silica and rice straw ash. The extreme decrease in water absorption and chloride ion penetration is detected in (10%RSA and 7.5% MS) as matched to control concrete. RSA and micro silica particles are 5 and 28 times finer than the OPC particles respectively. It has a higher confrontation of admixed concrete to water absorption as linked to control concrete. The capacity of pore space decreases with admixing of MS and RSA. [8]

**Kabeer Ahmed syed. K.I. “et al.” (2018)** have done an investigation on mortar with the use of MD as FA in mortar to decrease the uses of natural materials, to reduce the cost of the construction, and have eco-friendly environment. Because the used waste marble powder which is known as waste material and generates from cutting and shipping of marble tiles. The following replacement has been done from (0% to 100%) marble powder to river sand. Results illustration that mortar mixes with 20% replacement of river sand by MD can be used for masonry and rendering purposes. The use of 20% of Marble powder would assist extensive saving water in and river sand in building projects and also improve the chemical properties of the mortar-like compressive strength, fresh bulk density, tensile, bond strength and decrease the water absorption. [9]

**Gupta, “et al.” (2017)** reviewed on the marble powder obtained from the marble production and experiment with it by making the concrete by replacing cement. It provides the effective results in concrete and gives economic results. This process also reduces the effects of marble dust on environment. [10]

**Manpreet, “et al.” (2017)** this paper reviewed different methods of sand and cement replacement from the concrete by using marble dust. This work also considers the impact on the environment after using MD in concrete. The analysis of cost is also done to support the utilization of marble dust in concrete. The outcome of the study shows that it is beneficial and reduces its impact on the environment. [11]

**Vigneshpandianet, “et al.” (2017)** this paper proposed a method for the consumption of marble dust in manufacture concrete. Marble dust modified the properties like chemical, mechanical and physical of cement. It showed the protective material result in concrete and no perceptible result in the hydration progression. The results of the proposed method are better when sand is replaced by marble dust. [12]

**Dabai M. U “et al.” (2017)** have done the investigation on six mortar cubes which replaced cement by rice straw ash (0%, 2%, 4%, 6%, 8%, and 10%) by weight of binder to check compressive strength. The result of Compressive strength tests shows that at 2% replacement with RSA at the age of curing after 2, 7, and 28 days was found to be as 15.77, 34.73, and 48.53 N/mm<sup>2</sup> and increased with age of curing but decreased at 10% replacement for 7 days (18.06 N/mm<sup>2</sup>) and 28days (27.23 N/mm<sup>2</sup>) with increase in RSA content for all mixes. It

indicates that RSA can be used at 2%, 4%, and 6% to replace cement at the period of 2 to 28 days' age of curing, and increase the initial and final setting time when increase rice straw ash. [13]

**Manoharan Thiruvekitam (2016)** in his paper, the impact of foundry sand while fine total replacement on the compressive strength of concrete with an M20 mix design. The rate of foundry sand utilized for substitution were 100 percent, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90% and 100% as a result of weight of fine total. The test indicated great outcome, demonstrating the ability of foundry sand for being a segment in cement for granting strength.

## MATERIALS AND METHODS

1. Compression Test
2. Mix Design Calculation
3. Mix Design of the Materials
4. Compaction Methods
5. Curing Samples
6. Lab Testing
7. Water Absorption Test

## CONCLUSION

It would be a great choice to substitute natural materials of mortar which is fine aggregate. Usage of materials as a replacement of natural material in construction mortars will bring good advantages: Saving of natural sources from ending, taking away of loss materials and keeping lands for different other usages. Usage of RSA as a part of fine aggregate of mortar can decrease environmental damage and cost of construction materials.

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# REVIEW OF GEOPOLYMER CONCRETE IN CONSTRUCTION IN INDIA

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## Abstract

Concrete is the world's most versatile, durable and reliable construction material. Next to water, concrete is the most used material, which required large quantities of Portland Cement. **Geopolymer concrete** has excellent properties within both acid and salt environments. Low calcium fly ash based **geopolymer concrete** has excellent compressive strength, exposure to aggressive environment, workability, exposure to high temperature and is suitable for structural applications. There are many ways to reduce environmental pollution (carbon dioxide) caused by the production of Portland cement and by the increasing of waste material. Around 120 million tonnes of fly ash get assembled every year at the thermal power stations in India. It becomes a serious problem due to inadequacy of land disposal. Utilization of geopolymer concrete brings economy in construction; reduce pollution and less harmful to the environment. So far in India, geopolymer concrete has been used in the Delhi Metro Project. Thus it can be considered that Geopolymer concrete, as a replacement for Portland cement has wide scope in India. An effort has been made in this project to study the advantages, application and feasibility of geopolymer concrete in India.

## INTRODUCTION

The geopolymer concept was introduced by Joseph Davidovits in 1976 for alkali aluminosilicate binders. [1] The transformation of kaolinite into tridimensional tecto-aluminosilicates used for the polycondensation of organic resins at low temperature is very similar with the thermosetting method of these materials. The result of the process is a nanocomposite that looks like an artificial rock. The geosynthesis take place itself in great abundance in nature. The crust of Earth is composed, in 55% of volume, from siloxo-sialates and sialates, yet, just only 12% are pure silica or quartz. The geosynthesis process is based on changes induced in crystallography of silica backbone by the aluminium ion (6-fold or 4-fold coordination) and on the chemical changes produced by the same aluminium ion [2]. These materials possess chemical composition similar to zeolites consisting of a polymeric Si-O-Al framework, different properties and amorphous structure. Their properties are highly depending of: the Al-Si source, the activator, the aggregate source and its grading, the water source, the mix quantities of each material, the hardening/curing time, the temperature, the dimensions of particles, the calcium concentration, the heat treatment,

if applied [3-5]. Depending of cost and the final desired properties, there are a wide range of raw materials that can be used to create geopolymers, such as: metakaolin [6], red mud [7], fly ash [8-9], different wastes [10], etc. During manufacturing, the emission of CO<sub>2</sub> and energy consumption is very low comparative with Portland cement, this new binder offer a strong reduction of the global warming by releasing just 169 kg CO<sub>2</sub>/m<sup>3</sup> when ordinary Portland cements release 306 kg CO<sub>2</sub>/m<sup>3</sup> for the same mechanical properties, which represents a decrease of emission by 45% [11].

The following are the constituent of geopolymer concrete ;

- Fly ash rich in Silica and Aluminium
- Sodium Hydroxide and Potassium Hydroxide
- Sodium Silicate and Potassium Silicate

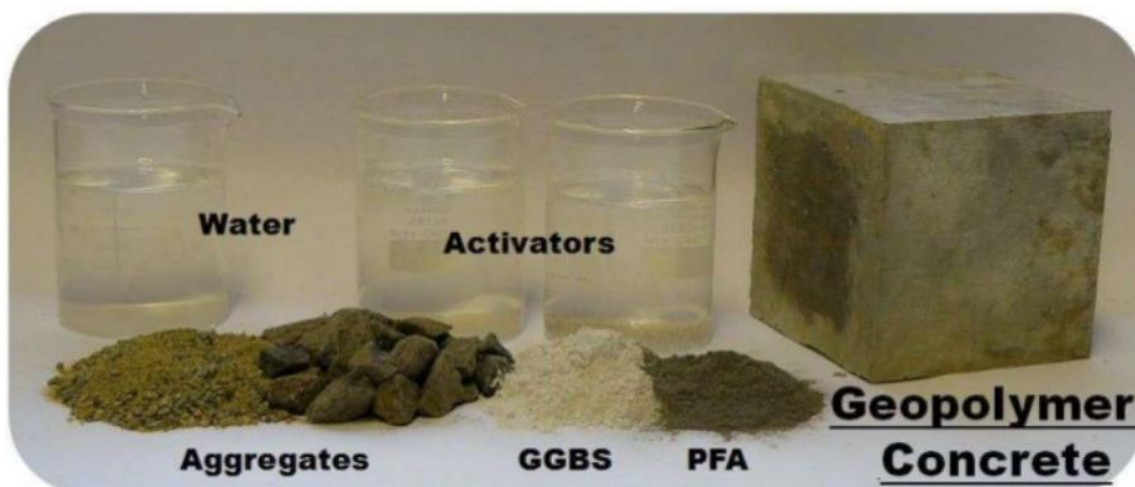


Figure 1 : Geopolymer Aggregates [ Source - <https://images.app.goo.gl/ie3ec8TiTQ4VNuBf7>]

## LITERATURE REVIEW

Several authors have reported the use of Geopolymer Concrete for various civil engineering applications

- *Song et al (2005) have carried out an experimental study and has revealed many facts about the resistance of geopolymer concrete to sulphate and chloride attack. It has been found that, after being exposed to sulphuric acid solution, fly ash based geopolymer concrete was structurally inert except development of some fine cracks on the surface whereas OPC concrete shows sign of severe damage.*
- *Olivia et al (2008) have investigated on the water penetrability of low calcium fly ash geopolymer concrete. The conclusion drawn is that fly ash geopolymer concrete exhibits low water absorption and sorptivity. Low water/binder ratio and a better*

- grading are recommended in order to reduce the capillary porosity and the overall porosity of geopolymer concrete. Anurag Mishra et al (2008) have carried out an experimental study on the effect of concentration of alkaline liquid and curing time on strength and water 15 absorption of geopolymer concrete. It has been reported that compressive strength increases with increase in concentration of NaOH from 8M to 16M. Increase in compressive strength was observed with increase in curing time and also tensile strength increased with increase in concentration of NaOH except for 72 hours curing time.*
- *Ranganath et al (2008) have conducted an experimental investigation on effect of fly ash, water content, ratio of sodium silicate to sodium hydroxide solution by the mass and the duration of elevated temperature curing on the properties of fly ash based geopolymer concrete (GPC). It was found that as the water content increases the optimum fly ash content also increases to obtain maximum strength. In addition the given fly ash content increase in the alkaline solution content does not contribute additional strength. It has been found that long curing at elevated temperature increases the strength of geopolymer concrete; however elevated temperature curing beyond 20 hours does not contribute significant strength.*
  - *Andi Arham Adam (2009) has carried out an experimental investigation on the strength and durability properties of Alkali Activated Slag (AAS) and fly ash based geopolymer concrete in terms of chemical attack. Concrete has been tested for workability, compressive strength, depth of carbonation, rapid chloride permeability and chloride ponding. Microstructure studies were conducted using Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray Spectroscopy (EDAX). The study concludes that AAS and fly ash based geopolymer concretes can exhibit comparable strength to OPC and slag blended OPC concretes.*
  - *Deevasan et al (2010) have studied the development of environmentally friendly construction materials with particular attention to the utilisation of industrial waste materials in their manufacture for sustainable development*
  - *Abdul Aleem M.I and Arumairaj (2012) made an attempt to find out an optimum mix for the Geo-polymer concrete and they have casted concrete cubes of size 150 x 150 x 150 mm and cured under Steam curing for 24 hours based on the compressive strength. The optimum mix is Fly ash: Fine aggregate: Coarse aggregate (1:1.5:3.3) with a solution (NaOH & Na<sub>2</sub>SiO<sub>3</sub> combined together) to fly ash ratio of 0.35. High and early strength was obtained in the Geo-polymer concrete mix. Abdul Aleem M.I and Arumairaj P.D (2012) conducted a review surveying on Geopolymer concrete. It was presented that due to the high early strength Geopolymer Concrete shall be effectively used in the precast industries, so that huge production is possible in short duration and the breakage during transportation shall also be minimized. They revealed the characteristics of geopolymer concrete and informed that Geopolymer Concrete can be used in place of ordinary Portland cement concrete*



- Lyon E et al (1996) studies the Fire Response of Geopolymer structural composites. They study the use of Geopolymer composites in infrastructure and transportation applications. They revealed that Geopolymer composites are non – combustible structural materials which are suitable for infrastructure applications where a high degree of fire resistance is needed at low to moderate cost. Also it was interred that load bearing capability during fire exposure, where temperatures reach several hundred degrees centigrade, will be significantly higher than organic resin composites.

## Discussion

In the present study the work is carried out the following aspect of Geopolymer concrete in India along with its different useful property:

- Considering the high percentage replacement of cement with class C fly ash to the possible extent.
- Study of the workability characteristics through slump cone test of the six mix proportions without plasticizer and another six with plasticizers
- Study of the strength characteristics of the six mix proportions without plasticizer and another six with plasticizers. Compressive strength based on cubes and cylinders, split tensile strength based on cylindrical specimen, modulus of rupture based on prisms and modulus of concrete based on cylindrical specimens.
- Assessing the necessity of using additives to fly ash based concrete and studying the workability characteristics of concrete mixes.

## Applications of Geopolymer Concrete

The applications is same as cement concrete. However, this material has not yet been popularly used for various applications This concrete has been used for construction of pavements, retaining walls, water tanks, precast bridge decks. Recently world’s first building Structural Building, The University of Queensland’s Global Change Institute (GCI) has been constructed with the use of geopolymer concrete. It is a four story high building for public.

Geopolymer concrete is a newer product that is making traditional concrete look not so spectacular. Here are some of the top advantages of geopolymer concrete.

- **High Strength:** Geopolymer concrete has a higher compressive strength as compared to ordinary concrete. It also has rapid strength gain and cures very quickly, making it an excellent option for quick builds. Also it has high tensile strength and is brittle than Portland cement. It is not completely earthquake proof, but does withstand the earth moving better than traditional concrete.
- **Very Low Creep and Shrinkage:** Shrinkage can cause severe cracks in the concrete from the drying and heating of concrete or even the evaporation of water from the concrete. Geopolymer concrete does not hydrate. It is not as permeable and will not experience significant shrinkage. Creep is the tendency of the concrete to become permanently



deformed due to the constant forces being applied against it. And the creep of geopolymer concrete is very low.

- **Resistance to Heat and Cold:** It has the ability to stay stable even at temperatures of more than 2200 degrees Fahrenheit. Excessive heat can reduce the stability of concrete causing it to spall or have layers break off. Geopolymer concrete does not experience spalling unless it reaches over 2000 degrees Fahrenheit. As for cold temperatures, it is resistant to freezing. The pores are very small but water can still enter cured concrete. Geopolymer Concrete will not freeze.
- **Chemical Resistance:** Geopolymer concrete has a very strong chemical resistance. Acids, toxic waste and salt water will not have an effect on geopolymer concrete. Corrosion is not likely to occur with this concrete as it is with traditional Portland Concrete.
- **Some other Benefits of Geopolymer Concrete:** Geopolymer concrete uses industrial waste products like fly ash and blast furnace slag, it gives good abrasion resistance. GPC offers reduction in cost of concrete from 10% to 20% and 80% reduction in CO2 emissions. It is Environment Friendly. There are wide span of applications of geopolymer concrete.

## LIMITATION OF GEOPOLYMER CONCRETE

While geopolymer concrete appears to be the super concrete to take the place of traditional Portland concrete, there are some disadvantages of it.

- **Difficult to Create:** Geopolymer concrete requires special handling needs and is extremely difficult to create. It requires the use of chemicals such as sodium hydroxide that can be harmful to humans.
- **Pre-Mix Only:** Geopolymer concrete is sold as only pre-cast or pre-mix material due to the dangers associated with creating it.
  - **Geopolymerization Process is Sensitive:** This field of study has been proven inconclusive and extremely volatile. Uniformity is lacking.

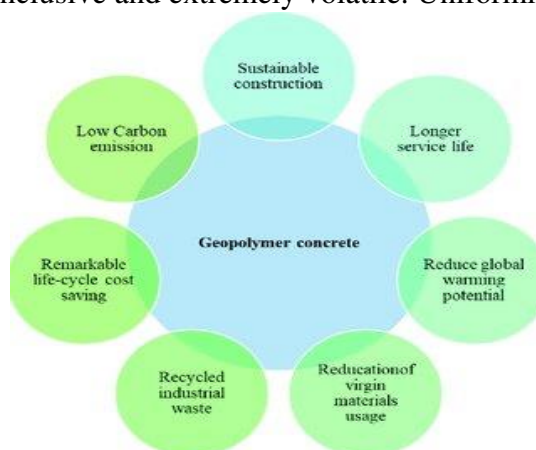


Figure 2 : Benefits of Geopolymer Concrete

[Source: [https://www.researchgate.net/figure/Schematic-of-the-usefulness-of-GPC-in-sustainable-construction\\_fig2\\_331656886](https://www.researchgate.net/figure/Schematic-of-the-usefulness-of-GPC-in-sustainable-construction_fig2_331656886)]

## **BEHAVIOUR UNDER SEVERE ENVIROMENTAL CONDITION**

Ever since the introduction of geopolymer binders by Davidovits in 1978, it has generated a lot of interest among Engineers as well as in the field of chemistry. In the past few decades, it has emerged as one of the possible alternative to OPC binders due to their reported high early strength and resistance against acid and sulphate attack apart from its Environmental friendliness. Though geopolymers can be manufactured from various source materials rich in silica and Alumina such as fly ash, silica fume, ground granulated blast furnace slag and metakaolin etc, fly ash based geopolymers have attracted more attention. Geopolymer binders might be a promising alternative in the development of acid resistant concrete since it relies on alumina-silicate rather than calcium silicate hydrate bonds for structural integrity. Davidovits found that geopolymer concrete has very low mass loss of 5%-8% when samples were immersed in 5% sulphuric acid and hydrochloric Acid solutions. In contrast, Portland cements could be completely destroyed in the same environment.

## **METHODOLOGY OF GEOPOLYMER IN CONCETE**

Geopolymer concretes (GPCs) can be produced by chemical activation of industrial by-products and processed natural minerals that contain aluminosilicate. There have been a few demonstrative constructions built using of GPCs as a greener alternative choice to Portland cement concrete (PCC); unfortunately, there is no standard or specification of guidelines for the design of GPC mixtures. This is partially because of so many variables affecting GPC manufacture, such as the property of raw materials, type and dosage of activator and curing scheme. Despite the fact of convention of building industry, the lack of proper mixture design method limits the wide acceptance of GPC in industry. In this paper, a review on currently reported mixture design methods of GPC prepared with slag and fly ash is presented. The various methods are classified into three categories: target strength method, performance-based method, and statistical factorial model method. The difference in the procedures, advantages and disadvantages among those methods are discussed. It is recommended that a proper design method should be chosen according to actual production situation and performance requirement of GPC

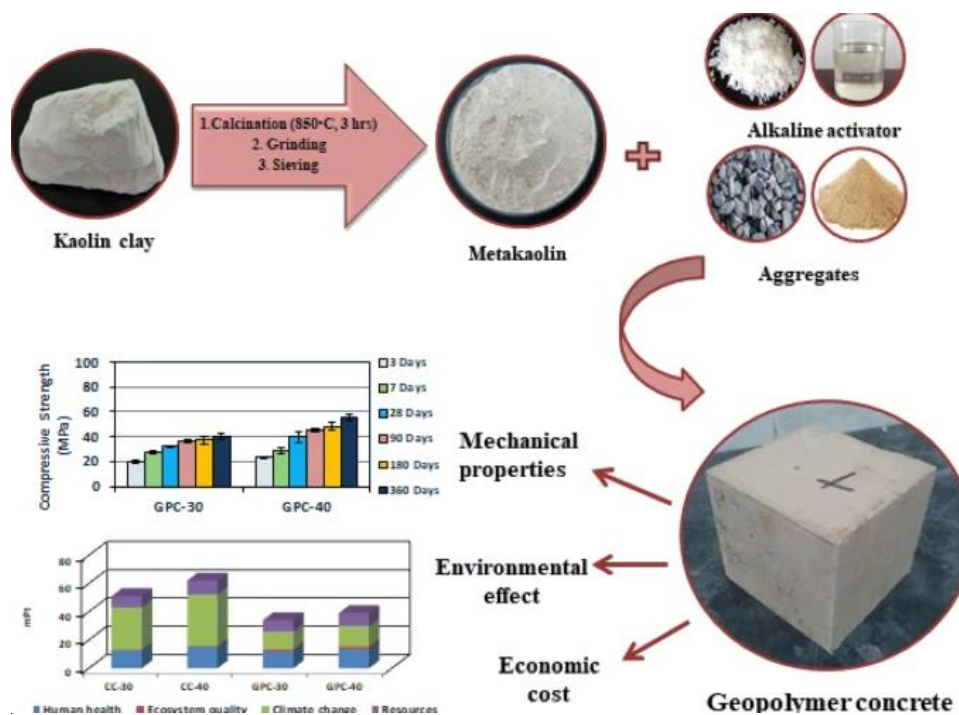


Figure 3 : Constituents of Geopolymer Concrete [Source: <https://link.springer.com/article/10.1007/s10098-020-01811-4>]

## CONCLUSION

The aim of this study is to provide an exposure to the Geopolymer concrete concepts as a favourable alternative to Portland cement concrete. The main conclusions which can be drawn from the results of this study are the following:

- The reduced CO<sub>2</sub> emissions of geopolymer concrete build them a good alternative to ordinary Portland cement concrete.
- The strength of geopolymer concrete can be increased with increase in percentage of GGBS in a mix. It gains strength Within 24 hours at ambient temperature without water curing.
- The necessity of heat curing of concrete can be eliminated by incorporating GGBS and fly ash in a concrete mix. High temperature curing is not required in all cases of GPC, as sunlight curing can be used at least in tropical countries for Geopolymer concrete mixes.
- To make the geopolymer concrete, sodium hydroxide and sodium silicate must be optimized and ambient temperature curing of Geopolymer concrete must be well researched.
- Geopolymer concrete can be prepared at comparable cost with Ordinary Portland cement based concrete.
- Compressive strength of GPC increases over controlled concrete by 1.5 times (M-25 achieves M-45). Split Tensile strength of GPC increases over controlled concrete by 1.45 times. Flexural Strength of GPC increases over controlled concrete by 1.6 times.

- The fly ash-based Geopolymer concrete shows good fire resistance and shows less reduction in compressive strength than the General OPC concrete, without causing spalling.
- With its high strength and resistance to corrosion and extreme temperatures, geopolymer technology offers a potentially Favourable alternative to Portland cement concrete in certain specialized applications.

### **SCOPE FOR FUTURE STUDY**

From the available literatures on Geopolymer concrete and based on the findings in this study, following works are Suggested for further research.

- Development of high strength geopolymer concrete, manufactured with silicates and hydroxides of potassium and the Effects of higher strength in the flexural behavior of geopolymer concrete beams.
- Study on the addition of various fibres in geopolymer concrete and their effect on enhancement of strengths.
- Achieving ultra high strength geopolymer concrete by the addition of silica fume, quartz sand and quartz powder. User-friendly Geopolymer concrete, that can be used under conditions similar to those suitable for OPC, are the current focus of extensive world-wide research efforts. This concrete must be capable of being mixed with a relatively low-alkali activating Solution and must cure in a reasonable time under ambient conditions. Until such cements are developed, geopolymer Applications in transportation infrastructure will be limited. The production of versatile, cost-effective geopolymer concrete that can be mixed and hardened essentially like Portland cement would represents —game changing| advance-ment, Revolutionizing the construction of transportation infrastructure.

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THEME-II

ADVANCES IN ENERGY  
EFFICIENCY AND  
CONSERVATION





# EMERGING TECHNOLOGIES FOR WASTE TO ENERGY PRODUCTION

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**Abstract-** Growing population leads to industrialisation and urbanization which in turn generate huge amount of waste that represents a big problem for many developed and developing countries. Emerging solution for this problem can be use of wastes as a sustainable source of energy in the form of heat, electricity, fertilizer and biofuel like bioethanol. Type of technology employed is mainly based on the composition of waste whether it is rich in organic matter like MSW or not. WTE technologies reduce the volume of waste as well as decrease the dependence on fossil fuels for energy generation. This study focuses on overview of various available waste to energy conversion technologies like pyrolysis, gasification, incineration, biochemical treatments like landfill gas, aerobic and anaerobic digestion of wastes.

**Keywords-** Gasification, Incineration, Municipal Solid Waste, Pyrolysis, WTE Technologies.

## 1. INTRODUCTION

Rapid industrialization and urbanisation has increased the generation of waste worldwide due to changes in the pattern of lifestyle compared to the past as there is an increase in demand for energy resources. Out of the total waste generated Municipal Solid Waste (MSW) has become a major area of concern worldwide. It is expected that MSW generation will double by 2025. Municipal Solid Waste includes household, industrial, commercial, construction and demolition, residential and institutional waste. Municipalities and similar entities face many problems in the disposal of MSW and associated feedstock due to improper segregation and management. Conversion of MSW to energy proves to be a sustainable management of waste. Energy from Waste (EFW) or Waste to Energy (WTE) is referred as generation of electricity or heat from the processing and treatment of waste. WTE technologies lead to less dependence on fuels, decrease the demand for dumping sites and landfills, reduce environmental pollution as well as enhance the economic viability. China is the leading nation with more than 300 running plants for WTE conversion. In India, on an average 0.5 Kg of waste is generated by a single person per day. People with higher income generate more waste because of their power to afford and consume more goods. The Ministry of New and Renewable Energy of India is providing financial support for promoting WTE recovery and also supporting through providing incentives and subsidies.

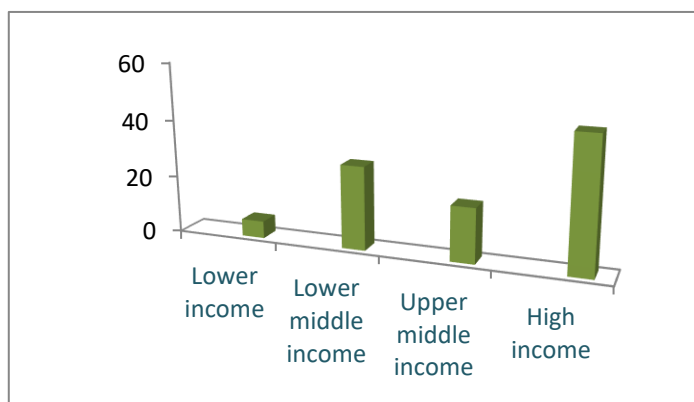


Figure 1: % Waste generation distribution by different income groups [14].

## 2. THERMOCHEMICAL TREATMENT OF WASTE

### 2.1 Incineration

Incineration is defined as the process to treat waste (non-refined and crude) by oxidative combustion [1] or can say by controlled burning in an advanced engineered structure i.e. incinerator [2]. It is one of the best methods for waste management as it reduces the volume of waste by 70% to 90%. Incineration of waste produces heat and energy at a temperature of minimum 800<sup>0</sup>C that can be used in production of electricity through steam turbines [3]. This technology is mainly practiced in the developed nations like the European Union, Japan and USA [4]. Though incineration is very efficient and simple technology, but cannot be employed on a large scale due to its high investment, operation and maintenance cost [5,6].

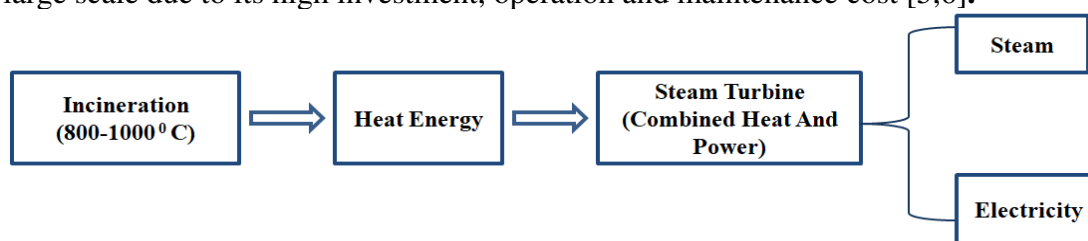


Figure 2: Treatment of waste through incineration [3].

### 2.2 Gasification

In this method of WTE, waste is acted upon by various agents like steam and oxygen at a temperature of about 500<sup>0</sup>C-1800<sup>0</sup>C in a controlled environment to produce Syngas which is one of the energy rich gases. Syngas is also known as Synthesis gas. It is made up of carbon monoxide, hydrogen, carbon dioxide and other gases. Syngas is employed to produce electricity using gas turbines [3]. Gasification can reduce volume of waste by 90% and mass of waste by 70% [7]. Mainly solid and semisolid waste is employed in this technology [8].



Figure 3: Treatment of waste through gasification [3].

### 2.3 Pyrolysis

Pyrolysis is a thermal or endothermic process which converts waste to more valuable products having greater calorific value than initial waste [9]. In pyrolysis, complex chain of polymer breaks into simpler or less complex chains at a temperature  $500^{\circ}\text{C}$  -  $800^{\circ}\text{C}$  in anaerobic condition (absence of air). Depending upon the temperature, residence time, pyrolysis reactor and composition of waste three major types of products are formed namely char, oil and gas [1]. This method is mainly employed in petrochemical industries. This is the best method for handling MSW but their use is limited due to high maintenance and operation cost when employed at commercial level [10].



Figure 4: Treatment of waste through pyrolysis [3].

## 3. BIOCHEMICAL TREATMENT OF WASTE

### 3.1 Anaerobic digestion

Anaerobic treatment is also referred as biomethanation. In this process, anaerobic microbes act upon and digest organic rich MSW to produce biogas in the absence of air [7]. Biogas is composed of 60% methane, 39% carbon dioxide and 1% other gases like ammonia [1]. This biogas can be used in electricity production. Sites near food processing industries and dairy farm will be a potential site for setting up of biogas plant. Wastes having high cellulosic material can be used to produce bioethanol that can be used as an alternate fuel for petrol. Bioethanol is produced using yeasts by fermentation process. After extraction of bioethanol from the waste, the digestate obtained can be used as a fertilizer and fodder for cattle [11,12].

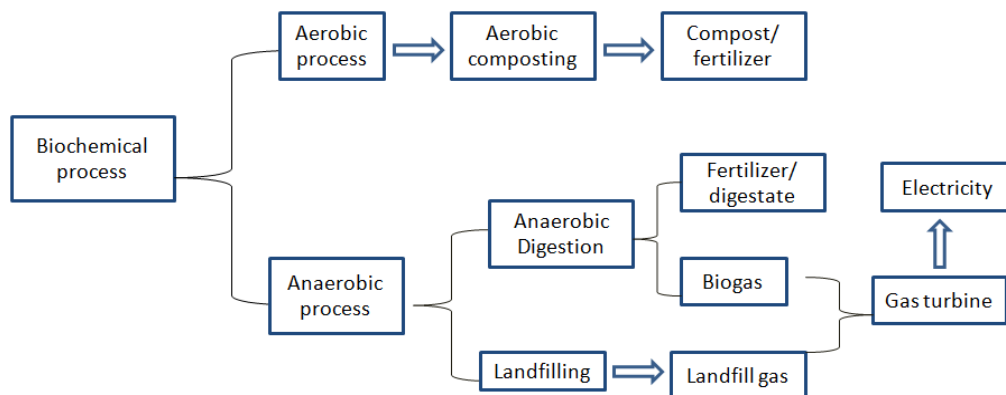
### 3.2 Aerobic composting

In this method, organic rich wastes decomposed by the action of aerobic microbes to produce nutrient rich compost which can be utilized as a fertilizer in agricultural fields [7].

Less space is required for treatment of waste through anaerobic than aerobic treatment [13]. Wastes having high moisture content can be treated efficiently by anaerobic digestion. Segregation of waste is required before applying biochemical treatments microbes do not act on non-biodegradable wastes. This treatment method is very time consuming, but it is very economical and environmentally friendly [14].

### 3.3 Landfill gas

Landfill gas is produced from the decomposition of organic waste material in unsanitary landfills. Landfill gas contains 50% methane, 45% carbon dioxide, 4%-5% hydrogen sulfide and 1% nitrogen. This method is not environmentally friendly as it's leachate pollute the ground water of the vicinity and also release greenhouse gases like methane and carbon dioxide in the atmosphere which can be employed to generate electricity when treated in sanitary landfills [15, 16].



**Figure 5: Biochemical treatment of waste [3].**

## CONCLUSION

It may be concluded from the above knowledge that efficiency of WTE technologies depends on the type of waste to be treated. Wastes having low organic and moisture can be treated efficiently through thermochemical treatment methods like incineration, pyrolysis and gasification. Anaerobic digestion can be considered to be the most beneficial method for waste treatment in developing countries. These WTE technologies are known to be environmental friendly, efficient and economical, the only need is to promote these technologies at larger scale with the support of Government subsidies, policies and regulations. There is also a need to develop sustainable waste management related awareness among the people worldwide.

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# STRATEGIES FOR CONVERSION OF WASTE PLASTIC TO FUELS

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**Abstract:** The current economic growth rate is untenable without saving the fossil energy like natural gas, coal, petroleum. There are many substitutes to fossil energy such as wind energy, hydro power, biomass etc. also suitable waste management strategies are also another important aspect. Economic development and modernization have brought about a large increase in the production of all kinds of materials, which again increase waste indirectly. The production of plastic waste is a big issue due to its large effect on environment and ecosystem. The paper presents the current scenario of the plastic consumption and recycling techniques of plastic waste. The recycling process is divided into four classes, primary, secondary, tertiary and quaternary. The calorific values of plastics and fuel are comparable, so that the production of fuel could be an alternate to reduce plastic waste. There are many methods for converting plastic into fuel like pyrolysis, catalytic degradation etc. By using these methods, we can reduce the problem of plastic waste disposal, insufficiency of conventional fuel and can help in promotion of sustainable environment.

**Keywords:** Catalytic conversion, Gasoline, Plastic pyrolysis, Plastic waste, Polypropylene

## 1. INTRODUCTION

At present, the sudden growth in living standards had a curious impact on the environment. Plastics have been now basic materials and the demand is continuously increasing due to their attractive applications in industries and household. Plastics are generally low cost, easy to manufacture, durable, electrically and thermally insulative and resistant to corrosion. Due to these properties consumption of plastic materials is vast and has been growing steadily. Most used plastics are poly-olefins such as polypropylene, polyethylene, which have a large production and consumption in agriculture, electronics, building and health care. [1]

Major portion of plastic waste contains thermoplastic polymer and its amount is continuously increasing around the world. Now, plastics waste is become a big environment challenge because of its large amount and disposal problem as thermoplastics are non-biodegradable. Plastic waste can be divided into two types as industrial and municipal waste plastics, according to their origins. Generally industrial plastic wastes are more homogeneous and contamination free and municipal plastics tend to be more heterogeneous and contains low density polyethylene, high density polyethylene, polypropylene etc. As of 2018, About 380 million tons of plastic is produced worldwide each year. From 1950 to 2018, an estimated 6.3 billion tons of plastics has been produced worldwide, of which an estimated 9% has been recycled and 12% has been incinerated [2]. Overall, about 50-70% of the total plastic waste is packing materials, derived from polyethylene, polypropylene. On average polyethylene make the greatest fraction of all plastic wastes (69 %) especially plastic bags [3]. Recycling is only the possible solution to the environmental Challenges faced by the plastic industry.

The process of recycling can be done through physical and chemical process. Physical methods are as "Three R", reduction, reuse and recycling [4]. This method is not appropriate because plastic



waste returns to the environment and requires high labor costs for this process [5]. An alternate strategy is chemical recycling, with the objective of converting waste plastic into petrochemicals, has been recognized as an ideal approach and can significantly reduce the net cost of disposal.

## 1. METHODS OF CONVERTING WASTE PLASTIC TO FUEL

The conversion of plastics to the fuel is one of the most demanding research topic through the worldwide. There are methods like thermochemical process or hydrolysis, gasification, hydro-cracking, catalytic conversion [6].

**1.1 Thermochemical-** The treatment breaks down the large polymers into smaller hydrocarbons and is done in an inert and air free environment at elevated temperature [7]. The hydrocarbons having boiling points between 35-185 0 C, can be used as motor gasoline, between 185 to 350 0c as diesel, 350 to 538 0c as a vacuum gas oil and above 538 0c as the residue [8]. These components can be obtained by the selection of appropriate thermal treatment for different types of plastics ,degradation time ,catalyst type [8,9].

**1.2 Hydro-cracking-** It is the process of cracking of larger hydrocarbons into fuel range hydrocarbons in the presence of hydrogen at elevated temperature [10]. Hydro-cracking is more effective when performed with a catalyst like acidic supporting materials like alumina , silica-alumina ,zeolites and loaded with transition metals (Pt ,Fe, Ni & Mo) [7].

**1.3 Catalytic Conversion-** The catalysts are added to hydrolysis reaction to enhance conversion improves fuel quality, selectivity and lower the hydrolysis temperatures and time required [7]. Selectivity and fuel quality vary with the strength of the catalyst's acidity. This process results give much narrower product distribution of carbon atom. Reuse of effective catalysts in lesser amount can optimize this process. This process can be cost-effective commercial polymer recycling process for solving the acute environmental problem of plastics waste [11].

**1.4 Gasification-** The process is a subset of the thermal treatment. In this, Thermochemical conversion of solid or liquid carbon based materials into a combustible gaseous product by supply of gasification agent. Gasification agents allow the feed materials to be quickly converted into gas by mode of different heterogeneous reactions [13]. Indirect gasification process, there is no requirement of oxidizing agent and needs an external energy source gasification agent, because it is easily produced and increase the amount of hydrogen content of combustible gas. Gasification system contains three fundamental elements,

- (1) Gasifier, helpful in producing combustible gas.
- (2) Gas clean up system, required to remove the harmful components from combustible gas,
- (3) Energy recovery system.

This process can be a future alternate to the waste disposal for the thermal treatment of homogeneous carbon waste and pre-processed heterogeneous waste.

## CONCLUSION

Plastics have been one the greatest innovation of the last millennium and have the best feature of not rusting or rotting. Plastics are light weight, low cost to manufacture and easy to produce with being readily cheap. But their biggest drawback is that they take a very long time to decompose and because of being cheap they are just thrown and pollute the environment everywhere. The present issue is handling of the plastic waste and optimization of gasoline range of products produced from wide range of plastic mixtures. Huge amount of plastic waste produced must be treated by specially designed methods to produce fuel that may replace fossil- fuels and the method

is needed to be superior in ecological and economical terms with proper support and funding for continuous research and development to reduce pollution due to waste and produce hydrocarbon fuel from the waste plastics. Challenge is to develop a standard procedure for the different plastics that are used and one the advanced is pyrolysis technique for waste management. The hydrolysis reactor is needed to be designed to able to handle a mix waste of plastics and needs to be small scaled and medium scaled products and continuous research in the field will help in reducing cost and improve the economic feasibility of process. There are many factors that affect the economics of fuel production like raw material collection, transportation, electric energy, cooling and heating requirements. The cost of recycling needs to be less than that of dumping so that it may adopted at large scale. So, continuous research is needed in field so new developments may be achieved in the field.

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# WEATHER API BASED SMART HYBRID SOLAR MANAGEMENT SYSTEM

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**Abstract** - Switching on or off of the solar street light is a major concern. To automate it a method is proposed and implemented. During foggy and rainy days when the sun is not visible and solar light intensity is very poor, batteries cannot be fully charged. Because of this the load which is a DC led does not glow to proper intensity during night time. The solution propped is too fold. The first one is to develop a system that can obtain sunrise and sunset data from a weather API to switch on or off the light without wasting battery charge. The second one is to develop a charge controller that is hybrid. Due to this hybrid charge controller battery will never go in deep discharge as it is the facility to switch to AC mains in case of low solar intensity. This solution provides an uninterrupted power supply to the street light.

**Keywords**- API, Hybrid Controller, Pedestrian accidents, Real-time, Solar Intensity, Street-Light, Vehicle accidents.

## 1. INTRODUCTION

Wastage of power in India is a major concern. Over 3 Billion units of electricity are wastage per year in India. It is equal to nationwide one-day consumption. Due to the lack of fossil fuels, we have shifted ourselves to renewable energy power generation i.e. solar energy generation. But the issue of wastage is not yet resolved. Consider an example of a morning driving. We can see sometimes that streetlights are glowing even after sunrise and in some cases, they are not switched on after sunset. Due to this sometimes the battery gets a deep discharge. There are many solutions present in the world to overcome this. The most effective solution is using a Light Dependent Resistor. Light Dependent Registers sense light to switch on or off the streetlight. With the deposition of dirt LDR sometimes failed to do what it is designed for. To overcome this problem another method is suggested i.e. using the reference voltage from the solar panel. Reference voltages changes after sunrise and again changes after sunset. The reference voltage is set by the voltage generates by the solar panel. This method is not perfect as it has some drawbacks. In the case of foggy and rainy days, we have faced problems. Sometimes our streetlight gets switched on in the morning times and sometimes it gets switched off at night times which leads to accidents. During night times the number of accidents is generally 3-4 times more as compared to daytime.

Time	Number of Accidents
06:00 - 09:00 PM hrs	86,836
09:00 - 12:00 PM hrs	51,425
12:00 - 03:00 AM hrs	27,954
03:00 - 06:00 AM hrs	30,291
Total (Night Time)	196,506

**Table 1.1 ROAD ACCIDENTS AT NIGHT AT DIFFERENT INTERVAL**  
(Source: <http://pibphoto.nic.in/documents/rlink/2016/jun/p20166905.pdf> )

Above **Table 1.1** interprets that amount of the accident is higher at night time even the amount of vehicles on roads is very less. If we take accidents to traffic ratio the statistics of night time is quite frightening. According to the ministry report, pedestrian accidents are more as compared to other accidents i.e. 25% of all accidents and 50% of casualties take place during night time. To increase the safety of the night time all the street lights must be working smoothly so that proper illumination provides better visibility that leads to fewer accidents.

To overcome this issue, we have developed a system that can overcome all the problems in the prior art to work as expected. We have introduced two new methods and algorithms to get the desired output. Switching on or off the street light is a major issue. So first we have developed a system that can take data from weather API. Weather API provides us the exact time for sunrise and sunset. With the help of which street light can be switched on or switched off.

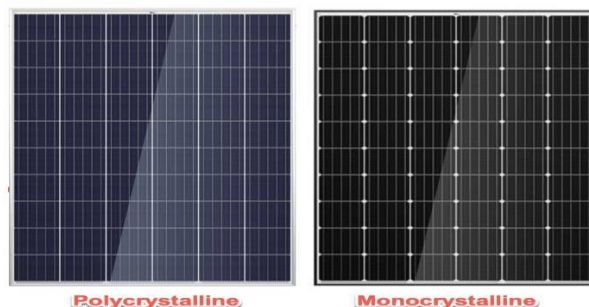
Another problem we face is the season of low solar intensity i.e. winter, rainy and foggy days. These days' solar intensity is very less because which battery does not get enough power to get fully charge. So, in this case, we have implemented a system i.e. Hybrid charge controller which can shift to AC Mains if the solar intensity is less and automatically shift to a Solar charger if the solar intensity is appropriate for charging. Both the problems can be solved using these solutions enclosed in an architectural design or a setup.

## 2. METHODOLOGY

As discussed earlier Solar based street light switching on or off is a major concern. To overcome this issue, we have implemented two types of methodology which we are going to discuss here. Switching is a major concern that needs a perfect solution. For this, we have to acquire exact sunrise and sunset data. For this, we have to look for weather API Data. In this case, we have taken google weather API data. With the help of Weather API, we can get the exact sunrise and sunset data of an exact location. Weather API also informs us about the sunny, rainy, and foggy days. With the help of the types of days our environment going to face and the visibility range the street light starts glowing or gets switched off. In the coming paragraphs, we will be discussing its design and work.

### 2.1 Experimental Design

**2.1.1 Solar Panel:** It is a type of photoelectric cell having electrical characteristics, such as current, voltage, or resistance, that varies when comes in contact with the light. Solar cells made up of photovoltaic modules, also known as solar panels, and are used as a photodetector (ex. infrared detectors), light detector, electromagnetic radiation detector across the visible range, and to measure the intensity of light. The photovoltaic cell operates in three steps: The absorption of light generates electron-hole pairs. There are some types of solar panels described below in **Table 2.1**.

Fig.2.1  
AND

SOLAR PANEL

POLYCRYSTALLINE  
MONOCRYSTALLINE

Solar Cell	Efficiency Rate	Advantage	Disadvantage
Monocrystalline Solar Panel	~20%	High efficiency rate; high life-time value	Expensive
Polycrystalline Solar Panels	~15%	Lower price	Sensitive to high temperatures;
Amorphous Solar Panels	~7-10%	Relatively low costs; easy to produce & flexible	shorter warranties & lifespan
Concentrated PV Cell	~41%	Very high performance & efficiency rate	Solar tracker & cooling system needed

Table 2.1 TYPES OF SOLAR PANEL

**2.1.2 MOSFET as a switch (IRZ44):** The MOSFET is a transistor used as an amplifier and also used as a switch for electronic signals. It consists of a source, gate, drain, and body. The substrate of it is connected to the source. In digital and analog circuits, it is commonly used. It requires less than 1Ma current, and output a higher current to a load of 50A or more.

**2.1.3 Wi-Fi Module - ESP8266:** This is a System on a Chip (SOC) with an integrated TCP/IP protocol that can give any microcontroller to access to any Wi-Fi network. Hosting an application or offloading all Wi-Fi networking functions from another application processor can be achieved by using this Wi-Fi module. This module is an extremely cost-effective board.

This module has a powerful on-board processing and storage capability which allows it to integrate with the sensors and other application-specific devices. It supports automatic power save delivery (APSD) for Voice Over Internet Protocol (VoIP) applications and Bluetooth co-existence interfaces. It contains a self-calibrated radio frequency allowing it to work under all operating conditions and requires no external radio frequency parts.

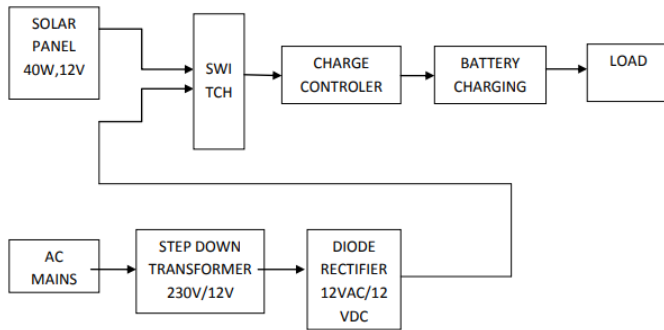
**2.1.4 Solar Battery:** It is a device that stores energy for later consumption which is charged by a connected solar system. The stored electricity is used after sundown, during peak period, or during a power outage. The most common usage is in residential or commercial buildings. Capacity and Power are two important factors in the case of solar batteries. It provides the amount of electricity a solar panel battery can store and how much electricity it can provide at any given moment of



time. The capacity of a battery is the total amount of electricity it can store, which can be measured in kilowatt-hours (kWh). The power rating of the battery tells us the amount of electricity that the battery can deliver at one time.

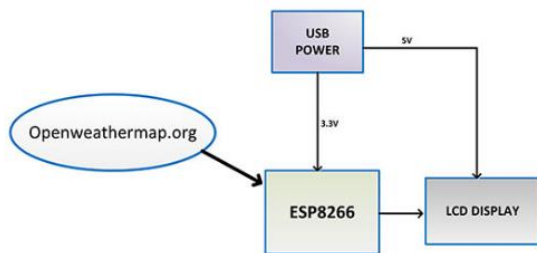
One can look at the two extremes; a battery with high capacity and low power, and a battery with low capacity and high power. A battery with high capacity and low power will be able to supply power to a number of key appliances in our home for a long time. A battery with low capacity and high power will be able to power our entire home for a short time.

**2.1.5 Charge Controller:** A charge controller is a much-needed part of solar management systems because it takes current from the solar panel and transfers it to batteries for charging. Its main purpose is to keep your batteries charged and safe. Charge controllers block reverse current and prevent the battery from overcharging. Charge controllers also prevent the battery from getting deep-discharge and also protect from electrical overload. It also displays battery status and the flow of power. Our developed charge controller is a Hybrid Type charge controller which possesses the ability to take Mains current in case of low solar intensity.



**Fig. 2.2 AC-HYBRID CHARGE CONTROLLER BLOCK-DIGRAM**

**2.1.6 Weather API:** Weather API is the application interface used for current weather information and forecasting. With the help of weather API, we can get to know whether the climate is clear, cloudy, foggy, hazy, rainy, icy, snowy, stormy, sunny. Weather API forecasting data up to a month before. With the help of weather API, we can collect sunrise and sunset data.



**Fig. 2.3 WEATHER API BLOCK DIAGRAM**

**2.2 Implementation:**

We will explain the methodology in few steps:

**2.2.1 First Step (Solar Charging):** The current output from the solar cell is transferred to the input of the solar charge controller. The charge controller then controls and regulates the voltage and current as per the requirements of the battery. Then its output is transferred directly to the battery for charging.

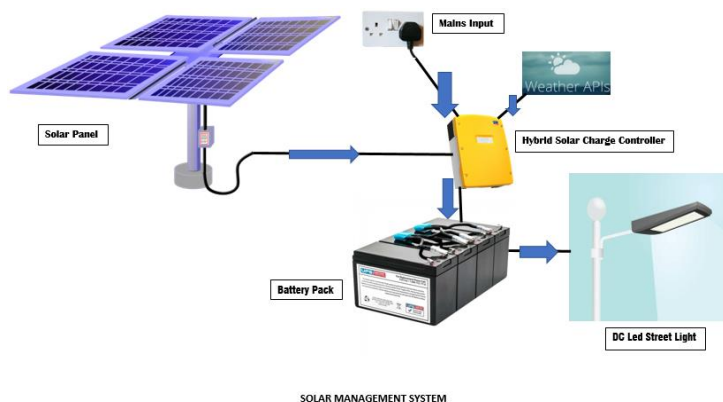


Fig. 2.4 HYBRID SOLAR MANAGEMENT SYSTEM

**2.2.2 Hybrid Charging:** In case of very less solar intensity or rainy and foggy days battery is charged from mains AC (220-240V). The charge controller converts AC to DC 12V for charging. Mains are connected when solar is not present at any battery voltage. Mains are connected when sufficient solar power is their i.e.  $\leq 11.8V/23.6V \pm 2\%$ . Mains disconnect when sufficient solar power for the battery is present i.e.  $\geq 13.8V/27.6V \pm 2\%$ .

**2.2.3 Charge Controller:** A charge controller is used to select the mode of charging. The charge controller regulates the current from the main energy source and auxiliary energy source and fed the power into the battery. When solar energy is available, it will charge the battery using a solar panel and when solar energy is not available, it will charge through AC mains.

**2.2.4 Switching On or Off:** Street light switching on or off is based on the data from the weather API. For example, if sunset time is 5:30 pm then the street light is switched on. If sunrise time is 6:10 am then the street light gets switched off. In case of rainy and foggy days if visibility is very less then it automatically switched on even in the daytime as per requirements.

## EXPERIMENTATIONS AND RESULTS

In this paper we have tested our entire setup in some of the street lights in our IIMT college premises. We have installed our full setup with indigenously developed charge controller.

We have measured and observe all the input parameters from the solar panel, mains, charge controller and battery and also measured all the output parameters from the solar panel, mains, charge controller, and battery. We have also calculated the number of hours the street light glows and practically tested it. We have found many results. We have taken optimized result for the proper specification. All parameters and specifications are discussed in the Table 3.1.

Table 3.1. CHARGE CONTROLLER PARAMETERS

<b>Parameters &amp; Specifications</b>	
<b>General</b>	
Operating Temperature	0*c to 60*c
Battery Type	Tubular/SMF, 12V/24V
Battery (Ah)	100Ah-180Ah
Battery Charging Regulation Method	4 Stage PWM
Solar Module Size	12V,20A: Up to 300W 24V,20A: Up to 500W 12V, 40A: Up to 500W 24V, 40A: Up to 1000W
<b>Electrical</b>	
Nominal System Voltage	12/24V DC
Charging Current (Solar)	40A/20A
Charge Controller Efficiency	>95%
Ideal Consumption	<20mA
Operating solar input voltage	22.5V/45V
Max. Solar input voltage	25V/45V
Min. Solar input voltage	15V/30V
Max. Solar Current	40A
<b>Battery Set Point At 25*C</b>	
Absorption Voltage	14.2V/28.4V
Absorption Duration	3hr
Float Voltage Battery	14V/28V
Bulk Voltage Battery	14.6V/29.2V

Equalize Voltage	14.9V/29.8V
Equalize Duration	3hr
Equalize Calendar	28 days
Mains Reconnect when solar not present	At any batt. voltage
Mains reconnect when insufficient solar power	$\leq 11.8V/23.6V \pm 2\%$ .
Mains Disconnect when enough solar power for battery	$\geq 13.8V/27.6V \pm 2\%$ .
<b>Protection</b>	
Battery Reverse Polarity	
Solar High Voltage	
Over temperature	

## CONCLUSION

In this paper we have presented weather API based smart hybrid solar management system. Our system can automatically switch on or off itself thus reduces all types of power wastages. In case of low solar intensity, it can shift its power source from photovoltaic to AC mains.

Our main aim is to develop a system which offers low cost solutions for our society and reduce power wastage in all aspects. In the future despite everything we still need to consider environmental factor to optimize system performance and make it more useful in the coming time.

## ACKNOWLEDGMENT

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# A STUDY OF STRUCTURAL, MICROSTRUCTURAL AND ELECTRICAL PROPERTIES OF PVDF/BATIO – BASED ENERGY HARVESTER

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**Abstract:** Motivated with promising applications of Poly (vinylidene fluoride) (PVDF)-based composites, in this work we report the synthesis of  $Ba(1-x)Sr_xTiO_3$  (BST)- Poly (vinylidene fluoride) (PVDF) nanocomposites and their characterization. Firstly, BST nanoparticles were prepared by a solid-state reaction method with varying concentration of Sr ( $x = 0\%$  to  $15\%$ ) and subsequently these nanoparticles were used for the synthesis of BST- PVDF composite films by simple solution casting method. Structural, microstructural, and dielectric properties of  $Ba(1-x)Sr_xTiO_3$  ceramics and its composites with PVDF semicrystalline polymer were studied. Synthesized samples were characterized by using X-ray diffractometer (XRD), Field enhanced scanning electron microscopy (FE-SEM), Fourier Transform Infrared Spectrometer (FTIR), and Impedance analyzer. It has been found that Sr doping of the  $BaTiO_3$  (BT) retains the perovskite structure of host  $BaTiO_3$  and causes a slight shifting of peak position towards high angle side, confirming the doping of Sr into BT. Further, different wt% of BST were uniformly distributed in PVDF polymer to as seen by FE-SEM. FTIR results reveal the increased fraction of  $\beta$ -phase PVDF with increasing concentration of Sr doping.

**Keywords:** Nanocomposites, Structural properties, Electrical properties, PVDF

## 1. INTRODUCTION:

Energy crisis is a grim reality of the present time because of the limitation of fossil fuels, growing energy demands, environmental problems like global warming. Growing energy demands and involvement of modern technological devices have promoted the investigation and development of pollution free renewable energy sources. Ambient outdoor energy sources such as solar energy, tidal energy and wind energy, etc. are largely expected to satisfy our large power demands.

Moreover, there are small amounts of ‘wasted’ energy such as heat generated while braking of automobiles, heat emitted by many of our home appliances, vibrations while our movement and movement of our body parts, that could be useful if captured. Recovering even a fraction of this energy would have a significant economic and environmental impact. This technique of capturing the energy is called energy harvesting that comes in.

Energy harvesting, or energy scavenging, is a process that captures small amounts of energy that would otherwise be lost as heat, light, sound, vibration or movement. It uses this captured energy to Improve efficiency and enable new technology. It offers several benefits as free maintenance, environmentally friendly, applications in transportable and wearable electronics.

Following the above consideration, in the past decade, polymer/ceramic composite dielectrics have been intensively investigated and great progresses have been successfully made. Especially, the PVDF based ferroelectric polymers have been mostly investigated in the composites for their high and tunable permittivity.

### 1.1 Barium Titanate ( $BaTiO_3$ )

Barium Titanate ( $BaTiO_3$ ) is a lead free perovskite material with general formula  $ABO_3$ . It possesses various interesting properties such as high dielectric constant, ferroelectric behaviour below  $130^\circ C$ , spontaneous polarization and non-linear optical coefficients. The origin of ferroelectricity in  $BaTiO_3$  derives from the displacement of ions relative to each other. It is well known that dielectric properties of  $BaTiO_3$  can be systematically modified by chemical substitution of barium and/or titanium sites and can be exploited for non- volatile ferroelectric FRAM's memories, detection of gaseous pollutants like CO, positive temperature coefficient resistors (PTCR), optical data storage at High density, and ultrasonic transducer [1]

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Strontium-doped barium titanate (BST) has been widely used for various applications, particularly in the fields of electronics and telecommunications, because of its high dielectric constant, large electric field tunabilities, relatively low dielectric losses, variable Curie temperature depending on Sr content, large polarization and large induced strains [2].

The aim of the present work is the synthesis, by the solid state process, and characterization of pure and strontium doped BaTiO<sub>3</sub> materials, in view of investigation of the influence of Sr-doping on their structural, microstructural and dielectric properties. It is known that synthesis of BaTiO<sub>3</sub> needs high calcination temperatures [3]. In this regard, our interest consists also in optimizing this parameter.

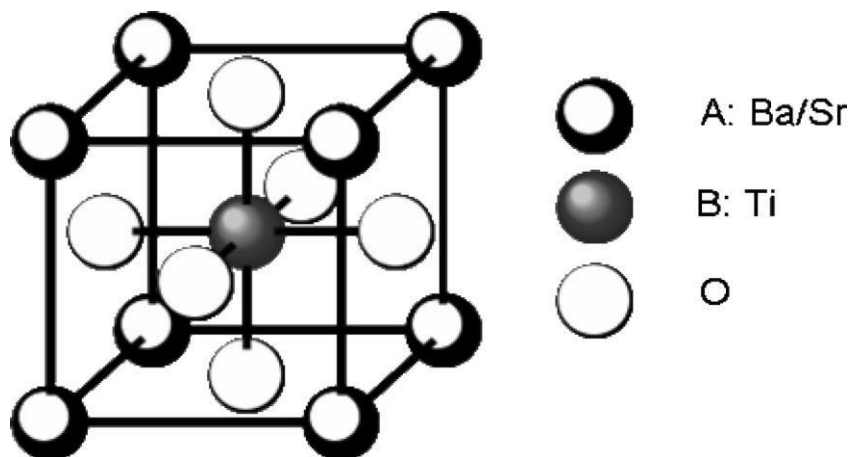


Fig. 1: Cubic Barium Titanate structure

BST is an ABO<sub>3</sub> perovskite lattice as shown in Fig. 1. Barium and strontium are both resident on the A-site (i.e. corners) of the lattice; titanium sits on the B-site (i.e. center); and, the oxygen atoms occupy the face-center sites. BaTiO<sub>3</sub> is found to exist in several phases based on the temperature range as shown in Fig. 2.

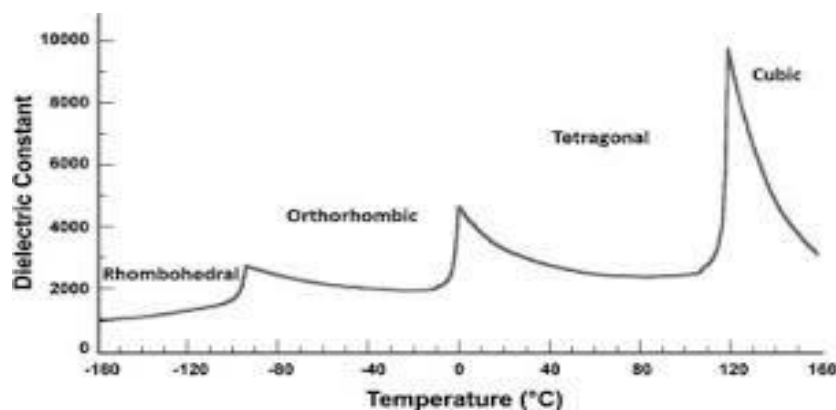


Fig.2: Temperature dependent behaviour of BaTiO<sub>3</sub>

BST has been widely used for various applications, particularly in the fields of electronics and telecommunications, because of its high dielectric constant, large electric field tunabilities, relatively low dielectric losses, variable Curie temperature depending on Sr content, large polarization and large induced strains.

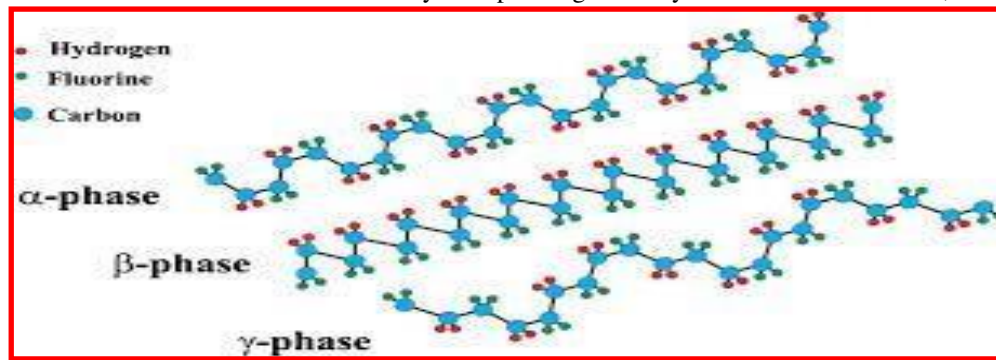
- Functional properties are sensitive to microstructure and chemical Modification.
- Shifts the curie temperature to room temperature.
- Make relaxers.

- It induces high chemical stability, high permittivity and low dielectric losses.

### 1.2 Poly (vinylidene fluoride)-based composites

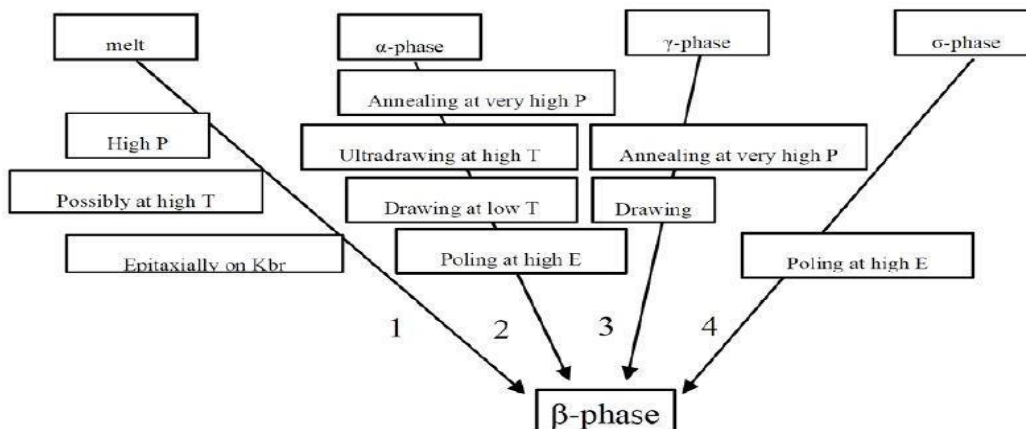
Lead-free ceramic, BT, exhibit wonderful properties to be exploited for energy harvesting and energy storage applications. However, low breakdown strength, high brittleness and heavier mass restrict it for its application in many modern technological applications such as sensors and actuators for aerospace applications and in wearable or transportable devices. Poly (vinylidene fluoride), PVDF ( $\text{CH}_2\text{-CF}_2$ ) with interesting scientific and technological properties is the typical representative of ferroelectric polymeric materials, which is lighter in mass, flexible, and has high breakdown strength. It has frequently been utilized for matrices in the dielectric nanocomposites due to their piezoelectric, ferroelectric, and pyroelectric properties. PVDF may exist in five crystalline polymorphs or different combinations of these conformations depending on different processing methods. These conformations are  $\alpha$ ,  $\beta$ ,  $\gamma$ ,  $\epsilon$ , and  $\delta$ . The chain conformation for different phases of PVDF, respectively  $\alpha$ ,  $\beta$  and  $\gamma$  phases is shown in Fig. 3. The  $\alpha$ -phase is the one commonly obtained directly from the melt by crystallization. The all-trans planar zigzag conformation of  $\beta$ -phase can induce a significant dipole moment. Furthermore, a large spontaneous polarization is generated by additive dipole moments. Polymer- based nanocomposites are of great interest as high permittivity materials for energy conversion, applications such as energy harvesters, capacitors, power-storage, and memory devices [4].

Such unique virtues of PVDF have been reinforced by incorporating a variety of fillers such as metals, carbon



**Fig. 3: Schematic representation of the chain conformation for  $\alpha$ ,  $\beta$  and  $\gamma$  crystalline phases of PVDF**

For all above-mentioned applications, only  $\beta$ -phase of PVDF is highly desired because of large piezoelectric response. However, synthesizing  $\beta$ -phase of PVDF from easily synthesized  $\alpha$ -phase of PVDF is quite challenging. Several methods are suggested to achieve  $\beta$ -phase. Mechanical stretching, electrical poling, introduction of fillers are the ways to achieve  $\beta$ -phase as represented in Fig. 4.



**Fig. 4: Conversion of PVDF from different conformations of PVDF to  $\beta$  phas**

The nanofillers induce more  $\beta$  phase content in the PVDF composites due to its interaction with the fillers and this increases the piezoelectric performance of the nanocomposites. Aluminium oxide decorated by reduced graphene oxide were incorporated in PVDF and used to fabricate a new piezoelectric nanogenerator for low frequency and low pressure based sensing applications [8-10].

Despite of several advantages of  $\beta$ -phase PVDF, there are few limitations that restrict its use in energy storage and harvesting areas such as low dielectric constant. The strategy to design an effective material for applications in aerospace and microelectronic devices, is to unify the properties of ceramic and PVDF. Combining the nanoparticles of ceramics into PVDF matrix, termed as ceramic-PVDF nanocomposites, resulted in wonderful applications. Powering small electronics (like artificial skin, sensors and biomedical devices) for indoor applications, depend highly on mechanical energy, since it is accessible anywhere at any time. Self-power systems reduce the requirement of external energy sources and the maintenance cost [5]. One way of energy harvesting that has received much attention is the conversion of mechanical energy to electrical energy by piezoelectric materials. Nanogenerator based on piezoelectric nanomaterials which can convert even human body motion to electrical energy. The mechanism of energy conversion in a typical piezoelectric material is the variation in dipole moment network by the application of strain and thereby creating a potential difference within the system. Inorganic ceramic particles such as BT and lead zirconium titanate (PZT) are well known for their piezoelectric and ferroelectric performances [8, 11]

## 2. EXPERIMENTAL DETAILS

In this chapter, firstly materials that are extensively used in this work are described. Secondly, the synthesis process of BST nanoparticles and PVDF-BST is described.

### 2.1 Material and Methods:

Materials used in the synthesis of BST nanoparticles and the polymer nanocomposite films are as follows:

#### Polyvinylidene fluoride (PVDF)

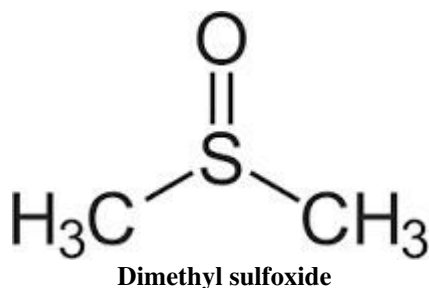
Polyvinylidene fluoride is a highly non-reactive thermoplastic fluoropolymer produced by the polymerization of vinylidene difluoride having chemical formula  $-(C_2H_2F_2)_n$ . It exhibits a ferroelectric and piezoelectric property that makes this polymer an important material for scientific research. PVDF having molecular weight 180,000 and density 1/78 g/ml (at 25 °C) was purchased from Aldrich and were used as received.

#### BARIUM TITANATE: With and without doping of Sr

Barium titanate nanoparticles were synthesized using Barium carbonate, Strontium carbonate and Titanium oxide powders purchased from the Aldrich.

#### DIMETHYL SULFOXIDE (DMSO)

Dimethyl sulfoxide (DMSO) is an organosulphur compound with the formula  $(CH_3)_2SO$ . This colorless liquid is an important polar aprotic solvent that dissolves both polar and nonpolar compounds and is miscible in a wide range of organic solvents as well as water. It was used as a solvent for PVDF polymer.



## SYNTHESIS OF BA(1-X)SR<sub>X</sub>TiO<sub>3</sub> NANOPARTICLES

Nanoparticles of  $Ba(1-x)Sr_xTiO_3$  were prepared by using solid state reaction. Solid state reactions are performed in the absence of solvents by either grinding or melting the starting materials together or simply applying heat to a mixture of starting materials. This type of reaction is usually performed in order to obtain polycrystalline inorganic solids but may also be used in organic synthesis. Solid state reactions offer reduced costs, decreased amounts of chemical waste and, sometimes, an increase in yield. Solid state reaction method is easy and quick method, however, step by step synthesis procedure, in this study, is given below:

For preparing the BST, we use the solid state method reaction with different powder, i.e. barium carbonate, strontium carbonate, titanium (iv) oxide.

- The BST powder mixture was grinded/milled by agate mortar .
- The powder mixture was mixed with acetone to form slurry.
- Then milled in agate mortar for different quantities i.e. 0%, 1%, 2%, 5%, 10%, 15%.
- Ingredients have been mixed, milled during 3 hours to form solid powder.
- Resulting powders were kept in high temperature furnace at 1100 °C for calcination for 3 hours.
- Sample pellets were pressed by mold machine which have been sintered in a furnace at 1300°C.

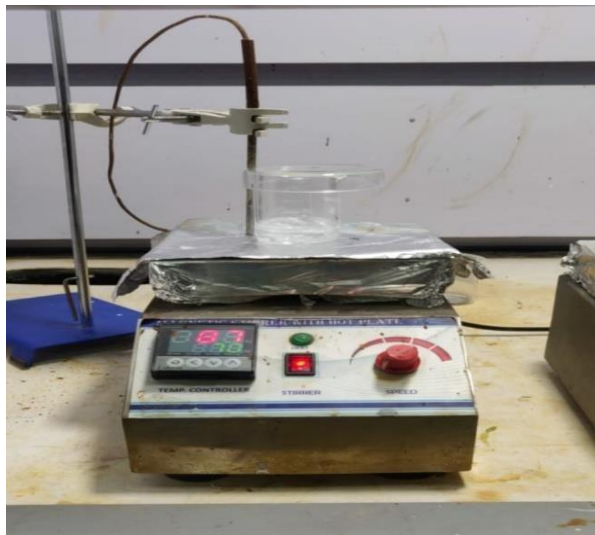
### SYNTHESIS OF PVDF-BST NANO-COMPOSITE FILM

The preparation of PVDF-BST nanocomposite films was prepared using a mixed solvent system as described below:

Step 1-

- PVDF and DMSO were taken in ratio of 3:1. i.e., PVDF=1.6 gm and 20 ml DMSO.
- dissolve this in a beaker and put magnetic bar.
- Mixture was kept on magnetic stirrer for approx. 1hr till PVDF dissolved completely at 70 °C. Step 2-
- Added BST=0.4gm
- then probe sonicate for half an hr at @10 gap with 60 °C temperature.
- Now set the temperature of ultrasonication at 70 °C.
- After probe sonication put this beaker for ultrasonication for 1 hr.
- After that put this beaker on magnetic hot plate, covered with Al-foil, for stirring with magnetic bar overnight.

Finally, the solution was poured in a clean petri-dish and kept in oven at 100 °C for 4 hours to make self- standing composite film. These fabricated films were used for the characterizations and images of the working steps are given in Fig5



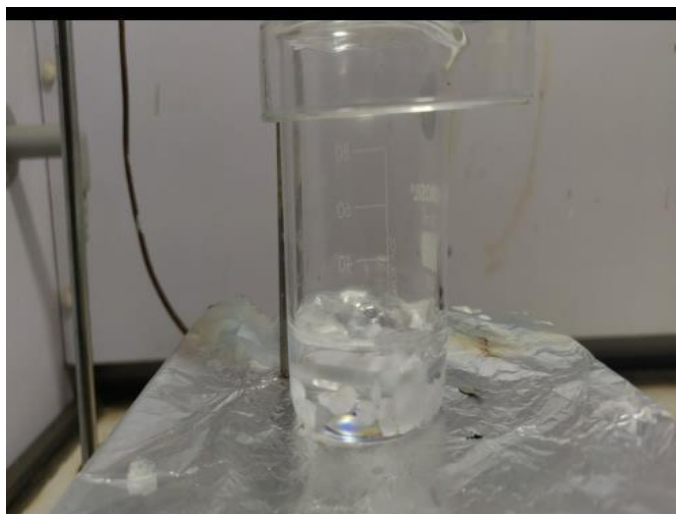
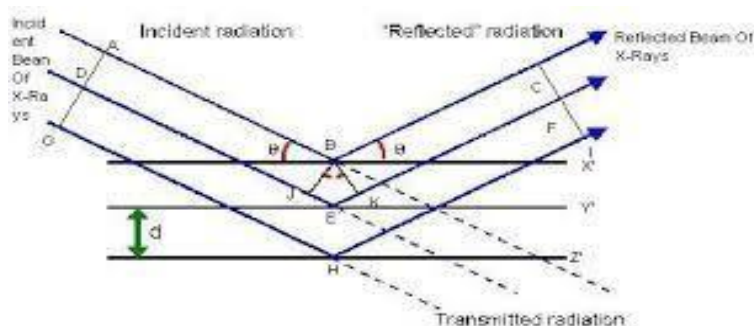


Fig. 5: Photographs of the important steps of composite film formation

### X-RAY DIFFRACTION (XRD): -

XRD is based on constructive interference of monochromatic x-rays diffracted from the crystalline sample (see Fig. 10) and is a commonly used technique in studying atomic spacing and crystal structure. In this x-rays are generated by a cathode ray tube which is filtered to produce monochromatic radiation which after collimation is directed towards the sample. Constructive interference (with a diffracted ray) is produced when incident rays interact with sample, satisfying Bragg's law ( $2d\sin\theta = n\lambda$ ).

It involves the study of the structure of an optical diffraction grating by examining interference pattern produced when visible light falls on the grating. Here for a glancing incident beam (small  $\theta$ ) detector will register only background radiations, with an increase in detector will register high-intensity radiation and we have a diffraction peak. It is also found that (diffraction angle) increases with a decrease in  $d$ -spacing. Main diffraction methods include Laue's method, rotating crystal method and powder method, each having different parameters to determine crystal structure.

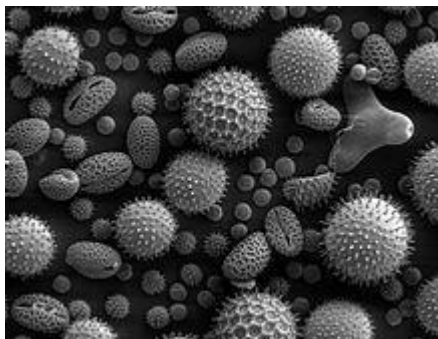


- Fig. 1: Schematic of interaction of X-rays with atomic layers in a crystal XRD is mainly used for –
  - Determination of crystal structure of unknown materials.
  - Measurement of average spacing between layers of atoms.
    - The orientation of single crystal planes or grain.
    - Determination of lattice constant.
- Measurement of shape, size and internal stress of small crystalline regions, by determination of lattice mismatches between films and substrates.



## SEM (SCANNING ELECTRON MICROSCOPE)

A **scanning electron microscope (SEM)** is a type of electron microscope that produces images of a sample by scanning the surface with a focused beam of electrons. The electrons interact with atoms in the sample, producing various signals that contain information about the surface topography and composition of the sample. The electron beam is scanned in a raster scan pattern, and the position of the beam is combined with the intensity of the detected signal to produce an image. In the most common SEM mode, secondary electrons emitted by atoms excited by the electron beam are detected using a secondary electron detector (Everhart-Thornley detector). The number of secondary electrons that can be detected, and thus the signal intensity, depends, among other things, on specimen topography. SEM can achieve resolution better than 1 nanometer.



**Fig. 2:** Image of pollen grains taken on an SEM shows the characteristic depth of field of SEM micrographs

## RESOLUTION OF SEM

1. The spatial resolution of the SEM depends on the size of the electron spot, which in turn depends on both the wavelength of the electrons and the electron-optical system that produces the scanning beam.
2. The resolution is also limited by the size of the interaction volume, the volume of specimen material that interacts with the electron beam.
3. The spot size and the interaction volume are both large compared to the distances between atoms, so the resolution of the SEM is not high enough to image individual atoms, as is possible with a transmission electron microscope (TEM).
4. The SEM has compensating advantages, though, including the ability to image a comparatively large area of the specimen; the ability to image bulk materials (not just thin films or foils); and the variety of analytical modes available for measuring the composition and properties of the specimen.
5. Depending on the instrument, the resolution can fall somewhere between less than 1 nm and 20 nm. As of 2009, The world's highest resolution conventional ( $\leq 30$  kV) SEM can reach a point resolution of 0.4 nm using a secondary electron detector

## FTIR (FOURIER TRANSFORM INFRARED RADIATION)

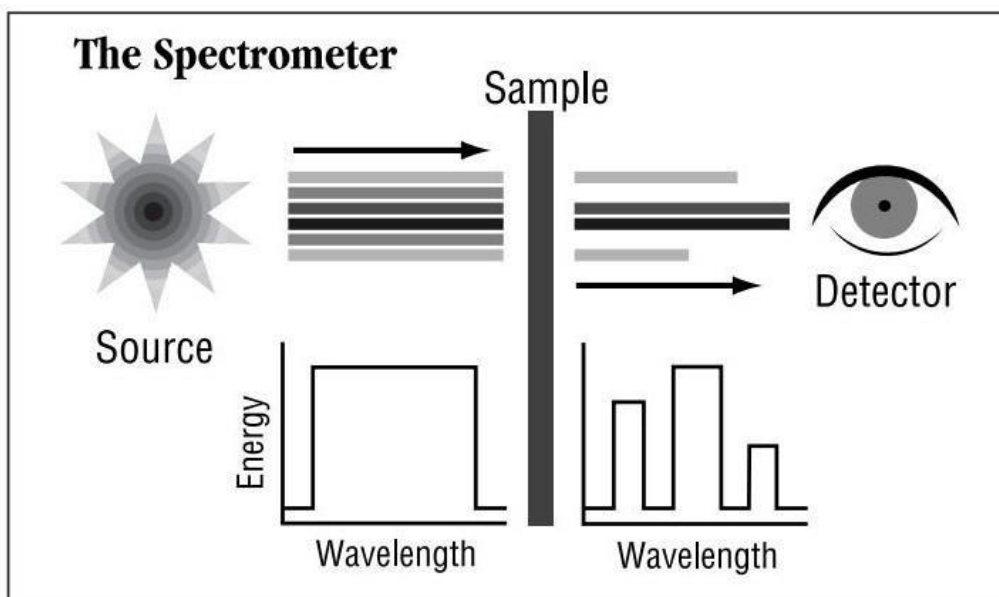
FT-IR stands for Fourier Transform InfraRed, the preferred method of infrared spectroscopy. In infrared spectroscopy, IR radiation is passed through a sample. Some of the infrared radiation is absorbed by the sample and some of it is passed through (transmitted). The resulting spectrum represents the molecular absorption and transmission, creating a molecular fingerprint of the sample. Like a fingerprint no two unique molecular structures produce the same infrared spectrum. This makes infrared spectroscopy useful for several types of analysis. So, what information can FT-IR provide? • It can identify unknown materials • It can determine the quality or consistency of a sample • It can determine the amount of components in a mixture This booklet is an introduction to the concepts behind FT-IR spectroscopy. It covers both the basic theory of FT-IR and how it works as well as discussing some the practical aspects of FT-IR use. We hope that it gives you a good understanding of the importance and usefulness of this powerful technique.





**Fig. 3: FTIR instrument**

FTIR spectrometry was developed in order to overcome the limitations encountered with dispersive instruments. The main difficulty was the slow scanning process. A method for measuring all of the infrared frequencies simultaneously, rather than individually, was needed. A solution was developed which employed a very simple optical device called an interferometer. The interferometer produces a unique type of signal which has all of the infrared frequencies “encoded” into it. The signal can be measured very quickly, usually on the order of one second or so. Thus, the time element per sample is reduced to a matter of a few seconds rather than several minutes.



**Fig. 4: Schematic of FTIR spectrometer**

Fourier transform infrared spectroscopy is preferred over dispersive or filter methods of infrared spectral analysis for several reasons:

- It is a non-destructive technique
- It provides a precise measurement method which requires no external calibration
- It can increase speed, collecting a scan every second
- It can increase sensitivity – one second scans can be co-added together to ratio out random noise
- It has greater optical throughput
- It is mechanically simple with only one moving part

### **IMPEDANCE ANALYZER**

An impedance analyzer is a type of electronic test equipment used to measure complex electrical impedance as a function of test frequency. Impedance is an important parameter used to characterize electronic components, electronic

circuits, and the materials used to make components. Impedance analysis can also be used to characterize materials exhibiting dielectric behaviour such as ceramics, biological tissue, foodstuffs or geological samples. Impedance analyzers come in three distinct hardware implementations, and together these three implementations can probe from ultra low frequency to ultra high frequency and can measure impedance's from  $\mu\Omega$  to  $T\Omega$ . Impedance Analyzer measures Capacitance/Dielectric Constant, Inductance, Resistance, Impedance, Dissipation factor, Quality factor etc of samples in the frequency range of 20Hz- 30MHz and in temperature range of RT-1000°C. The image of the dielectric measurement system is shown in Fig. 5.

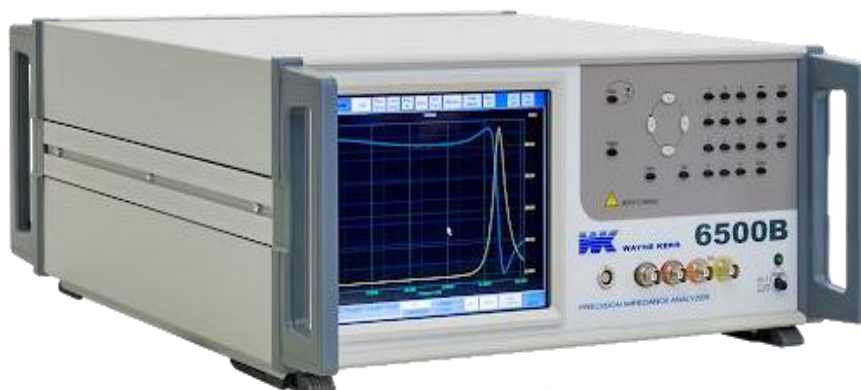


Fig. 5: Impedance Analyzer (Wayne Kerr, 6500 B Series, UK)

## RESULTS AND DISCUSSION

### X-RAY DIFFRACTOMETER:

X-ray powder diffraction (XRD) is a rapid analytical technique primarily used for phase identification of a crystalline material and can provide information on unit cell dimensions. The geometry of an x-ray diffractometer is such that the sample rotates in the path of the collimated x-ray beam at an angle  $\theta$  while the x-ray detector is mounted on an arm to collect the diffracted x-rays and rotates at an angle of  $2\theta$ . The instrument used to maintain the angle and rotate the sample is termed a *goniometer*.

### XRD OF BST CERAMICS

The sintered precursor was characterized by X-ray diffractometer (Bruker) using  $\text{Cu K}\alpha$ -radiation ( $\lambda=1.54060 \text{ \AA}$ ) at scanning speed of  $0.5^\circ \text{ s}^{-1}$ . The analysis of the observed pattern was done using X-Pert High-Score software. Fig. 1 shows the x-ray diffraction pattern of BST nanoparticles synthesized by solid state reaction method and calcined at  $1000^\circ \text{C}$  for 8 hr. The scanning is performed in the wide angle range of  $2\theta$  from  $20^\circ$  to  $80^\circ$  with Cu radiation having scan speed  $5^\circ/\text{min}$ . BT doped with 0%, 1%, 2%, 5%, 10% and 15% Sr (w/w) named as BST0, BST1, BST2, BST5, BST10 and BST15, respectively. XRD pattern of these samples are shown in Fig. 1.

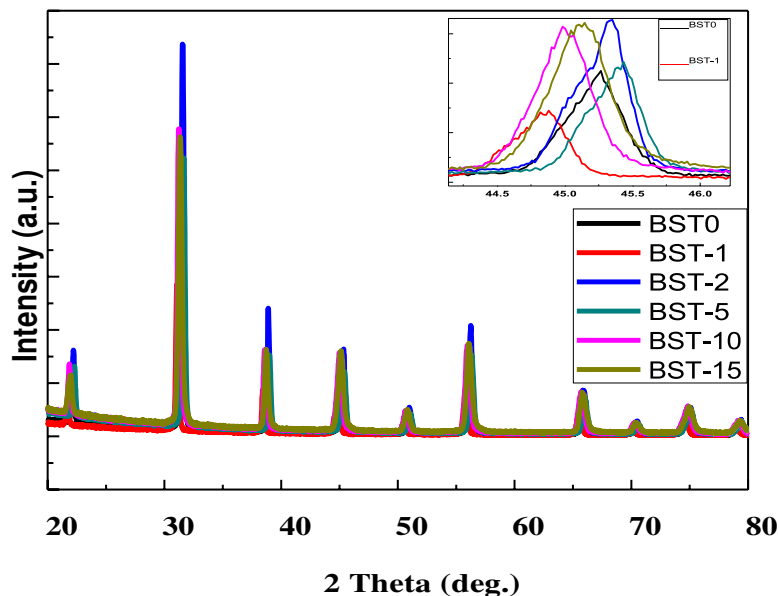


Fig. 1: XRD of BST nanoparticles calcined at 1000 °C.

Peak positions of the samples are consistent with the literature and reveal the formation of BST cubic phase. The samples have well defined diffraction pattern with strong and sharp diffraction peaks indicating they are crystalline. Crystallite size, as calculated by Scherrer relation ( $\text{crystallite size} = 0.9\lambda/\beta \cos\theta$ ), increases with temperature. Undesired cubic phase of BST might be due to insufficient calcination temperature. Therefore, all the samples were further calcined at 1300 °C for 4 hours. XRD pattern of these samples are shown in Fig. 2.

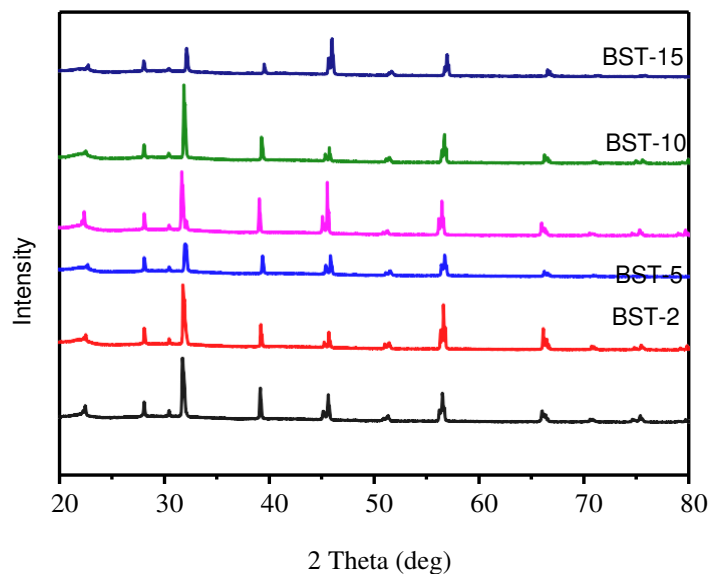


Fig. 2: XRD of BST nanoparticles calcined at 1300 °C.

Fig. 2 shows very clear and sharp peaks indicating the single phase BST. Further, doublets of the peaks, in contrast to single peak as observed in Fig. 1, indicates the tetragonal phase of BST samples. Peak positions are slightly shifted towards higher angle side, indicating doping of Sr.

## XRD OF PVDF-BST FILM

The impact of inclusion of BST nanoparticle into polymer matrix was evaluated using XRD analysis. XRD analysis of neat and modified PVDF films with BST (0%,1%,5%,10%,15%) nanoparticles were done to reveal the possible interaction between polymer chain of PVDF and magnetic nanoparticles

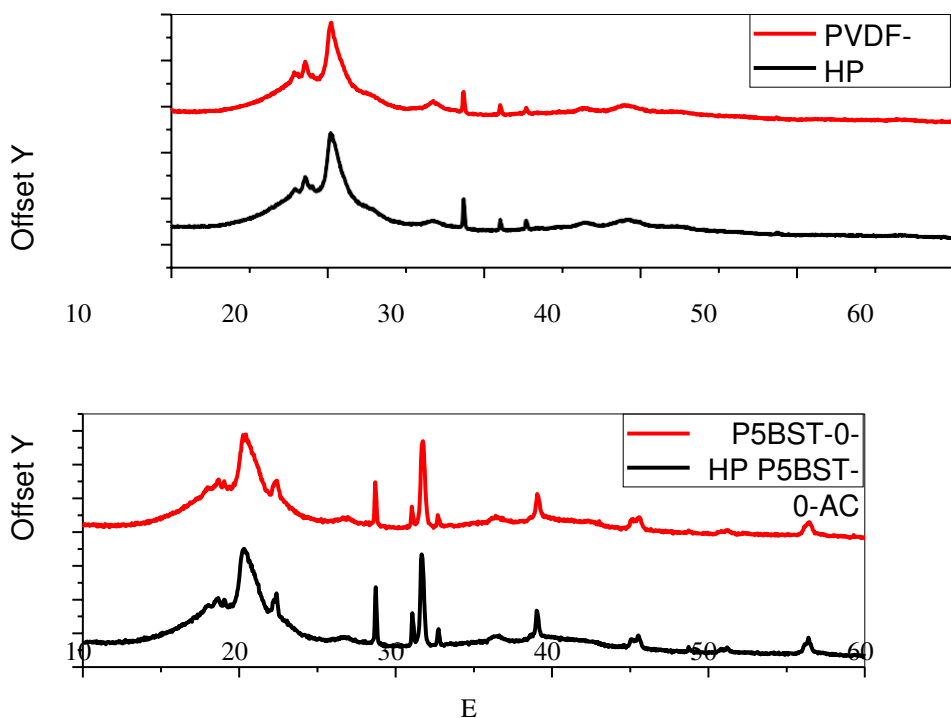


Fig. 3: XRD pattern of pure and doped PVDF films.

Following features of XRD pattern of the synthesized samples can be summarized as follows:

1. No effect of hot-pressing (300 Kg/Cm<sup>2</sup>, 160 °C, 3 min) is observed in PVDF.
2. After adding 5wt% BST-0, new peaks are observed as compared to PVDF. Again there is no effect of hot pressing here.

### SEM OF PVDF-BST NANOCOMPOSITES

Surface morphology of the neat and doped PVDF were studied using field enhance-scanning electron microscopy and are displayed in Fig. 5. Neat PVDF shows Lamellae feature whereas, uniform distribution of BST nanoparticles is observed. Although, with increasing concentration of BST, agglomeration takes place.

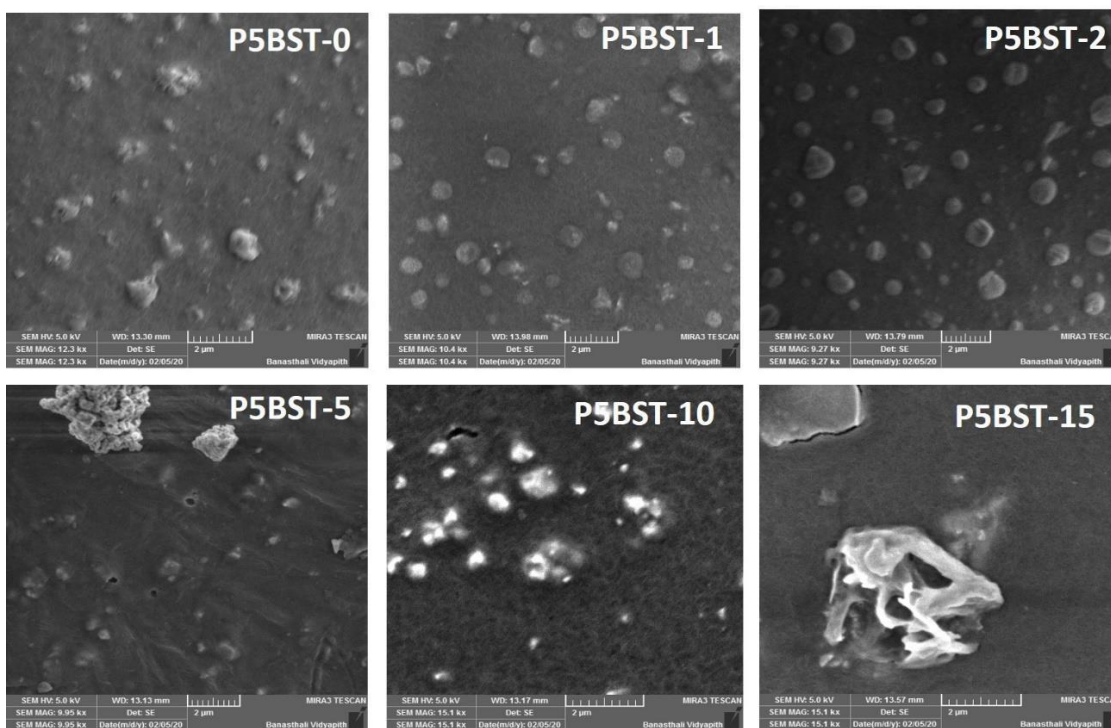
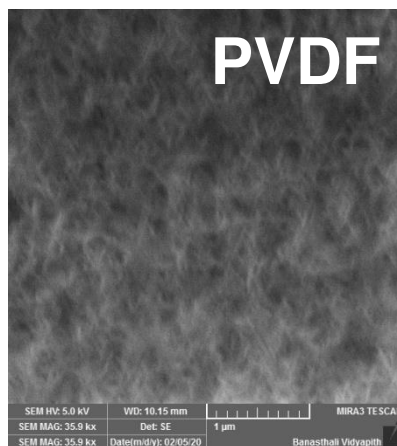


Fig. 5: SEM image of PVDF and its composites

## CONCLUSION

In this study, the BaTiO<sub>3</sub> and modified BaTiO<sub>3</sub> were synthesized by using the solid-state reaction method. These nanoparticles were mixed in PVDF matrix to make the nanocomposites. From the study, we conclude the following information:

- ❖ Tetragonal Phase of BST samples were synthesized by solid state ceramic route.
- ❖ With increasing Sr wt%, peak positions are shifted towards high angle side. It indicates the doping of Sr at Ba-site.
- ❖ PVDF/BST composites were prepared by solution cast method.
- ❖ XRD pattern of the composites reveals the formation of that the  $\beta$ -phase PVDF has increased after adding fillers.
- ❖ Homogenous distribution of ceramic particles in PVDF matrix as seen by SEM.
- ❖ Exhibits high dielectric constant for specific wt% of filler.

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# USE OF QUANTUM DOTS IN SOLAR ENERGY HARVESTING TECHNOLOGY

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**Abstract:** The solar photovoltaic market is one of the fastest developing energy markets in the world. By 2030, the solar power industry will see a growth of a factor of 10. In order for solar energy to succeed, a new technology is required that can provide superior efficiencies and lower the costs below standard silicon PV panels. Quantum dot solar cells just might be that technology.

A quantum dot solar cell (QDSC) is a solar cell that uses quantum dots as the captivating photovoltaic material. It is used to replace bulky materials such as silicon, or copper indium gallium selenide. Quantum dots have bandgaps that are adjustable through a wide array of energy levels by changing the size of the dots.

Quantum dots are considered to be artificial atoms. Their energy levels are adjustable by altering their size, which in turn delineates the bandgap. The dots can be grown in a variety of sizes, allowing them to convey a variety of bandgaps without changing the underlying material or construction. Sizing is achieved by varying the fusion duration or temperature.

Because the bandgap of the quantum dots can be adjusted, quantum dots are desirable for solar cells. Frequencies in the far infrared that are characteristically difficult to achieve with traditional solar cells can be obtained using lead sulfide colloidal quantum dots. Half of the solar energy reaching the Earth is in the infrared region. A quantum dot solar cell makes infrared energy as accessible as any other.

**Keywords:** Light harvesting, quantum dots, solar cells, tunable band gap.

## Nanotechnology for harvesting solar energy

From the previous research, it has been shown that nanotechnology is a powerful tool for a host of the solar system in support of efficient, sustainable energy conversion, storage, and conservation, in terms of

- tailoring the interaction of light with materials and enabling the processing of low-cost semiconductors into devices such as photovoltaics.
- Making more efficient photocatalysts for converting sunlight into chemical fuels.
- Developing new materials and membranes for the separations needed in many energy applications.
- Converting chemical fuels into electrical energy (and vice versa), and improving energy and power density in batteries.
- Improving efficiency in areas from displays and solid-state lighting to thermo-electric and friction.

## Solar cell technologies

Solar cells are usually divided into three main categories called generations.

1. First-generation solar cell (fully commercial) uses the wafer-based crystalline silicon (c-Si) technology, either single crystalline (sc-Si) or multi-crystalline (mc-Si).
2. Second-generation solar cell (early market deployment) is based on thin-film solar cell technologies and generally includes three main families: (1) amorphous (a-Si) and micromorph silicon (a-Si/ $\mu$ c-Si); (2) Cadmium–Telluride (CdTe); and (3) Copper–Indium–Selenide (CIS) and Copper–Indium–Gallium–Diselenide (CIGS).
3. Third generation solar cells include technologies, such as concentrating and organic solar cells that are still under demonstration or have not yet been widely marketed, as well as novel concepts are under development.

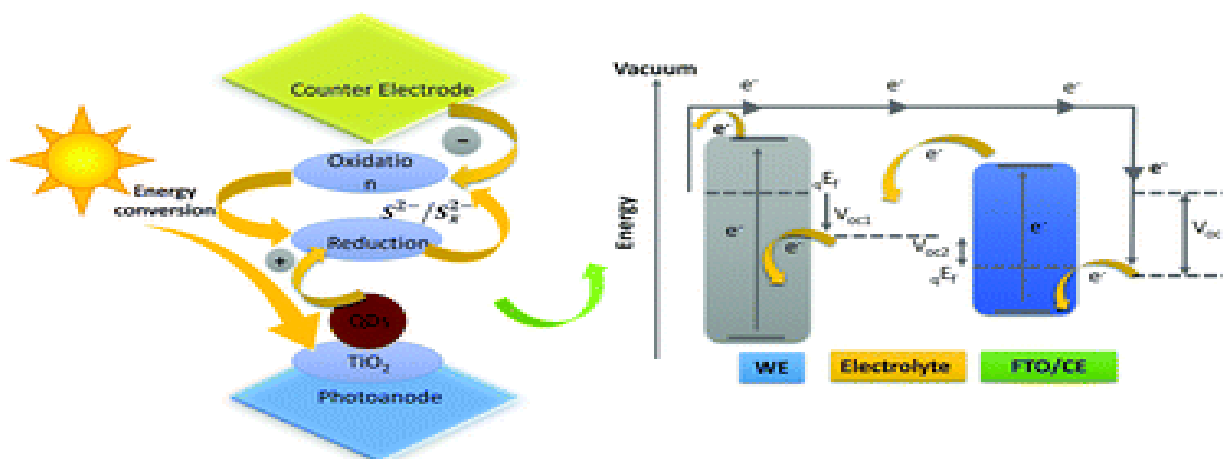
Quantum dots (QDs) are attractive for solar cell applications due to their ability to enhance light absorption via multiple energy levels and extend the absorption edge into the infrared range.

## Introduction to Quantum Dot Sensitized Solar Cells

As a cost-effective alternative to silicon-based photovoltaic systems, recently, quantum dot sensitized solar cells (QDSSCs) have gained considerable popularity. QDSSCs, an evolution from dye sensitized solar cells (DSSCs) which were first reported by O'Regan and Grätzel in 1991, are considered to have great potential as the next generation of solar cells (SCs). Several efforts have been made to obtain an ideal organic dye as a sensitizer to absorb photons in the full visible spectra. It has been a challenge to obtain such an ideal organic dye. Hence, narrow band-gap semiconductor quantum dots (QDs), such as CdSe, InAs, CdS and PbS became more popular as photosensitizers due to their versatile optical and electrical properties, such as higher stability towards oxygen and water, tunable band gap depending on the QD size, multiple exciton generation (MEG) with single photon absorption and larger extinction coefficient<sup>3,4</sup>. Light absorption and exposure of the photon-sensitive material to light are the two main factors that govern the efficiency of a SC. Very high light absorption can be achieved using QDs adsorbed on nanostructured materials. Through tuning of the band gap of the QDs, absorption of various wavelengths of the visible spectrum of light can be achieved. Coupling QDs with semiconducting nanorods which have high surface area allows better tapping of sunlight as more photon-absorbing QDs can be coupled to the surface. The incorporation of nanomaterials improves photoenergy absorption owing to high available surface area. In this article, the impact of nanomaterials in QDSSCs and various possible structures for improving the performance of QDSSCs are presented.

### Construction of QDSSC

Following figure shows the typical construction schematic of QDSSC. It consists of a photoanode and a counter electrode separated by a redox couple. The photoanode consists of a wide band gap, mesoporous semiconductor layer attached to conducting glass and QDs adsorbed onto the semiconductor layer. QDs work as sensitizer in which electron-hole pairs are created upon exposure to light. Mesoporous structure of the semiconducting layer provides enhanced surface-to-volume ratio, which in turn facilitates enhancement in the adsorption of QDs onto it. The redox couple scavenges the photogenerated holes and produces electrical equilibrium in the semiconducting layer. Sulphide/polysulphide redox couple is most widely used because of its higher open circuit voltage and better stability for photovoltaic operation. Various additives have been explored with sulphide/polysulphide redox couple. In fact, a new record of average power conversion efficiency of 12.3% of Zn-Cu-In-Se QD-based QDSSCs has been reported, where 6 vol% tetraethyl orthosilicate is used as an additive in polysulphide electrolyte.



CdS, CdSe, ZnSe, PbS, Ag<sub>2</sub>S, CuInS<sub>2</sub>, CdTe, InP and CdHgTe are materials of choice for QDs to be used as sensitizer in QDSSC design. The most popularly used wide band gap semiconductor in QDSSCs is TiO<sub>2</sub>. ZnO, SnO<sub>2</sub> and Nb<sub>2</sub>O<sub>5</sub> are also reported to be used as mesoporous semiconducting layer in QDSSCs.

Zinc Oxide with a direct band gap of 3.37 eV is also gaining attention along with TiO<sub>2</sub>, which has been the most sought after for DSSC photoelectrodes. The advantage of using ZnO over TiO<sub>2</sub> is its direct band gap (TiO<sub>2</sub> has an indirect band gap of 3 eV) and high exciton binding energy of 60 meV. ZnO also has a higher electron mobility (200 cm<sup>2</sup>/V/s) than TiO<sub>2</sub> (30 cm<sup>2</sup>/V/s), which makes it a better choice than TiO<sub>2</sub>. Another advantage of ZnO is that it has the largest collection of nanostructures ever recorded like nanorods/nanowires, hierarchical nanostructures, nano-sheets, nanoneedles, nanotubes, etc. By controlling the structure of single crystalline ZnO, it is possible to reduce electron hopping and electron mobility. The single crystalline ZnO nanorods provide a direct path for the diffusion of electrons through them. Further, densely grown ZnO nanorod arrays can provide a very high surface area compared to volume. ZnO nanorods can be grown using simple hydrothermal methods, making them the most suitable for low-cost QDSSC design. Numerous reports are available on the use of ZnO nanostructures in QDSSC. However, the reported efficiency of ZnO-based DSSCs is still lower than the TiO<sub>2</sub>-based ones.

### Challenges of utilizing nanotechnology

Researchers face various challenges for the development of this field such as

- The deficiency of similarity among experimental results from several groups.
- Poor long term stability of nanoparticle suspension.
- Poor theoretical knowledge on key energy transport mechanisms.
- Increased pressure drop and viscosity, lower specific heat and higher cost of nanofluids.
- Green technology for high volume production of nanofluids.
- Convective heat transfer of nanofluid with experimental studies is needed.
- Besides this, some parameters should be carefully considered while conducting experimental studies, i.e., change in thermophysical property with respect to temperature, particle migration and Brownian motion of particles.

### Conclusions

Incorporation of nanostructured materials in QDSSCs can significantly improve light absorption owing to large surface to volume ratio offered by them. Tunable bandgap and multiple exciton generation in QDs have opened up unnumerable possibilities in high efficiency SC designs. Nanostructured TiO<sub>2</sub> and ZnO are widely used as semiconducting material for the transport layer in QDSSCs. Though the efficiency obtained with TiO<sub>2</sub> is better than ZnO at present, the latter is gaining popularity as it has the advantage of higher electron mobility (200 cm<sup>2</sup>/V/s) than the former (30 cm<sup>2</sup>/V/s). Many structures of SCs have evolved based on QD sensitizers. Energy loss due to thermalization of hot charge carriers and sub-bandgap transmission can be addressed using tandem structures. A tandem structure of TiO<sub>2</sub>/CdS/Cu-ZnS is reported to have an improved efficiency of 3.35%, which is 82% higher than TiO<sub>2</sub>/CdS-based QDSSCs. It is reported that cell efficiency increases by 600% with double layer of passivation compared to cells containing only CdTe. In core-shell structure, cooling of the hot carriers is slower, which helps in carrier multiplication and hence improves efficiency. Lai et al. studied PbS core and CdS shell, and found four times higher efficiency than that obtained with simple PbS QDs coated with ZnS after deposition. CdSe/(CdSe)<sub>x</sub>(S<sub>1-x</sub>)<sub>5</sub>/(CdS)<sub>1</sub> core/shell QD based QDSSCs are reported to have a maximum photoconversion efficiency of 6.86%. An optically thick but physically thin structure of a SC is highly desirable. It can be achieved by means of plasmonic SCs, where light trapping mechanism is introduced in already designed cells. This review will be helpful to SC enthusiasts working on novel designs.

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THEME-IV

ADVANCES IN POLLUTION  
MONITORING AND CONTROL



# IMPACT OF LOCKDOWN FOR FIGHTING CORONA VIRUS ON AIR QUALITY IN NATIONAL CAPITAL REGION (NCR)

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**Abstract:** None was left affected by major and devastating disease coronavirus spread worldwide. The novel disease which affected everybody lived psychologically, economically, physically. People are suffering from tonnes of difficulties in surviving their life. Majority of population is in depression somewhere.

The Government of india was forced to take such steps which can control this deadly disease. Due to which government had to imposed lockdown several times so that the movement of people can be reduced and the transmission of this disease from one person to another can be lessened. This period brought depressive moments in majority of population but along with it this period proved happy in other aspect. It has positively impacted the environment and air quality. Taking its positive aspect this paper strives to find out the impact of lockdown due to fight against covid 19 on Air Quality Index considering the level of major particulate matters (PM 2.5, PM10, and NO<sub>2</sub>) in National Capital Region of India. This paper strives to comparing the level of these pollutants before lockdown and after lockdown in National Capital Region. The examination of data concluded that air quality levels improved in the lockdown periods as emission level reduced by 85% - 90 % as result pollution levels dropped to high level.

In this paper, we present an analysis of air quality (particulate matter-pm 2.5, air quality index, and tropospheric No<sub>2</sub>) over india using ground and satellite observations. A pronounced decline in pm 2.5 and aqi (air quality index) is observed over delhi, mumbai, hyderabad, kolkata, and chennai and also a declining trend was observed in tropospheric no<sub>2</sub> concentration during the lockdown period in 2020 compared with the same period in the year 2019. During the total lockdown period, The air quality has improved significantly which provides an important information to the cities' administration to develop rules and regulations on how they can improve air quality. In this paper, we present an analysis of air quality (particulate matter-pm 2.5, air quality index, and tropospheric No<sub>2</sub>) over india using ground and satellite observations. In this paper, we present an analysis of air quality (particulate matter-pm 2.5, air quality index, and tropospheric No<sub>2</sub>) over india using ground and satellite observations. In this paper, we present an analysis of air quality (particulate matter-pm 2.5, air quality index, and tropospheric No<sub>2</sub>) over india using ground and satellite observations. A pronounced decline in pm 2.5 and aqi (air quality index) is observed over delhi, mumbai, hyderabad, kolkata, and chennai and also a declining trend was observed in tropospheric no<sub>2</sub> concentration during the lockdown period in 2020 compared with the same period in the year 2019. During the total lockdown period. The air quality has improved significantly which provides an important information to the cities' administration to develop rules and regulations on how they can improve air quality.

**Keywords:** Coronavirus, Air Quality Index, Positive Impact, Pm 2.5, Pm10

## INTRODUCTION

Coronavirus is a disease which originated from wuhan city in china and which was spread across the world gradually and effected every country badly. In india coronavirus was spread after few month and got uncontrollable . To curb the spread of this highly contagious disease and minimize the fatality and fight against such deadly virus government had to impose several lockdown . In order to stop the spread of this highly deadly disease and minimize the death rate , government of india have adopted important measures to reduce interaction among individuals such as banning large scale public and private gatherings, imposing a curfew, restraining transportation, promoting social distancing, strict quarantine instructions, and locking down the country, states and cities, depending on the country-specific situation. The preventive measures against covid- 19 brought lot of difficulties , but on the brighter side, it effected society positively . Environmental conditions and Natural environment improved to a extent level which India had

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never achieved that level. This improvement may partially equilibrate the cost of these counter covid-19 measures. First time prime minister of india announced 14 hour “janata curfew” on 22 nd march 2020 which implied that nobody will move from their home outside except in extreme emergency and from 22nd march total lockdown was announced upto 31 march and it was extended to 15 may. considering the slump in cases government had to extend this date with further relaxations. In this period total activities got standstill and evrything was stopped and due to which air quality was majorly affected. The major sectors which contributes to air pollution are transport, industries, power plants, construction activities, biomass & refuse burning, road dust re suspension and residential activities. Under the nationwide lockdown, all transport services – road, air and rail were suspended with exceptions for essential services. Sectors like industrial establishments, construction activities, commercial and hospitality services, etc were also suspended. As a result of the reduction of emissions from various sources, air quality had a more reasonable and visualised effect.

## Research Methodology

Study is descriptive in nature as data has been generated from continuous ambient air quality monitoring (caaqm) network and data was analysed for delhi and its neighbouring major National Capital Region towns i.e. Faridabad, Gurugram, Noida and ghaziabad. Comparable study was conducted in which the impact of lockdown due to coronavirus on air quality major particulate matters (PM 2.5, PM10, and NO<sub>2</sub>) has been studied in NCR towns before Pre lockdown period and Post lockdown period.

## FINDINGS

Due to reduction in movement of vehicles and suspension of industrial activities, major reduction was observed in PM<sub>2.5</sub>, PM<sub>10</sub>, NO<sub>2</sub> level. As our research area was National Capital Region towns i.e. Faridabad, Gurugram, Noida and Ghaziabad. So after study followings findings were gathered in individual areas.

### Delhi:

In delhi study was conducted and it was observed that PM<sub>2.5</sub> reduced by 50% during lockdown phase and PM<sub>10</sub> reduced by 60%, NO<sub>2</sub> levels had fallen by 64% as comparing to pre lockdown phase.

### Faridabad

Like other cities, the impact of restrictions was visible in Faridabad in clear reduction in particulate matter and SO<sub>2</sub> levels. SO<sub>2</sub> and PM<sub>2.5</sub> levels reduced noticeably by an average of 55% and 49% during both phases of lockdown values as compared to pre-lockdown levels. Data for NO<sub>2</sub> seemed to be inconsistent and has not been considered in the analysis. PM<sub>10</sub> levels reduced by 45% and 34% in the first and second phase of lockdown respectively, as compared to pre-lockdown levels.

### Gurugram

NO<sub>2</sub> and SO<sub>2</sub> levels remained below National Ambient Air Quality Standards. The reduction in PM<sub>10</sub> levels are higher as compared to pre-lockdown levels as compared to PM<sub>2.5</sub> levels. Since dust & construction activities contribute 49% to PM<sub>2.5</sub> and 52% to PM<sub>10</sub> in Gurugram (TERI Source Apportionment study, 2018), it is likely that road dust resuspension due to vehicle restrictions might have come down resulting in lower emissions with 39% and 41% reduction in PM<sub>2.5</sub> and PM<sub>10</sub> levels during lockdown phase-I but was only 26% and 34% in PM<sub>2.5</sub> and PM<sub>10</sub> respectively in lockdown phase-II.

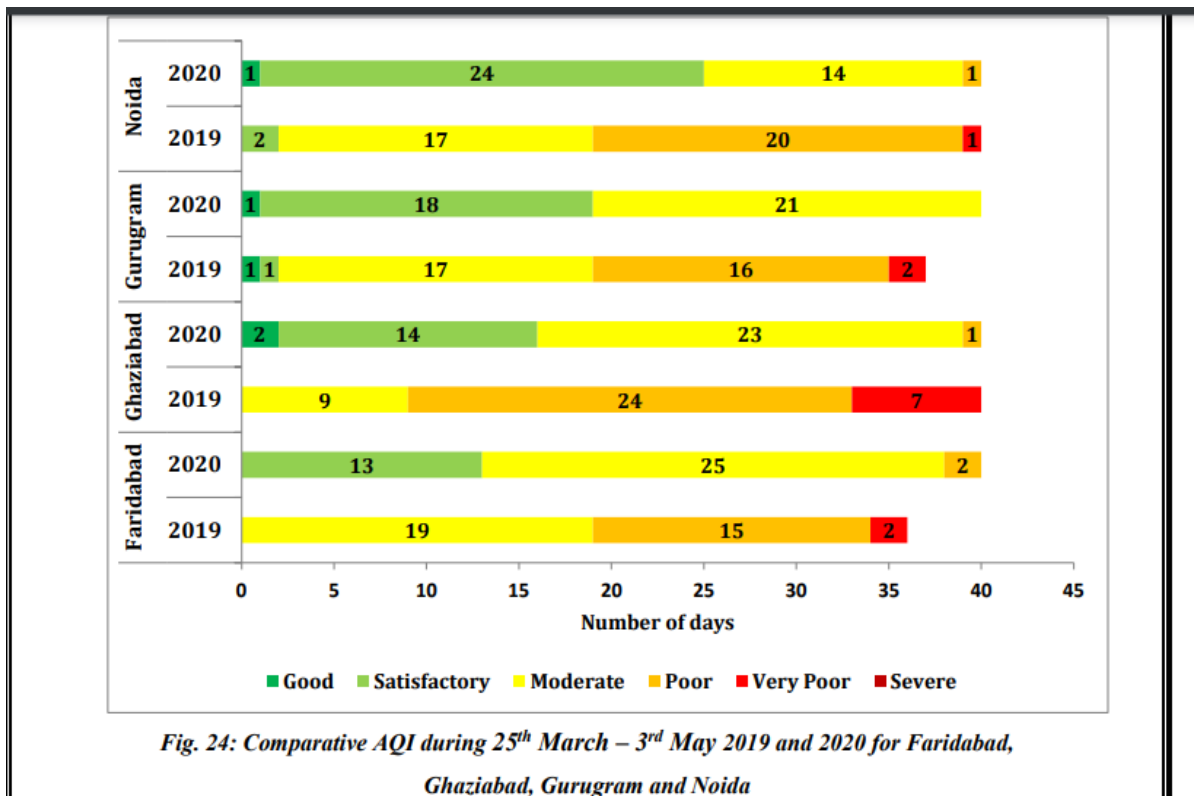
### Ghaziabad

NO<sub>2</sub> levels decreased by 51% and 47% in the first phase and second phase of lockdown respectively, as compared to pre-lockdown levels. PM<sub>2.5</sub> level reduced by 70% and PM<sub>10</sub> level has been reduced by 60%.

### Noida

Positive effects of lockdown on air pollution levels were observed in Noida, as emission levels reduced from the pre-lockdown period with over 29% reduction in PM<sub>2.5</sub> and PM<sub>10</sub> in the second phase of lockdown. NO<sub>2</sub> decreased by

over 55% in both phases of lockdown period. While dust (road, soil, construction) is a major emission source in Noida contributing 46% to PM<sub>2.5</sub> (TERI source apportionment study, 2018), considerable reduction in PM<sub>2.5</sub> levels decreased by 42% in the first phase of lockdown.



## Conclusion

Major improvement was observed in air quality at the period of lockdown due to suspension of activities. Factors responsible for improving air quality were restrictions on movement of vehicles due to which less pollutant was emitted, restrictions on carrying out industrial activities, management of air quality conditions. But due to COVID major changes were seen in air quality, people were able to breathe properly.

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# BIOPLASTICS: AN ALTERNATIVE TO TRADITIONAL PLASTICS

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**Abstract:** About 4% of the world's total petroleum reserves are used for plastic preparation, which are getting exhausted very quickly. Although plastics have vast applications in every field of life i.e. from construction to transportation, from food packaging to furniture. Traditional plastics (petroleum based) have many drawbacks such as landfills disposal which leads to deterioration of soil, incineration which cause greenhouse gases emission from industries and biodegradability of these plastics takes hundreds of year. Despite of having various adverse effect on environment the role of plastics in our life can't be ignored. As traditional plastics are non-biodegradable and also synthesized from renewable resources, there has been up surge interest in bio plastics which are bio based and biodegradable. This paper includes the mainly starch based bio plastics. Various types of bioplastics are produced from potato starch, corn starch, wheat starch, rice starch and agar using glycerol as plasticizer. Some plastics degrade in open and others are composted. This paper shows the potential of bio plastics for various industrial and commercial applications.

**Keywords:** bioplastics, corn, wheat, rice, potato, starch, biodegradability

## INTRODUCTION

Today plastics play a very important role in our daily life. More than 300 million tons of petroleum based plastics are produced annually until 2015. In plastic production, components of oil or natural gas are heated in cracking process, yielding hydrocarbons as monomer. Plastics have wide applications in all fields of life i.e. in food packaging, automobiles, electronic items, medical equipment, etc. They are widely used because of low cost, low weight and resistant to solar and chemical and microbial degradation. However, its overuse has caused many adverse effect on ecosystem. Disposal of plastics on land leads to deterioration of soil, greenhouse gas emission from industries which in turn affects the quality of life [1]. Due to these effects of traditional plastics, the development of bioplastics has arisen. Bioplastics are the plastics which are either bio-based or bio degradable. Bio plastics can be made from cellulose, starch, lignin, agar, proteins and lipids extracted from renewable resources. One of the most studied and promising raw material for production of bio plastics is starch which is completely biodegradable. Starch is mainly composed of two component i.e. amylose (linear) and amylopectin (branched). Starch occur in form of granules in plants such as potatoes, wheat, cassava, rice, maize. Starch is a white colour carbohydrate which is odourless, tasteless and insoluble in cold water but soluble in hot water [2]. The relative proportions of amylose and amylopectin varies with the biological sources of starch.

**Table 1.** The percentage of amylose and amylopectin concentration of various starch sources [3].

S.No.	Source	Amylose content (in %)	Amylopectin Content (in %)
1	Banana	17	83
2	Cassava	18.6	81.4
3	Potato	17.8	82.2
4	Corn	28	72
5	Rice	35	65
6	Wheat	20	80

Amylose content is important for bio plastics production because it is required for gelatinization and retro gradation during film formation. As amylose content was increased the tensile properties of the bioplastics would increase. About 50% of commercially used bio plastics are synthesized from starch. However, Starch based bio plastics has some drawbacks i.e. these bioplastics are brittle in nature. In order to increase their tensile strength, and water resistance capability plasticizers such as glycerol is added in synthesis of bioplastics [4]. The thermal, chemical,

mechanical and bio degradable properties of these bio plastics were also studied to analyze the potential of these bioplastics as a suitable substitute to traditional plastics.

## MATERIALS AND METHOD

Materials: Potato peels, glycerol, water, hydrochloric acid, sodium hydroxide, corn starch, acetic acid

### EXTRACTION OF STARCH FROM POTATO PEEL

Potato peels are pureed using distilled water and filtered with the help of muslin cloth and allow the starch to settle for 5 minute and then supernatant decanted. The crude starch was purified by using centrifugation of 10000 rpm for 1 minute. Then 100 ml distilled water was added to rinse the starch and water was decanted, a clear wet starch is obtained. Starch was dried in an oven to obtain white powder.

For bioplastic preparation, 5 g of starch powder was added to 50 ml distilled water. Then, 5 ml 0.1 N hydrochloric acid and 4ml of glycerol was added. The mixture was heated for 15 minutes by covering with a watch glass to prevent the evaporation of water. The pH of the solution was acidic. So, 5 ml of sodium hydroxide was added to neutralize the mixture [5]. The mixture was poured into petri dishes and baked in hot air oven at 130°C for 30 minutes. Bioplastic in the form of sheets was obtained.

### PREPARATION OF BIOPLASTIC FROM CORN STARCH, RICE STARCH & WHEAT STARCH

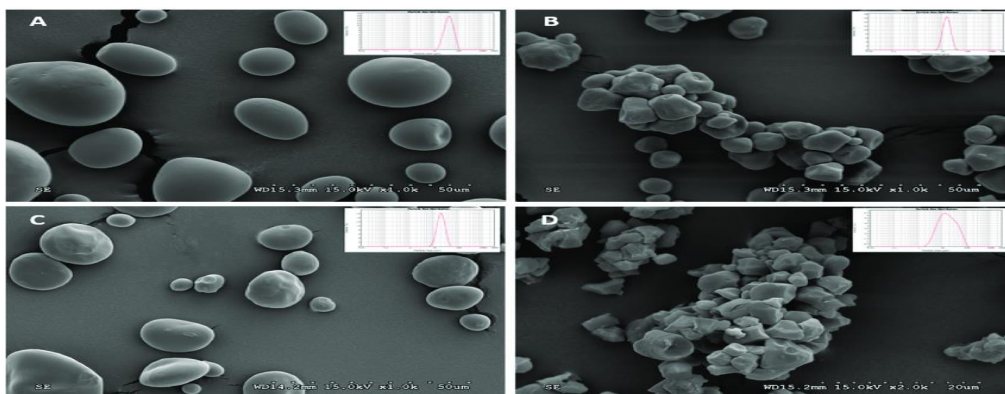
10 g of corn starch was added to a beaker containing 60 ml distilled water. 5 ml of acetic acid and 5 ml of glycerol were sequentially added. Then mixture was heated on low flame with constant stirring. The mixture was poured into petri dishes and baked in hot air oven at 130°C for 90 minutes. Corn starch based bioplastic was obtained in the form of sheets.

From same method the plastic sheet from wheat starch and rice starch can be synthesized.

## RESULTS AND DISCUSSIONS

### CHARACTERIZATION OF STARCH OBTAINED FROM POTATO, CORN, RICE AND WHEAT

The SEM analysis (figure 1) shows that potato starch granules have an oval shape, wheat starch granules have lenticular shape, corn and rice starch granules have polyhedral shape [6].

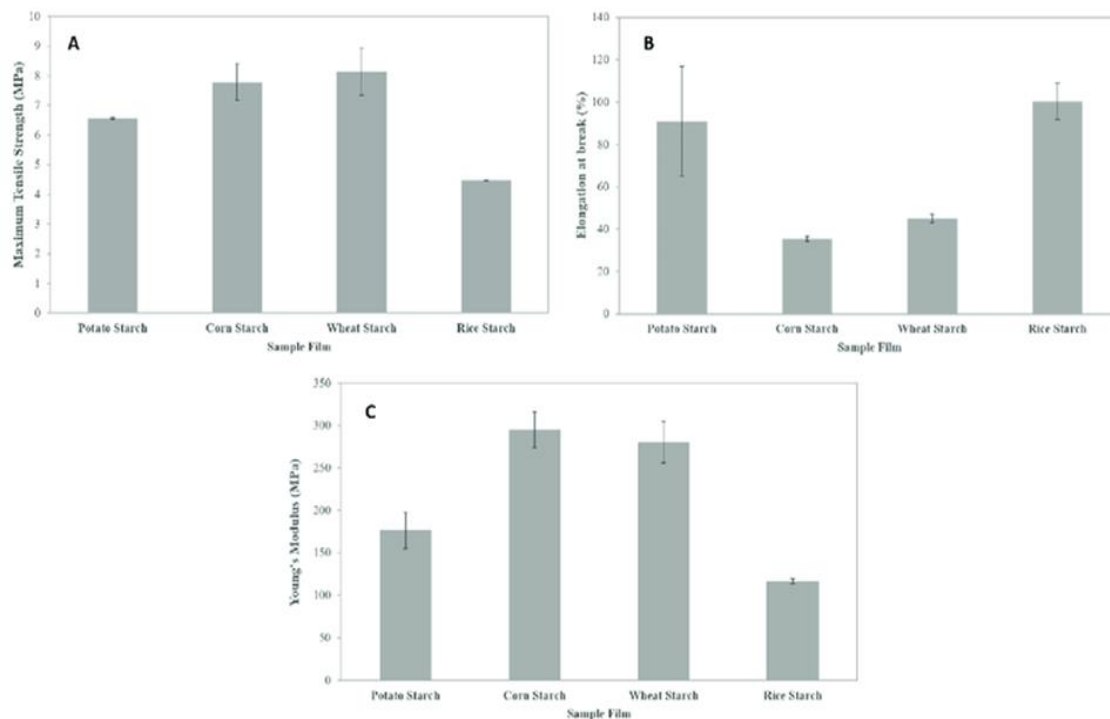


**Figure 1.** SEM micrograph of (A) Potato Starch (1000×), (B) Corn Starch (1000×), (C) Wheat Starch (500×), (D) Rice Starch (2000×). The particle size distribution profiles are given for each starch as measured by laser diffraction. [7]

All the films obtained were homogeneous, transparent and manageable. Laser diffraction measurements was used for determination of granule size of starch. The average diameter of starch grains was 16.38, 20.75, 23.30 and 46.02 $\mu\text{m}$  for corn, wheat, rice and potato. Micrographs points towards different size distribution [7]. SEM analysis also gave agreement with laser diffraction measurements i.e. higher average diameter of potato starch granules as compared to other granules and rice starch have a wider size distribution and great accumulation of grains which explains the high span value of rice starch.

## MECHANICAL PROPERTIES

To confirm the sustainability of these bioplastics, it is very necessary to study their mechanical properties. The mechanical properties of bioplastics are influenced by amylose content of starch, film thickness and molecular weight and crystallinity of the film [6]. The value of mechanical properties of the prepared starch films are shown in figure 2. Maximum tensile strength value varied from 4.48 to 8.14 MPa, elongation at break varies from 35.41% to 100.2% and Young Modulus varies from 116.42 to 294.98 MPa [7]



**Figure 2.** Mechanical properties of starch based bioplastic were studied A) Maximum tensile strength B) Elongation at break, C) Young's modulus [7].

From figure 2 it can be seen that corn starch and wheat starch films confer the similar tensile strength as both have approximately the same amylose content. Higher the amylose content, greater would be the mechanical strength [8] and hence higher will be the Young's modulus and tensile strength and lower will be the elongation at break of the starch film. These results may be due to the fact that high amylose content have bigger crystalline domains that leads to greater mechanical resistance. Different amylose content affect the mechanical values of the bioplastic films.

**Table 2. Comparison of bioplastics with traditional plastics [9]**

	Bioplastics	Traditional plastics
Sustainable	Yes	No
Greenhouse gases emission	Low	Relatively high
Arable land use	Currently low	None
Fossil fuel usage	Low	Relatively high

## CONCLUSION



The starch based bioplastics were successfully synthesized from corn, potato, wheat and rice and were completely biodegradable and thermoplastic in nature. The mechanical properties of starch based bioplastics are comparable to the traditional plastics. So, starch based bioplastics can be used in food packaging and other industrial applications. These properties of bioplastics make them a suitable substitute for traditional plastics.

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# EMERGING FROM EVERY HOME TO GLOBE-PLASTIC POLLUTION

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**Abstract-** The invention of plastic was a marvellous invention as it is very useful from our day to day life routine to great technological procedures. Unfortunately, it has proven that it has more harms than its benefits, not only to humans but the whole Ecosystem including land, air, water & its living organisms, mammals etc. Human is responsible for this harm and the whole environment is bearing its harmful effect. The More inventions to make human life luxurious, the more it is disturbing the natural environment. It has damaged so deeply that compounds of plastics are detectable in human and animal's body now and destroying the structure badly. Complete ban is not the solution for the existing situation but awareness, act and proper management is the urgent need.

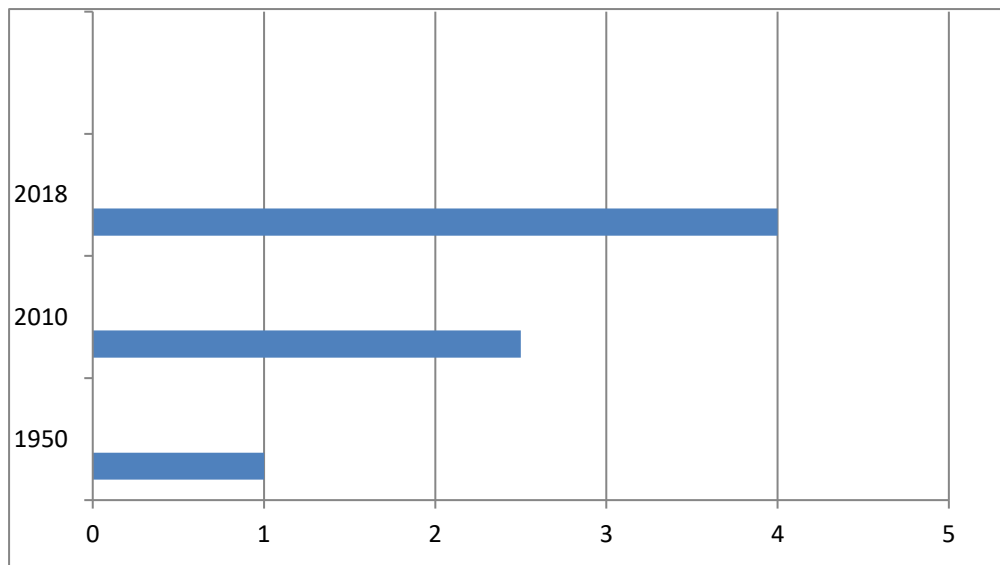
**Keywords-** Plastic pollution, Environment, Damaged, Awareness

## INTRODUCTION

Plastic was invented in 1907 by Leo H. Baekeland. It was useful invention that provides that next level of comfort to our modern lifestyle. With the comfort level it has also increased the pollution level, mainly because of its durability the pollution of plastic is piling up and up every year on the Earth. As the needs only increase and the amount of plastic that is created yet has not been disposed properly.



Acc. to Trade association Plastic Europe – World Plastic production grew 1950 – 1.5 million tonnes/ year, 2018 – 359 million tonnes/ year.



## DISTURBING ECOSYSTEM & BIODIVERSITY

Synthetic plastic is largely non biodegradable. It contains the polymeric material which has large molecules, on the same side silk and rubber also contain polymers but they are natural polymers which don't persist in environment unlike plastic polymers. So, the persistent tendency of plastic polymers creates harm to every dimensions of the planet. From the land, to its air and even it has entered into the ocean as well. Human population generates all this litter but the result of plastic poison is holistic. The main cause of plastic pollution is its improper dispose. Every year 18 billion pounds of plastic seeps into ocean from coasts. The human waste, chemicals of factories, all discarded in rivers through which it goes into oceans. Even packed food's plastic, plastic bottle cans can be easily seen floating on river or beaches. The sunlight breaks down the plastic molecules which then further turns into micro plastic in oceans which becomes hard to be wiped off. Then this whole trash goes in the stomach of aquatic life & animals. Even animals on land has found these plastics in their stomach, especially Indian cows occurred intestinal blockages from plastic bags.

## EFFECTING HUMAN LIFE

It is very much evident today that plastic's molecules can be detectable in Terrestrial and Aquatic animals as well as in human's body. Compounds present in plastic, such as phthalates are responsible for disrupting male and female hormones. Plastic has become existing part of our lives. They are everywhere around us be it medical devices, food packaging, automobile upholstery, flooring materials, computers, perfumes, cosmetics etc.

Plastic pollutes, through the release of compounds used in its manufacture. It is responsible for global warming, water scarcity pollution and biodiversity loss. From last 15yrs, plastic manufacturing has become highest and comparing with other materials, it become much inefficient to recycle plastic. Even plastic additives extend the life span of material as result it takes much more time to break down.

## CONCLUSION

To look for practical solution, we can't completely ban the plastic but we can reduce its pollution & effect from such large scale. One important thing is to prevent the improper disposal of the plastic, we can also limit the use of plastic products, and govt. should provide the guidelines for companies to use only certain amount of plastic per year for their products.

It's us who create this pollution so it becomes necessary that we should become more aware and responsible to limit its use and reduce it effects.

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# NEW IMPROVEMENT IN ENVIRONMENTAL ENGINEERING

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**Abstract-** An overview of the papers with topics focused on air quality and environmental evaluation of the technologies and focused on water and soil quality and wastewater treatment.

## 1.INTRODUCTION

Environmental quality is crucial to our health, our economy, and our lives. However, it faces several serious challenges, not least those of climate change, unsustainable consumption, and production, as well as various forms of pollution. This Special Issue collects research papers aimed at a wide range of environmental topics: water and wastewater treatment and management, soil degradation and conservation, sediment pollution control, the environmental impact of technologies, life cycle analysis (LCA), air quality and indoor environment, and advanced environmental materials. Contributions describe novel and significant knowledge, scientific results, and advanced applications in the field of environmental engineering. This Special Issue provides an integrated view of the trends in solving the problems associated with the achievement of sustainability in environmental engineering.

## 2.IDENTIFY, RESEARCH AND COLLECT IDEA

This issue contains twelve papers that have been selected as emerging studies dealing with the above-mentioned topics. The contributions, aimed at wastewater treatment, present a wide range of methods applied to various pollution removal methods. Investigating contaminants of emerging concern such as pharmaceuticals and personal care products reveals that the fate of these compounds in the aquatic environment has been a topic of wide interest and active research.

## 3.STUDIES AND FINDINGS

Lecours et al. [1] applied different electrochemical approaches to the study of the oxidation products of the anti-infective trimethoprim, a contaminant of emerging concern frequently reported in wastewaters and surface waters. The authors found that electrochemical techniques are relevant not only to mimicking specific biotransformation reactions of organic contaminants but also to studying the oxidation reactions of organic contaminants of interest in water treatment. Tian et al. [2] investigated the effects of physico-chemical post-treatments of sewage sludge using ultrasonic, ultrasonic-ozone, and ultrasonic+alkaline methods. The results showed that the post-treatments were able to increase biogas production and decrease the amount of volatile solids in the final effluent. In the work by Pipiska et al. [3], the biosorption methods for pollution removal from wastewater were studied. Dried biomass of freshwater moss *V. dubyana* has been used as biosorbent for cationic dyes methylene blue and thioflavin T removal from both single and binary

systems. Influence of a contact time, pH, and sorbate concentration on the dyes' removal efficiency has been investigated. The authors reported that an increase in pH has a positive effect on both thioflavin T and methylene blue sorption, and dye removal by moss *V. dubyana* is likely based on the electrostatic attraction.

Another paper [4], dealing with wastewater treatment, studied and quantified the elimination of sunflower oil from wastewater influent using a biological treatment involving activated sludge. The findings revealed that the efficiency of the elimination of sunflower oil using a combination of biodegradation and flotation was 90%. The next two papers deal with soil properties and sediment modelling. Gomboš et al. studied the selected parameters of soils for further numerical simulation of the water regime and its prognosis under heavy soil conditions. Soil profiles were evaluated for the distribution of volume changes to the horizontal and vertical components. The effect of texture on geometric factor values was analysed. A close correlation between the measured horizontal volume changes and the geometric factor value has been found [5]. Junakova et al. focused on the design of the mathematical model that was intended to

predict the total content of nitrogen, phosphorus, and potassium in bottom sediments in small water reservoirs depending on water erosion processes. The proposed model was validated in the small agricultural watershed of the Tisovec River, Slovakia. The results indicate the applicability of the new model in predicting the quality of the reservoir's sediment detached through erosion processes in the watershed [6]. The environmental impact of various technologies has been assessed in the next three papers. The paper [7] deals with the life cycle assessment of electricity generation from various energy sources in the Czech Republic. The greenhouse gas emissions were chosen as key indicators to evaluate the environmental load of particular energy sources. The obtained results revealed that the worst environmental impact in terms of greenhouse gas emissions is linked to electricity generation based on lignite. Zeleňáková et al. [8] reported on the environmental impact of a small hydro power plant including the selection of the optimal alternative of the assessed construction and proposed measurements to reduce the negative impact. Their paper points to the importance of assessing the impact of construction on the environment in the early planning phase. Eliminating the negative environmental impact of construction in the early phase of design is much more challenging than the implementation of measures in the construction or operation phases. The variant solutions of a selected

heating system were analysed by Ondrejka Harbulakova et al. [9] using methods of the environmental impact assessment (EIA). Multi-criteria analysis proved that the construction of the biomass-fired power plant was the most suitable solution among three assessed variants (zero alternative, biomass power plant, and modernized gas boiler). A significant negative impact on human health and the quality of life of millions of people worldwide is associated with urban air pollution. Tsai [10] presents an overview of the Taiwan's air quality with a special regard to the indoor air. The paper points to the importance of using green building materials in terms of the low emission of volatile organic compounds (VOCs) and other air toxics occurring indoors. The author highlights Taiwan's efforts to indoor air quality improvement through legal systems and promotion measures, which are relevant to the contribution to the quality and sustainability of the environment. Other dangerous pollutants in the air are particulate matters of various origins. Road traffic emissions caused by both exhaust and non-exhaust sources contribute significantly to the particulate matter (PM) concentration in an urban atmosphere. Penkała et al. [11] reported that direct road-surface abrasion is of minor importance when the road is undamaged. However, the paper analyses the impact of abrasion emission reflecting realistic conditions, analysing how such emission changes, both quantitatively and qualitatively, the character of PM near roads. With the development of new urban areas, there is a great challenge in finding new materials with an environmental added value. Pervious concrete can be an environmental solution for managing storm-water runoff. Kovac et al. [12] presented an alternative method for storm-water control using porous pavements. This paper presents the results of experimental work aimed at testing technically important properties of pervious concrete prepared with three different water-to-cement ratios. The results show that a decrease in water-to-cement ratio caused only slight differences in strength .

#### 4.CONCLUSION

It processed an overview of the papers with topics focused on air quality and environmental evaluation of the technologies and an overview of the papers with topics focused on water and soil quality and wastewater treatment.

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# A CONCLUSION ON ENVIOURMENTAL POLLUTION DUE TO WASTEAGE

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**Abstract:** The physical instruments which are widely used leads to various applications and also many man made pollution. Our atmosphere on global scale is heavily polluted. The buildup of green house gases will lead to significant changes in the weather patterns in the near future leading to global warming and Environment pollution also. The reason behind atmosphere, land, water, air and others kind of pollution is man and his modern way to live the life. Population growth, nature of modern technology, deforestation, industrial development, Unplanned Urbanization and Coal burnt Thermal Power Plants are common reasons behind the increase in Environmental pollution of various types. The main reason behind the various types of pollution is wastage. Wastage management is the main leading solution of Environment pollution.

**Keywords:** Global warming, Urbanization, Coal burnt, wastage management

## 1.INTRODUCTION

The term nature is directly related to the Environmental pollution. There can be so many causes of environmental pollution. Among them some are like fossil fuel emissions from power plants, pollution from vehicles, high quantity of exhaust gases, chemical effluents, pollutants, and soil erosion. An increase of risk of attack may be possible due to various type of Environmental pollution. All of them cause imbalance in ecosystem directly or indirectly. These all cause also have potentiality to cause health hazards to human beings and animals.

It is time to take action and control the pollution. Otherwise, the waste products from consumption, heating, agriculture, mining, manufacturing, transportation, and other human activities will degrade the environment completely and human life became more difficult.

## 2.TYPES OF POLLUTION

There are various types of pollution which effects the Environment in different ways.

**2.1AIR POLLUTION :** Air pollution is increase day by day due to various major pollutants. According to the World Health Organization, six major air pollutants include particle pollution, ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead. Air pollution has a serious toxicological impact on human health and the environment. Both human interventions and/or natural phenomena are the major causes of air pollution. Particle pollutants, Ground-level ozone, Carbon monoxide, Sulfur dioxide, Nitrogen oxide band lead are the major scientific air pollutant. Air pollution is a mixture of solid particles and gases in the air. Car emissions, chemicals from factories, dust, pollen and mold spores may be suspended as particles. Ozone, a gas, is a major part of air pollution in cities. When ozone forms air pollution, it's also called smog. Air pollution attributed to 3.4 million deaths each year in world. It may be very harmful after some years.



**2.2 WATER POLLUTION** : Since water is able to dissolve more substances than any other liquid on earth. Water pollution occurs when harmful substances often chemicals or microorganisms contaminate a stream, river, lake, ocean, aquifer, or other body of water, degrading water quality and rendering it toxic to humans or the environment. almost 40 million litres of wastewater enters rivers and other water bodies with only a tiny fraction adequately treated. A lot of negative effects of water pollution occurs in human life. Also various diseases result from drinking or being in contact with contaminated water, such as diarrhea, cholera, typhoid, dysentery or skin infections. Wastewater treatment, Green agriculture, Storm water management, Air pollution prevention, Plastic waste reduction and Water conservation are the different ways to reduced water pollution. By focusing on these solutions the negative effect of water pollution may be decreased.



**2.3 LAND POLLUTION** : The contamination or destruction of land through indirect or direct human actions leads to land pollution directly or indirectly. There are various reasons behind the land pollution. Among them Agriculture, Use of fertilizers, Use of pesticides, Deforestation, Mining, Industrialization, Landfills, Chemicals, Nuclear waste, Construction and Littering are the generally increases day by day which effects the land very much.



### 3. WASTAGE MANAGEMENT AS A SOLUTION OF POLLUTION

The wastage management may control the various kind of pollution. Waste collection methods vary widely among different countries and regions. One of the most important part of wastage management is recycling. It is not only benefits the environment but also positively effects the economy. Proper recycling leads to the waste segregation as its first step.

**Waste segregation** : Waste segregation is the separation of wet waste and dry waste. The purpose is to recycle dry waste easily and to use wet waste as compost. When segregating waste, the amount of waste that gets land filled reduces considerably, resulting in lower levels of air and water pollution. It is important to remember that waste segregation should be based on the type of waste and the most appropriate treatment and disposal.

The overall study leads to the conclusion about the management of waste materials. Waste materials plays an important part in enhancing the pollution of different kinds like the wastages from factories leads to water pollution, air pollution

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and also land pollution. The tasks of solid-waste management present complex technical challenges. The sources of solid waste include residential, commercial, institutional, and industrial activities. Segregated waste does not require as much manual sorting as mixed waste so, it is often cheaper to dispose.

In india, some states are contributing a lot in waste management e.g.

1. Project Tsangda in leh, ladakh by implementing agency Rural Development Department .
2. Kalkata solid waste management improvement project in Kolkata, west bangal

#### 4.FIGURES AND TABLE

- 1) Fig (1) indicates the side effect of air pollution.
- 2) Fig (2) indicates the side effect of water pollution.
- 3) Fig (3) indicates the side effect of land pollution.

#### 5.CONCLUSION

Overall conclusion leads that the good management of wastage can be play an important role in decrement of all kind of pollutions which are explained above. So, the industrial and others machinery wastage should be manage separately. Each city and country has different recycling programs in place that can handle the various types of recyclable materials which is the main part of wastage management. Some of the types of recycling include waste paper and cardboard, plastic recycling, metal recycling, electronic devices, wood recycling, glass recycling, cloth and textile.



#### 6.ACKNOWLEDGMENT

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# AN ANATOMY OF INDOOR AND OUTDOOR AIR POLLUTION AND THEIR MANAGEMENT

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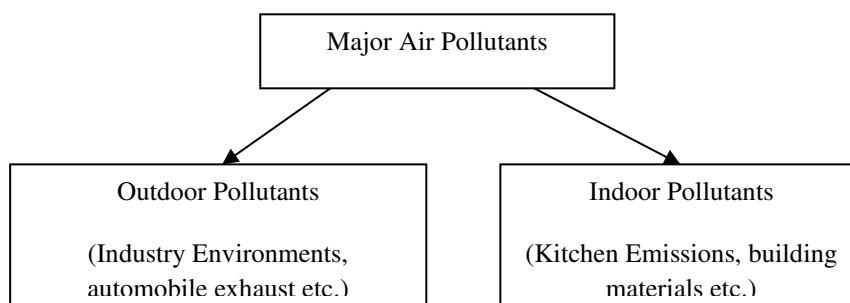
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**Abstract:** With the rapid development of industries, automobile exhausts, and building materials, it is evident that people in the present environment get inconvenience in human wellbeing due to air pollution. Air Pollution is becoming a hazardous concern to peoples and also for Global Warming across the world. Trying to figure out an effective air pollution management model to reduce the number of air pollutants such as  $SO_3$ ,  $NO_3$ , CO, and  $PM_{10}$ , etc. Over the years, various approaches for minimizing and monitor air pollution such as Logistic Regression, Genetic Algorithm, Support Vector Machine, and IoT-based Monitoring systems. This paper provides a brief survey of some recent algorithms of Air Pollution, various parameters handled by them, and methods used by them.

**Index Terms-** Air Pollution, Data Mining, Air Pollutants, Air Quality Index Prediction, Logistic Regression.

## 1. INTRODUCTION

Air pollution is defined as the presence of substances that has harmful or poisonous impacts into air. Increase in population, chemical industries, urbanization and increased vehicle use events in poisonous and harmful effects on human health. Nowadays, Air pollution has turned into major problem for every nation either it is developing country or developed country. Health issue have been spreading in a quick manner especially in urban areas of developing countries where a huge number of vehicles and industrialization results in release a number of air pollutants. Adverse effects of air pollution can become origin of allergic reactions such as irritation of the eyes, nose and throat, as well as a number of serious problems like heart diseases, pneumonia, aggravated asthma, lungs and bronchitis [1], [2]. Air Quality monitoring system provides measurements of air pollutant either in the form of outdoor pollutants or indoor pollutants which can then be decided presented and explained [3].



**Fig. 1.1: Types of Air Pollutants in Air**

Major air pollutants are broadly classified into two categories firstly as outdoor pollutants and secondly as indoor pollutants as shown in Fig. 1.1 [8]. The data mining strategies used for tackling air pollution management are linear regression and multilayer Perceptron to reduce air pollutants such as sulphur dioxide ( $SO_2$ ), nitrogen dioxide ( $NO_2$ ), carbon monoxide (CO), ozone ( $O_3$ ) and particulate matter (PM). However, amount of carbon monoxide and nitrogen dioxide may show minor enhancement due to growing number of 2 wheelers on road. [4]. Different pollutants present in atmospheric air such as Particulate Matter ( $PM_{2.5}$  and  $PM_{10}$ ) that represents a convoluted pollutant as it comprises of a number of components in various concentrations. The main source of PM in Delhi is road traffic emissions, mainly from diesel vehicles. It is also radiated from power generation and industrial combustion plants, residential and commercial combustion processes.  $NO_2$  pollutants are produced while high temperature burning of diesel from road



vehicles, cookers and heaters. SO<sub>2</sub> pollutants are produced mainly by burning of fossil fuels especially from power stations, production of sulfuric acid and smelting processes. Sulphur dioxide mainly responsible for acid rain as well as injurious effects on lung functions. CO pollutants are produced mainly when Carbon fuels burnt, either in the existence of too little oxygen or at too high temperature. O<sub>3</sub> pollutants are produced when a chemical reaction of volatile organic compounds and NO<sub>2</sub> occurs in the existence of sunlight results of ozone layer is generally higher in the summer. The Air Quality Index (AQI) is an air quality standards indicator in accordance of air pollutants which have negative effects on environment and on the human health [5], [6].

## 2. LITERATURE REVIEW

Krzysztof Siwek [1] proposed methods for prediction of air pollution using data mining. Two efforts in such an obstacle are important: selection and generation of the prognostic features, and final prognostic system of the pollution for the upcoming day. Atmospheric parameter which acts as advance features of prognostic system was proposed. Two mechanisms of feature selection were compared from the prediction point of view. First applied a genetic algorithm (global approach), and the second mechanism applied a linear method of stepwise fit (locally optimized approach). In accordance of these mechanisms, sets collect data in atmospheric pollutants prediction such as PM<sub>10</sub>, SO<sub>2</sub>, NO<sub>2</sub> and O<sub>3</sub>. In this work, a modified tree learning algorithm was used that selects a random subset of the feasible features. Algorithm structure of the network is analogous to the Multi-Layered Perceptron (MLP), except the Gaussian function results in great simplification of the learning algorithm in the multidimensional space. Radial Biased Function (RBF) networks followed a nonlinear transformation of the data from the input field to a high dimensional field. Individual output neuron of the radial biased function network performs a simple weighted summing operation as shown in equation 2.1 as follows;

$$y(x) = w_0 + \sum_{j=1}^K w_j \phi_j(x), \quad (2.1)$$

where  $\phi_j(x)$  represents nonlinear Gaussian function. The learning problem of this network is divided into two phases. The first phase chooses the number of hidden units characterizing the Gaussian nonlinear functions and alteration of function parameters (centers and widths). On the basis of input attributes to the three neural predictors (the SVM, RBF and MLP), their appropriate features were integrated into the final system. In training purpose of MLP network, 12 hidden units were enforced. The RBF network achieved the superior results at 300 Gaussian basis functions of the width equivalent to 1. The hyper parameters of the SVM network were as follows:  $C = 100$ ,  $\epsilon = 0.01$  and the Gaussian unity width function where  $C$  represents margins, and  $\epsilon$  represents similarity between two points. The prediction analysis was examined 10 times using randomly selected testing and learning phases for calculating the average errors in testing data beyond all 10 trials were computed. Sequentially, results of prediction are correlated in accordance of their statistics. The consecutive definitions of errors were applied;

- Mean absolute error (MAE) is as shown in equation 2.2 as follows,

$$MAE = \frac{1}{n} \sum_{i=1}^n |y(i) - d(i)| \quad (2.2)$$

- Mean absolute percentage error (MAPE) is as shown in equation 2.3 as follows;

$$MAPE = \frac{1}{n} \sum_{i=1}^n \frac{|y(i) - d(i)|}{d(i)} \cdot 100\% \quad (2.3)$$

- Maximum percentage error (MAX) is as shown in equation 2.4 as follows;

$$MAX = \max \left\{ \frac{|y(i) - d(i)|}{d(i)} \cdot 100\% \right\} \quad (2.4)$$

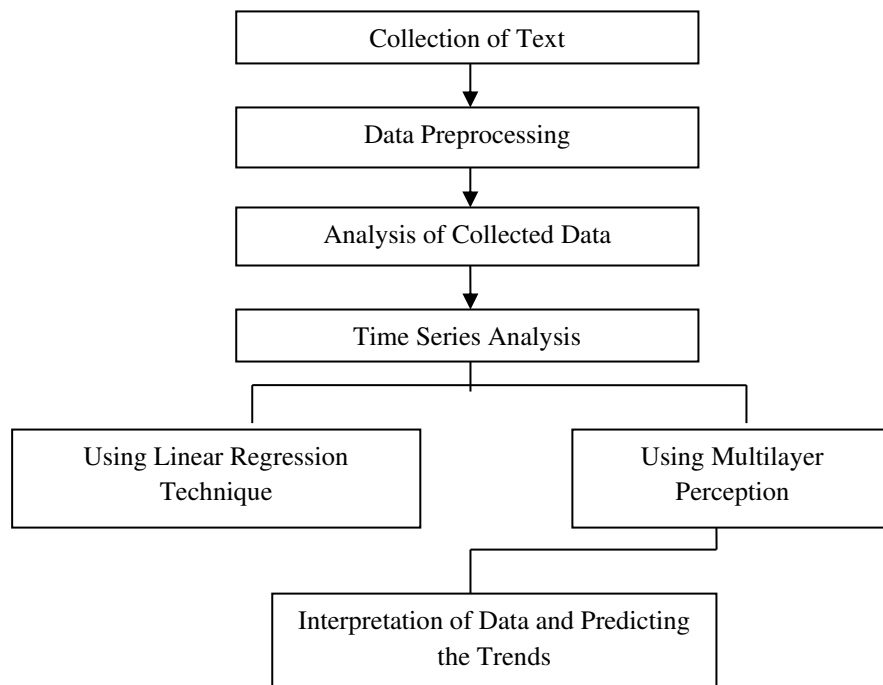
- Root mean squared error (RMS) is as shown in equation 2.5 as follows;

$$RMS = \sqrt{\frac{1}{n} \sum_{i=1}^n |y(i) - d(i)|^2} \quad (2.5)$$

The variables  $d$  and  $y$  used in these definitions represent the results of real and prediction values of daily mean pollution respectively. Only testing data related errors which were not taking part in learning in 10 repetitions of the calculation will be granted.

Shweta Taneja[3] used a dataset taken from Central Pollution Control Board (CPCB) comprising of six attributes that are namely as air pollutants like Sulfur Oxides (SO<sub>2</sub>), Nitrogen Oxides (NO<sub>2</sub>), Carbon Mono-oxide (CO), PM<sub>10</sub> and Ozone (O<sub>3</sub>) and time (in months) respectively. A prediction trends in pollution workflow chart in Delhi using Data Mining approach is shown in Fig. 2.1 [3].





**Fig. 2.1: Predicting Trends of Pollution Workflow Chart in Delhi using Data Mining Approach**

For analysis decisions, Time series analysis method was used with two methods namely as Linear Regression and Multilayer Perceptron. In this analysis, time series was employed in order to investigate the behavior of data that predicts forecast future values in accordance of previously observed values. MLP consists of different layers of nodes in a directed graph, with each layer having fully associated to the next layers which are not linearly separable. Linear Regression technique used in this prediction as it expresses relationship between one or more independent variables using linear predictor function with unknown values of functions.

Y. Xie[4] proposed the strategy of control of air pollution and joint prevention to adequately control the serious regional air pollution that has an impact to global concern. In this strategy, new methods were deployed to settle these problems, consisting of (i) the strategy of using data-mining technologies for subdividing large regions problem into sub-regions and (ii) the strategy of estimating the priorities for JPCAP sub-regions in accordance of an ideal solution method (TOPSIS) by originating four key indicators. To test the strategies, strategies were applied to a case study of JPCAP for particulates lesser than  $2.5\ \mu\text{m}$  in diameter ozone ( $\text{O}_3$ ) and ( $\text{PM}_{2.5}$ ) in 15 cities of the Yangtze River Delta, China. The priorities selected to these sub-regions match their original circumstances in provision of industrial structure, population density, climate and geographic features, recommending that the new strategies are effective as well as scientific in nature. Thus, application of the new strategies should help to reduce regional pollution obstacles both in China as well as in around the world.

Researchers developed two new strategies for developing the capability of Joint Preservation and Control of Air Pollution (JPCAP) strategy: (i) A new strategy for estimating the JPCAP scopes in accordance of data-mining technologies; (ii) A new TOPSIS-based strategy for estimating the JPCAP priorities afterwards configuring 4-indicator estimating system on the basis of comprehensively considering each region's pollution control importance, elasticity and pollutant output to neighboring areas and improvement to the whole region's pollution. The empirical observations showed that the 15 cities of YRD region can be clustered into 4 JPCAP sub-regions for  $\text{PM}_{2.5}$  and 9 JPCAP sub-regions for  $\text{O}_3$ ; the difference results from differences in the natural distinctive of the two pollutants in terms of longevity plus how they are transported and produced. Thus,  $\text{PM}_{2.5}$  can be composed finest using large JPCAP

areas, whereas O<sub>3</sub> pollution has more local features results in requiring a small-scale JPCAP implementation. Thus, the TOPSIS-based strategy of estimating priorities would be increasingly simplified in nature and more appropriate for utilization with higher accuracy and these strategies are applicable to pollutants such as sulfur oxide (SO<sub>3</sub>), nitrogen oxide (NO<sub>3</sub>), carbon monoxide (CO) and PM<sub>10</sub> etc. A detailed table of various AQI range descriptions is presented in table 2.1 [4].

**Table 2.1: AQI Various Range Descriptions**

Standards	Description
0-50	Normal AQI. No cause of fear as air quality is better.
51-100	Moderated High AQI. Moderate air quality and should be conserved.
101-150	High AQI. Unhealthy AQI for sensitive peoples.
151-200	High AQI. Unhealthy AQI.
201-300	High AQI. Unhealthy AQI therefore attention is required.
301-500	Very High AQI. Hazardous AQI therefore immediate attention required.

In this study, calculation of distances of sub-region *i* taken away the optimal scheme  $Z^+$  and are shown in Equation 2.6 as follows;

$$ZD_i^+ = \sqrt{\sum_k (\max Z_{ik} - Z_{ik})^2}, \quad (2.6)$$

Therefore, next step is calculation of closeness of sub-region *i* to the optimal scheme  $CL_i$  is shown in Equation 2.7 as follows;

$$CL_i = \frac{ZD_i^-}{ZD_i^+ + ZD_i^-}, \quad (2.7)$$

### 3.CONCLUSION

Monitoring of indoor and outdoor pollution as well as their management in perspectives of environment in a rapid manner is a task of great importance. In this paper, a considerable survey on various air pollution management and monitoring methods has been carried out shown in literature. Each of these methods focused on the various solutions to eliminate air pollution. People should prefer public transport rather than minimizing personal vehicles as much as possible. WEKA Data mining tool employed to predict future pollution levels in Delhi. Literature study showed that pollutants such as nitrogen dioxide and ozone are likely to enhancement in future, while sulphur dioxide and carbon monoxide levels will follow a similar trend of the past. A practical governmental policy for minimizing air pollution should be employed at Delhi's air pollution levels. Converting High Motor Vehicle fuel form diesel to Compressed Natural Gas, greening of roadside space beyond strict pollution laws will results in minimizing air pollution and air quality index.

### 4.ACKNOWLEDGMENT

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# CONSTRUCTION POLLUTION: AN OUTCOME OF COUNTERPRODUCTIVE WORK BEHAVIOUR

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**Abstract:** Advancement, change and Development, both in the physical and virtual world, are considered as the key to address the basic need of people and other living beings. Development is also considered as a significant factor in making the life of people easy and comfortable. Man has attained a great achievement in addressing the needs and creating the easiness and comfort for the humanity and other living beings. But in the blind race of development, man has lost his sense of decision that what he should do and what he should refrain to do. Consequently, the high speed pace of development has created not only the positive and constructive wonders to this earth and its environment, but also it has resulted in lot of negativity and destruction to the earth and its ecosystem and environment. Basically, the human behaviour (while dealing with the earth and its resources and ecosystem) can be fixed responsible for the expected damage/ destruction or reparation/ construction to the earth and its eco-environmental system. Present study has examined the consequences of counterproductive work behaviour of construction site employees on the earth, environment and ecosystem. Findings of the study reveal that the present generation of construction professionals have well developed and tested strategies, rules and regulations for the control and protection of the construction pollution but still it is not under control. The study suggests that the construction pollution is outcome of the counterproductive work behaviour.

**Keywords:** Construction Site, Environmental Pollution, Counterproductive Work Behaviour.

## 1. INTRODUCTION

Food in the form of animal flesh and vegetation, security and safety by tools and arms made of stone, wood and animal bones and shelter in the form of hut made up of straw had been the available resources on the name of the basic needs during the primitive times. The journey of development for modern man started from such a state of primitive times, where the ancient man was struggling to manage his most basic needs of food, safety and appropriate place to live. The journey of development over the period of thousands of years brought lot of achievements to the modern man to address not only his basic needs but it also created lot of comfort, pleasure, luxury and choices. Better living conditions, comfort, pleasure, choices, luxury and safety in the different walks of life were the attractive outcomes of development which is persistently motivating the man to involve more and more in the process of development. The taste of fruits of development has made the man blind passionate of the development and he has lost his sense of judgment to decide right and wrong. The behaviour and actions of modern man, in the blind race of development, has become hazardous and dangerous towards self, other living beings, nature and environment. On the name of development, present man is busy in such activities which are not appropriate for him and his ecosystem. Specially, the actions and behaviours of employees, working with the modern industrial and business organizations, are aligned in the direction of organizational goals achievement only. Man has given least concern to the evaluation and foreseeing the negative and destructive impact of blind development on the sustainability of natural resources and purity of environment and eco-system. On the name of development, man is senselessly busy in different type of activities. Construction of infrastructure for mass living, production, industrial development, transportation and other purposes is one of the key activities of development.

Construction sector is one of the major contributors of the environmental pollution on this earth. The remotest area of earth, which were completely out of human reach are witnessing the presence of mega construction project sites. Presence of these construction project sites over the complete face of the earth is a severe source of increased pressure

of pollution on the earth and its ecosystem. Pollution breaks down the natural cycles of basic elements, such as; water, air and soil etc. and in continuity it deteriorates the ecosystems of earth and results in the bad impact on the sustainability of limited natural resources. Declining sustainability of natural resources results in the worsening socio-economic, psychological and political conditions. If we try to understand this severely deteriorating phenomenon, it resembles to the activity, where a man is sitting on a very high branch of tree and cutting the same. What would be the fate of such a man, same will be the situation of modern man as a result of his majority of senseless human developmental activities. The basic reason behind this senseless working for the devastating development is the human attitude and behaviour towards self, nature, environment and earth. If modern man wants to check the socio-economic, political, natural and ecological deterioration, he needs to understand that what should be done and what he should refrain to do. The classification of human acts, what should be done and what he should abstain to do, for ensuring the sustainability and protection to environment and eco-system can respectively be categorized as productive work behaviour and counterproductive work behaviour. Productive work behaviours are the human actions and activities which are supportive in the maintenance of sustainability, pure environmental and ecological conditions, whereas the counterproductive work behaviours (CWB) are the actions and activities which badly affect the sustainability and pure environmental and ecological conditions. Present research will discuss the role of counterproductive work behaviours of the construction site employees in deterioration of the sustainability and eco-environmental conditions.

## **2. COUNTERPRODUCTIVE WORK BEHAVIOUR**

The popular understanding about counterproductive work behaviour is the set of activities, attitude and behaviours deliberately executed, observed and practiced by the organizational people to hamper the organization and its stakeholders to achieve their goals and objectives. Counterproductive work behaviour may also be explained as the behaviours of the organizational people that stop them to achieve the objectives and concerns. Basically any action of organizational people which limits the productivity of the organization is called the counterproductive work behaviour. According to Robinson and Bennett (1995), counterproductive behaviour may be classified as; production deviance, property deviance, political deviance and personal aggression. The factors responsible for deciding a behaviour as a counterproductive work behaviour is that it should decline the organizational productivity. So the acts of the organizational people supportive in declining and deteriorating the sustainability and protection to environment and eco-system can also be categorized as counterproductive work behaviour.

## **3. CLASSIFICATION OF IMPACT OF CONSTRUCTION ON EARTH AND ENVIRONMENT**

Mega construction projects have a severe impact on the natural conditions. The impact of construction on earth and its environment can be categorized as under:

- 1) Man and other living beings
- 2) Earth and its natural resources
- 3) Vegetation and ecological system
- 4) Environment and climatic conditions

### **3.1 Impact of construction on man and other living beings**

As per U.K. Green Building Council (2007), the construction sector all over the world uses millions of tons such materials every year which have very severe deteriorating effect on the environment conditions. Not only this, according to one of the United States agency, the construction workers use such resources and materials, like; chemicals etc which can seriously “harm public health and the environment.” One of the research studies by construction blog Bimhow, reveals that construction sector is responsible for about 23% of air pollution, 50% in climatic change, 40% water pollution, and 50% of landfill wastes.

Nowak, D. J., Crane, D. E., & Stevens, J. C. (2006), A very comprehensive research study conducted by involving 650 major cities of the world on urban pollution has revealed that the impact of air pollution on human health is both

the short and long term and it is directly associated with the deaths of millions of people, especially those who have high morbidity. Another study by Bauman, A., Bull, F., Chey, T., Craig, C. L., Ainsworth, B. E., Sallis, J. F., ...

- & IPS Group. (2009) a team of 50 international scientists carried out a research and collected data from major cities from 24 countries. This study finds out that the increase in the contaminating pollutant particles increases the daily mortality as a result of all the reasons and especially because of respiratory and cardiovascular problems.

### **3.2 Impact of construction on Vegetation and Ecological system**

Pollutants released in the eco-system and bio-diversity by the construction projects can lead to serious air, soil and water contamination. On the site negligence can result in toxic spillages which can be taken away by the water and then mixed into both the surface and underground aquatic systems (Kein et al., 1999). One of the studies by Langford et al (1999) has revealed that one third of the earth surface is degraded by the pollutants which have further disturbed the naturally balanced ecosystem. According to Ofori & Chan, 1998 and Kein et al., 1999 A huge amount of waste is released by the production, transportation and use of materials in the construction. Construction projects contributes approximately one third of the pollutants and waste all over the world. Studies on the mega construction projects have revealed that both the processes of defoliation and construction have very high possibilities to reuse and recycle their waste and discharges. The construction has direct impact on human beings, animals, plants and other living species. The ecological disturbance can have impact on all the habitats and associated ecosystem within and adjacent to the proposed construction projects. Within the construction project area, the issues of release of hazardous waste and discharges and their dumping at the construction site and also the dust deposition, sedimentation and air & water pollution. According to Langston & Ding, 1997 the process of recycling and conversion of construction and demolition waste and discharge matter into useful material are the highly time consuming activities and as a result of poor environmental awareness the construction people are not practicing these methodologies. According to Sterner, R. W., & Elser, J. J. (2002) strategic waste management plan developed during the planning and design phase can decline the construction waste by 15 %, and can reduce the cost on waste management by 50 %.

### **3.3 Impact of construction on Earth and its natural resources**

Uppermost surface of earth is known as soil and it is one of the most valuable finite resource for the ecological and biological system. Any type of damage or loss to it is irrevocable. Any bad impact to the soil can dangerously affect not only the food, water and air consumed by the human beings and other animals but also it can directly deteriorate the health of all living beings, without healthy soils we wouldn't be able to grow our food. In fact, it is estimated that 95 percent of our food is directly or indirectly produced on our soils. All types of construction activity, like; Excavation, Concreting, Carpentry, Brick masonry, Plumbing, Welding, Electrical, Roof, laying, Glazing and Finishing have very deteriorating impact on environment and damages it very badly. The environmental deterioration creates ecological imbalance by harming the natural flora and fauna and polluting the air, water soil and rocks. The environmental damage further results in deterioration of crops, trees, gas, metals, stone and sand etc.

### **3.4 Impact of construction on Sustainability**

The construction process of buildings, dams, roads, railway traces, airports and other mega infrastructures intensively uses, both directly and indirectly, a very huge quantity of energy and releases enormous volume of hazardous waste and discharges in the form of pollutants in the environment. Both, the heavy consumption of energy and releasing of hazardous waste and discharges as pollutants in the environment are considered as the key factors of badly affecting the sustainability, because the activities of energy consumption and waste disposal are directly responsible for loss of resources, money and reduced sustainability.

## **4. MAJOR CONSTRUCTION ACTIVITIES RESPONSIBLE FOR POLLUTION**

**Construction activities responsible for pollution include:**



Land clearing,  
 Operation of diesel engines,  
 Operations of heavy Machinery  
 Working of Earth Moving Machinery  
 Rock Cutting Machinery  
 Demolition,  
 Burning,  
 Excavation,  
 Finishing  
 Labors camps,  
 Sewage treatment plant,

Concreting,  
 Carpentry,  
 Brick Masonry,  
 Plumbing,  
 Welding,  
 Electrical Work,  
 RoofLaying,  
 Glazing  
 Use of Toxic Materials

#### 4.1 Types of construction pollution:

Noise,  
 Dust,  
 Solid wastes,  
 Toxic generation,  
 Air pollution,  
 Water pollution,  
 Bad Odour,  
 Climate change,  
 Land use,  
 Hazardous Emissions

#### 4.1. Measures for Construction Pollution Protection and Sustainability Maintenance

- 1) Adoption of Techniques for Prefabrication of Construction
- 2) Appropriate and best Material Selection.
- 3) Care and Protection of Ecology and Bio-diversity
- 4) Construction Site Pollution Control Management
- 5) Observation and Practice of Processes of Recycling and Reuse of Waste and Discharge
- 6) Optimization of Energy and Resources Use.
- 7) Optimum utilization and transportation of Manufacturing Materials
- 8) Strategic Practice of Sustainability
- 9) Strategic use of Green Practices
- 10) Use of Protected and Controlled Environment of Construction
- 11) Waste and Discharge Minimization.

## 5. NECESSARY RULES AND REGULATION AND STANDARD OPERATIONAL PROCEDURES FOR ENVIRONMENTAL POLLUTION PROTECTION

Standard construction site pollution protection practices can prevent and control the environmental pollution. Measures for environmental protection can be practiced after evaluation of construction activities and required materials. Following measures can have practiced for environmental pollution protection:

- Prevention of land disturbance and protection of vegetation cover.
- Protection of dust discharge by screening and regular water spray on the construction site.
- Proper covering of the vehicles used for the transportation of construction materials and its damping.
- Proper storage of construction materials away from water sources and its appropriate coverage.
- Identification of non-toxic materials and their use in construction and if no alternative of toxic materials, then store them properly to prevent spillage and contamination.
- Practice of proper strategies for waste water and other discharge treatment.

- Minimize burning on the site of construction.
- Appropriate control and protection of noise pollution.
- Covering of the construction site, sand heaps, soil and other dust spreading materials.
- Control on spread of littering or blockage of water sources.

## 6. CONSTRUCTION POLLUTION AN OUTCOME OF COUNTERPRODUCTIVE WORK BEHAVIOUR

A detailed description about construction, construction pollution, impact on construction pollution on earth, environment, man, living beings, natural resources, vegetation, ecological system and climatic conditions have been given in this research article. Major construction activities responsible for pollution, types of construction pollution, measures for construction pollution protection and sustainability maintenance and necessary rules and regulation and standard operational procedures for environmental pollution protection have also been included in the previous paragraphs. If the present generation of construction professionals understands the key factors of construction, construction pollution, impact and remedies for the construction pollution and measures of protection from it as well as there is availability of effective strategies rules and regulations for the management of the problem and challenges of construction pollution then why this is not being managed. The remedial strategies, rules and regulations have been developed by the nationally and internationally acclaimed bodies and organizations and the effectiveness of these strategies and rule and regulations have been tested and found effective. Now the matter of surprise is that, if we have such an effective system for the redressal of the problem of construction pollution, then why this challenge has not been managed. To reply this burning question, there is need to understand the role of counterproductive work behaviour of organizational people who are involved in the execution of the construction projects. If construction has to be made completely pollution free then there is need identify, understand and eliminate such activities, behaviours and attitudes of organizational people of construction projects which are not in the compliance with the preventive strategies, rules and regulations and hampering the utmost important organizational goal of controlling the pollution and maintaining the sustainability. Such behaviours are called as the counterproductive work behaviours.

## 7. CONCLUSION

Construction is one of the most important activities for socio-economic development. Infrastructure development is feasible with the support of construction only. Infrastructure development is considered as backbone of the national development. So, construction is a mandatory, continuous and important global mega activity of world. Whereas this study reveals that pollution is a necessary hazardous outcome of the construction. Therefore, on the one hand construction is mandatory activity for the development and survival and on the other hand it is a major source for different types of pollution, which is considered as a serious problem present before the global population. To check and control the pollution resulted from construction; lot has been done by the governments of different countries and also by international bodies by developing remedial actions, procedures and legislations. With the support of all these remedial actions and national and international legislations, pollution can be controlled to a great extent, if observed seriously and honestly. But this is not happening so, still there is serious threat of to the nature, its different elements, like; water, air, soil etc and environment as a consequence of construction pollution. Reason for this threat of pollution to the environment is because of irresponsible behaviour and non-compliance with the remedial actions and legislations by the people working in the field of construction. This tendency of non-compliance with the remedial actions and legislations by the construction people is known as the counterproductive work behaviour. So, construction pollution is an outcome of counterproductive work behaviour

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# MONITORING AIR QUALITY WITH NEW EMERGING TECHNOLOGIES

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**Abstract:** Nowadays, pollution is increasing at a rapid rate due to excessive use of vehicles, fossil fuel emissions from power plants, contamination of water resources by industries etc. Due to all these factors, India has reached unbearable level of pollution. Out of various types of pollution, air pollution is causing respiratory problems to people. With the due advancement in the technology like AI, Machine learning, IOT (and many more), there are certain ways by which Air Quality can be monitored and controlled thereby reducing health hazards to people.

**Index Words:** Internet of things (IOT), Air Quality Index (AQI), Extraction Transform Load (ETL), Online Analytical Processing (OLAP), Relational Online Analytical Processing (ROLAP), Structured Query Language (SQL), Radio Frequency Identification (RFID).

## 1. INTRODUCTION

Pollution level in India is growing on a large-scale day by day. It was reduced during the lockdown period because the movement of vehicles on roads across the country was not there; hence some experts call it as the "wake-up call" and asked the government to stop its "obsession" with "development" at the cost of the environment. The level of Nitrogen Oxide (NO<sub>x</sub>) pollution, which can increase the risk of respiratory conditions is mainly caused due to a high motor vehicle traffic. An AQI (Air Quality Index) between 0-50 is considered good, 51-100 satisfactory, 101-200 moderate, 201-300 poor, 301-400 very poor and 401-500 severe. Environmental Monitoring have become center of attention nowadays and it stresses on using scientific and engineering principles to improve environmental conditions.

## 2. Related Work:

Air Quality Index (AQI) scale measures the level, how polluted is the air. Greater AQI indicates more dangerous air is for human health. Environmental monitoring, modeling, and management helps to gain a deeper understanding of natural environmental processes but main task for engineers is to monitor, model, and manage these processes [2]. The key technologies and tools include real-time operational database (RODB); extraction–transformation–loading (ETL); on-line analytical processing (OLAP) and relational OLAP (ROLAP).

### 2.1. Internet of Things:

The Internet of things (IoT) is a system of interrelated computing devices, mechanical and digital machines provided with unique identifiers (UIDs). These devices are capable of transferring data over a network automatically without human intervention. The Internet of Things (IoT) supports in marking important challenges in our environment, industries, cities, homes and society by collecting, integrating and analyzing data from potentially millions of sensors and other internet-connected devices [3].

The term "Internet of Things" was first used by Kevin Ashton in 1999 [4]. Before working on IOT, one must have knowledge of RFID tags, sensors, actuators, and mobile phones [5]. Key technologies of IoT include RFID technology, sensor network and detection technology, Internet technology and intelligent computing technology, but technical challenges must be tackled before these systems can be widely applied [6]. Intelligent devices are being introduced which when equipped with a measuring chip or a component can check the quality of air on its own using Internet of Things (IoT) [12]. Every electronic equipment with mobility can be embedded with the smart device or the smart device can itself be used externally whenever and wherever required. There exist various traditional approaches those measure the level of air quality index accurately but the problems with these are that they are located or stagnant at a particular area.

Integrated environmental monitoring and management based on IoT is very interesting and attracting topic for the scientists, engineers and even for the public and the administrators, and it covers broad issues and involves many technologies in the computer and information sciences.

## **2.2 Environmental informatics:**

It consists of exact environmental problems which are connected computer science applications and systems engineering techniques, management information system (MIS), and environmental information system (EIS). Engineers are using these systems to collect, process, and exchange data and information for very long time. Data can be collected automatically by using remote sensing (RS), geographical information system (GIS), global positioning system (GPS) [6]. Other than these, some modern technologies are radiofrequency identification (RFID) and sensor technologies which were introduced later to create decision support systems (DSSs) and integrated environmental information systems (IEISs). Environmental informatics can be classified into five categories: database system (DBS), GIS, DSS, expert system (ES) and IEIS.

## **2.3 EMMS (Environmental Monitoring and Management System):**

It is used to create data-sharing platform for many environmental sectors. EMMS will help in getting the basic data for the acquiring and managing environmental monitoring data along with environmental forecasting and analysis capabilities. The main function of EMMS is to provide a combined service platform, with website information issue and management, laboratory management, environmental monitoring, pollution source information management, emergency monitoring modules, covering all aspects of the work of environmental monitoring.[1]

## **2.4 Integrating Big Data into traditional EMMS:**

Data is growing at a greater pace and so are the Big data technologies. Some of them are defined below:

### **2.4.1 Apache and Map Reduce technology:**

Apache Cassandra is used to manage very large amount of data among several commodity servers. Cassandra provides high scalability and availability regardless of performance issue.[8] MapReduce technology is a programming paradigm which includes two functions called map and reduce that allows for large job execution scalability against thousands of servers. For using Hadoop MapReduce, users have to define the map and reduce functions only [9].

### **2.4.2 Data storage and management technology:**

Hive is used for data storage and management of Big Data. It is an SQL-like feature on top of Hadoop. All types of Joins, Group functions can be used using Hive as in SQL. HBase is an open source, distributed and non-relational database model after Big Table of Google. Its feature is to provide read/write access on real-time bases [10].

## **3. Literature Survey:**

Shifeng Fang, Li Da Xu, Yunqiang Zhu, Jiaerheng Ahati, HuanPei, Jianwu Yan, and Zhihui Liu” explained how to combine Internet of Things(IoT), Cloud Computing, Remote sensing(RS), geographical information system (GIS), global positioning system (GPS), and e-Science for environmental monitoring and management, by proposing an IIS [2]. The authors have used a case study on regional climate change and its ecological effects.

S.Muthukumar, W.Sherine Mary [11] published a paper on IOT based air quality monitoring and control system in ICIRCA 2018. The system was based on using PIC16F877A microcontroller which took information from sensors and

sent it to Wi-Fi transceiver. Air quality is monitored to collect data and to provide the information required by scientists, policy-makers and planners so that they can take decisions for managing and improving the environment.

Rohan Kumar Jha has proposed a reporting system, which is an advanced real time air quality reporting system supported with Internet Of things (IOT) architecture [7]. Author has tested the proposed system and proved that this system was able to sense and send air quality data to thing speak server and from there using API key gets transmitted to the android application.

Gagan Parmar, Sagar Lakhani, Manju K. Chattopadhyay [11] presented a paper on “An IOT based low cost air quality monitoring system”. The author’s system was getting data from sensors and using raspberry pi to interpret and send it to the Wi-Fi module, after that it could be seen to the online data servers. The author has used semiconductor sensors due to which the proposed system has become low cost, quick response, low maintenance, ability to produce continuous measurements, etc.

Nilay Mishra, Neetu Gupta and Ajay Rana has discussed a Monitoring system in their paper which is based on sensor node functionality. This system works on the principle of how the signal works and the amount of time it takes to deposit on the sensor. Its components are signal conditioning- changes in air, signal calibration and a processing unit which is controlled by micro controller. This Processing unit coordinates with the sensory devices and maintains the working interval. The proposed architecture will help in analyzing the air quality for some specific surrounding in the real time so that appropriate action can be taken [12].

#### 4. Conclusion:

The major problem with environment is to monitor the quality of surrounding and to see whether the air in surrounding is in the safe level index or not. The main aim of this paper to familiarize with the new emerging technologies which work effectively in monitoring the Air Quality Index automatically and efficiently. In past recent years, lot of work has been done in the area of air pollution monitoring system and an attempt has been made to discuss that work collectively in this paper.

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# ANALYSIS OF STUBBLE BURNING PROBLEM IN NORTH INDIA

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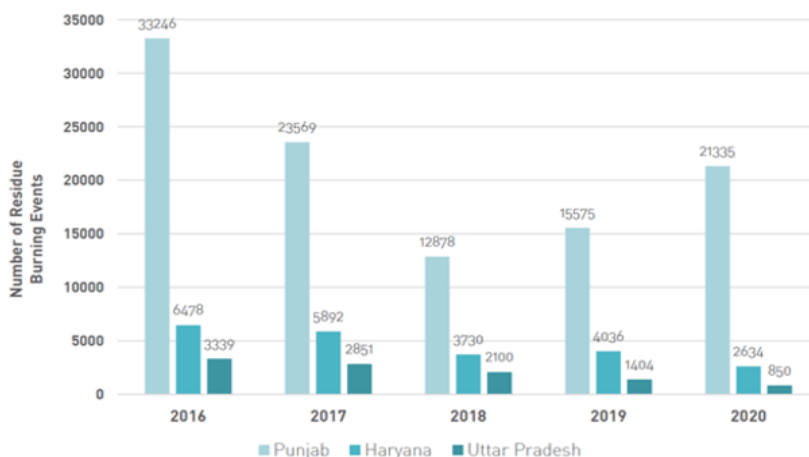
**Abstract:** Every year during the months of October and November, when the pollution levels in Delhi-NCR areas go very high, much emphasis is placed on stubble burning in surrounding areas. Stubble burning is a major source of air pollution at this time of the year. As per Wikipedia, Stubble burning is intentionally setting fire to the straw stubble that remains after grains, like paddy, wheat, etc., have been harvested. Burning is the cheapest, easiest and fastest way to dispose of the straw left after harvest so that fields can be made ready for seeding the next crop. Despite government incentives and penalties, stubble burning continues to be rampant. This research study aims at finding the causes of this age-old practice to be still continued despite government initiatives, and suggest solutions.

**Index Terms-**Stubble burning, north India, problem

## 1.INTRODUCTION

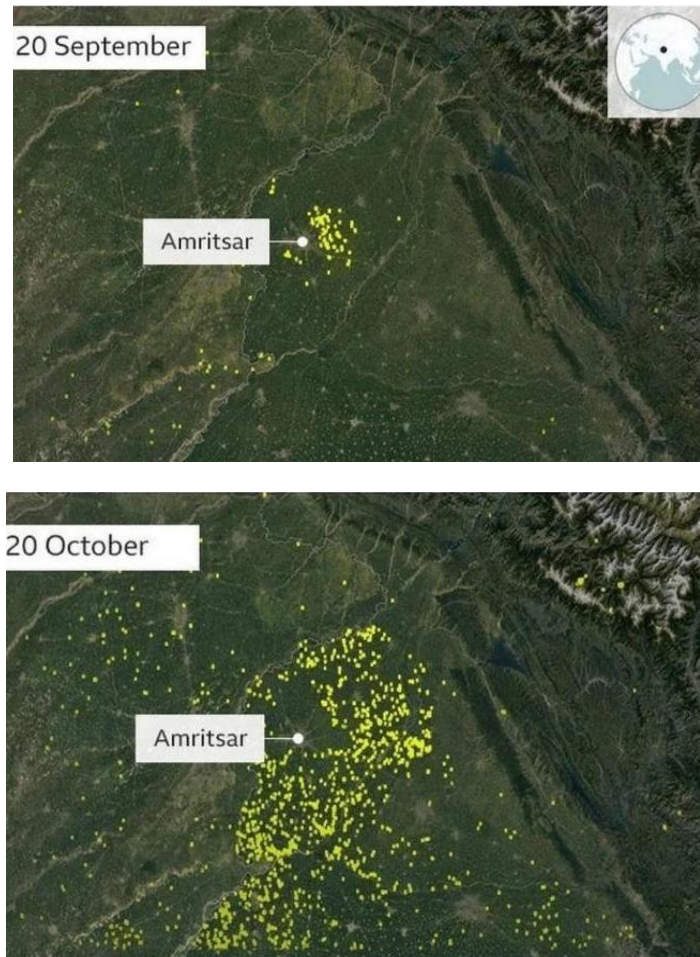
Stubble burning is intentionally setting fire to the straw stubble that remains after grains, like paddy, wheat, etc., have been harvested. Burning is the cheapest, easiest and fastest way to dispose of the straw left after harvest so that fields can be made ready for seeding the next crop. Fig.1 shows the comparison of fire events between Oct 1 and Oct 28 of Punjab, Haryana and Uttar Pradesh. According to data released by the Punjab Remote Sensing Centre, the State recorded 76590 incidents of stubble burning between September 21 and November 20 which is the highest after 2016. Fig. 2 shows the satellite images of areas on fire on 20th September 2020 and 20th October, 2020. The number of cases had been falling till 2019, only this year it was different. According to the Ministry of Earth Sciences' air quality monitor, SAFAR, the share of stubble burning in Delhi-NCR's pollution peaked to 42% on November 5, when 4,135 farm fires were recorded in the region. According to Central Pollution Control Board, in Punjab there has been an increase of 46.5% in stubble burning incidents as compared to last year. In Haryana, there has been a decrease of 28.6%. In In Haryana and Uttar Pradesh, the incidents of stubble burning have decreased constantly and considerably but still remain enough to be a cause of concern for the environment. In the present conditions, worsening air quality can make the Covid-19 pandemic deadlier. State governments are providing a 50% to 80% subsidy to farmers and cooperative societies to buy modern farm equipment for in-situ management of paddy straw, installing paddy straw-based power plants and running a massive awareness campaign against stubble burning [https://www.thehindu.com/news/national/other-states/stubble-burning-maximum-cases-in-punjab-anger-over-farm-laws-among-major-reasons/article33101909.ece]. Despite the heavy penalties being imposed by Punjab and Haryana governments, stubble burning cases continued unabated. Thus, the study was carried out to focus on finding the causes of

burning,  
North India  
solutions.



continued stubble  
especially in  
and suggestion of

**Fig. 1:** Year Wise Fire Event Counts between Oct 1 and Oct 28



**Fig. 2:** Areas spotted with fire in September and October 2020

“Stubble burning has increased by 46.5 % during 2020 in comparison to 2019” [m.economictimes.com.news].

## 2. RESEARCH ELABORATIONS

The methodology involves Problem Identification, Literature review and identifying the research gaps, Data Collection and Analysis of data to identify the causes of continued stubble burning. Step wise explanation of this is given as follows:

- 1) Problem Identification - The study involves identification of the problem of stubble burning specifically in North India.
- 2) Literature review and identifying the research gaps - Literature review was carried out from various journal papers, conference papers and from pollution control board websites, IARI data, SAFAR data, past researches on this issue etc.
- 3) Data Collection - Collection of primary data by visits to some farming sites in NCR areas, discussing with farmers regarding the usefulness of government steps, limitations of these initiatives and their expectations from the administration. Collecting secondary data from government agencies like state pollution control boards, environmental agencies, institute of agricultural research etc.
- 4) Analysis of data to identify the causes of continued stubble burning

### 3.RESULTS AND DISCUSSION

The causes of stubble burning are identified as follows:

- 1) In the case of Punjab, the harvested area increased manifold leading to more residues.
- 2) A good harvest this year resulted in a large residue, which makes it more difficult to work it into the soil or spread evenly across the field.
- 3) Clear weather meant that the biomass was drier and easily burn-able.
- 4) Farmers have not been paid the incentive despite Supreme Court orders. Also, the financial incentive is barely enough to cover the cost of fuel used for the machinery.
- 5) Non-availability of farm labour, since many returned to their native places due to the pandemic, made manual clearing of fields more difficult and expensive.
- 6) The cost of mechanical as well as manual clearing is very high vis a vis a 2 Rupee matchstick required to burn it.
- 7) There is a very short period (about 15 days) between harvesting of paddy and sowing of the next season crop which force farmers to resort to fastest methods despite government penalties.
- 8) There is not much monetary value of the stubble directly for the farmer unlike wheat residue which can be used as animal fodder. Non basmati paddy straw is considered useless because of high silica content and so farmers burn it.

### 4.CONCLUSION

The solutions for the above problem in the study can be given as:

Generating awareness among the farmers regarding pollution and harmful effects caused by stubble burning. The farmers and their families are likely to be hit the most with this smoke because they are the closest to these farm fires. Farmers have to be provided with agricultural machines that can either till back the straw into the ground or help it to be composted on the field itself. The cost of such machinery have to be subsidised.

The incentives to the farmers should be lucrative and must be paid in advance to enable them to afford the fuel cost incurred in using the machinery.

There should be a common pool of machines like super SMS, happy seeders, rotavators etc. managed by a group of farmers in a particular area. The machinery should be made available to all, especially small and marginal farmers, free of cost.

Parali (stubble) can be used to prepare high-grade organic fertilizers and straw can be used for electricity generation. Government can set up straw-based power generation plants and bio- CNG/bio-ethanol plants, which will give farmers a price for the straw and therefore, an incentive not to burn it. State government can take the responsibility of getting the fields cleared and the cost can be made up by selling the stubble. Only, proper logistics are required like cooperatives etc. because no farmer can afford delays due to the short interval available for sowing the next crop.

The farmers need to be encouraged to diversify the crops and shift from non-basmati paddy which apart from stubble problem also consumes large amounts of water depleting the water level in their fields.

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# GREEN DRY-CLEANING TECHNOLOGY AS A SUSTAINABLE ALTERNATIVE

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**Abstract:** There are many technologies which have been invented and applied by humans which help to carry out day to day activities. But these activities are prone to cause adverse effects on the environment. Therefore, there is an urgent need to introduce those technologies which are eco friendly and sustainable. New technologies have already been developed which are a result of increasing awareness among environmentalists. These technologies are said to be green or clean technology. The principles of green technology are: energy efficiency, sustainability, controlling emissions, curbing the depletion of non-renewable energy resources, and many more. Here we discuss the green alternatives in the field of dry-cleaning. Green dry cleaning- a concept to replace 'Perc', with environment friendly alternatives. This is because Perc is a harmful toxic chlorinated compound and it has a long residence time in the environment. This paper discusses the concept, principle and usage of sustainable options as an alternative to conventional dry-cleaning. This paper brings into light the growing need and importance of Green Technology.

**Keywords:** Green-technology; Perc; Dry-cleaning; carcinogen; Sustainability

## 1. INTRODUCTION

Green technology refers to the technology which is environment friendly. In other words, it poses much less or no threat to the environment. It can also refer to clean energy production. Although the concept of green technology is relatively new, it has garnered a significant interest and concern of environmentalists to deal with the pollution and threat to biodiversity. The goal of green technology is to protect the environment and conserve biodiversity and, in some cases, to even repair past damage and harm done to the environment by humans. According to a 2018 report released by the United Nations, global investment in renewable energy and green technology processes surpassed \$200 billion in 2017; \$2.9 trillion has been invested in sources like solar and wind power since 2004 (Will Kenton). The green tech covers many factors such as source reduction (making changes in production and consumption), innovation (finding alternative fuels and technologies), viability (linking the green technology to the economy and making its implementation feasible and efficient).

Green technologies have their application in a number of areas like soil remediation methods, carbon sequestration technology, solar panels, wind turbines, solar heating, recycling, fluid extraction, dry cleaning etc. One of the recent inventions in green technology is Green dry-cleaning. This is concerned with replacing the harmful solvent with the green solvent in the dry-cleaning process.

## 2. GREEN TECHNOLOGY

Green technology is a sustainable technology. It is concerned with protection of the environment and repairing the damages caused to it in the past. The rising pollution and threat to the environment calls for an urgent need to bring green tech in application in industries and almost in every field.

The term 'Green' is interpreted as something which helps to retain the greenery of the environmental systems or the basis of the ecosystem, the plants (producers). Green tech ensures clean water, clean air, conserved natural resources. Non renewable energy resources should not be depleted at higher rates. There is a need to find the alternative resources and fuels which ensure protection of natural resources and maintain sustainability. One of the most famous examples of green technology is the solar cell, which directly converts energy from natural light into electrical energy, based on the principle of photovoltaic. Generating electricity from solar energy helps in less consumption of fossil fuels, as well as the reduction of pollution and greenhouse gas emissions. An interesting point to note about green technology is that it is a good business and a fast growing market with an appreciable growth as many of the environmentalists are likely to put stress on the usage and application of green in industries. At the same time it is the duty of consumers to buy and promote the products of green technology which will further help to balance the economy.

In the traditional technological innovation mode, system improvement focused on the end process of environmental governance, mainly includes: collect taxes on polluters according to the harm caused by pollution, use taxes to make



up gap between the private cost and social cost, tradable emission permits can contribute to the internalization of environmental externalities. Environmental system improvement based on green technology innovation substantially reduces the pressure at the end process of environmental governance through the prevention of the links. Green technological innovation saves resources and protects the ecological environment in various stages of resource input, resource conservation, production process, product output, waste disposal.

### 3. Dry cleaning and 'Green' Dry cleaning

Dry cleaning is an important part and process of human clothing. The process uses a solvent which helps to clean the clothes without the usage of water. But the concern arises in the process that the solvent which is used in the dry-cleaning process is based on chlorinated compounds. The solvent is known as '**Perc**' or PCE which is an abbreviation of **Perchloroethylene**. PERC has been identified as a carcinogen with high toxicity. This can contaminate drinking water and soil too. The compound contains chlorine and due to the fact that C-Cl bond is very strong, the compound is not easily degradable and is persistent for a long duration in the environment.

The main health effects that are associated with human exposure to PERC are carcinogenicity and toxic effects on the central nervous system, kidney, liver, and reproduction and development. Human data on the effects of PERC exposure are mostly from occupational studies involving workers repeatedly exposed to PERC in the dry-cleaning process. According to a study in the US, tetrachloroethylene was detected in seven out of eight samples analysed in breast milk.<sup>16</sup> Studies of PERC's effects on humans and animals have demonstrated that PERC is readily absorbed by inhalation, skin contact or ingestion.<sup>[1]</sup> This problem can be tackled by replacing Perc with Environmental friendly solvents.

**3.1 Wet-Cleaning:** Wet cleaning process uses water and special detergents which are milder than the traditional products which are used to clean the household laundry and clothes. The EPA has shown a green flag to this method as it has proved to be the easy and safe method without posing any major threat to the environment and without leaving any persistent residues. There is no usage of any hazardous chemicals, neither it leads to waste generation. This technology will efficiently reduce the problems of water contamination and persistent pollutants.

**3.2 Liquid Carbon Dioxide (CO<sub>2</sub>) Cleaning:** Carbon dioxide (CO<sub>2</sub>) can be used as a cleaner. It basically uses a mixture of liquid CO<sub>2</sub> mixed with a detergent as the cleaning substance. The liquid CO<sub>2</sub> is formed by placing the nonflammable and nontoxic gas under high pressure. This condition is called supercritical conditions. Liquid CO<sub>2</sub> is non-toxic and is used in many soft drinks, foods and various household products. This process uses less energy than traditional dry cleaning due to the fact that there is no need to heat any solvent.

**3.3 DF-2000 Hydrocarbon Solvent:** DF- 2000 is an organic synthetic solvent which is produced from petroleum. This solvent is almost an odorless hydrocarbon and has proved to be capable of replacing the harmful chlorinated solvents and ultimately curbs greenhouse gas emission.

**3.4 Silicon Based Solvent:** A mixture of liquified sand and silicon dioxide can be used to replace perc. The usage of a silicone based solvent called siloxane or D-5. Siloxane is similar in nature to some of the general ingredients used in deodorant and shaving creams. When this mixture is discarded, it breaks down into sand, water, and carbon dioxide. The advantage to silicon-based solvents is that there is no use of chemicals which directly touch the clothes. However, there is demerit too that the manufacture of siloxane uses chlorine, which can form carcinogenic dioxin during the process of manufacture.<sup>[2]</sup>

## CONCLUSION

The topic chosen for this paper was Green dry cleaning technology as a sustainable future. The reason being- the growing importance and need of green tech to keep up with the sustainability and deal with the depletion of non renewable resources. This paper discussed the basic idea behind Green technology, how it works and why it is significant. It can be applied in various fields at various levels. The most famous technology related to day to day life is green dry-cleaning which helps to find an alternative solvent for Perc (a harmful chlorinated toxicant). Hence, Green technology is a very wide and emerging concept both for the environmental concerns and for the technological world. There is a need to increase more awareness and promote extensive research and studies to develop and bring out more advancements in inventions and usage of Green technology.



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# TREATMENT OF WASTEWATER BY NANOTECHNOLOGIES

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**Abstract:** Water is very much important for all living organisms and it is a natural source of earth. Furthermore, people are suffering from major issue of drinking water. Water pollution being a threat to our lives and certain reasons behind that are metals, gases, micro organisms which are added after rain and leached out through soil, agriculture pollution, river dumping, marine dumping, and moreover radioactive substances. This polluted water can be treated by nanomaterials with huge potential which contain inorganic, organic substances and metal toxin substances. The nanostructured catalytic membranes, nanosorbents and nanophotocatalyst based approaches to remove pollutants from wastewater are eco-friendly and efficient. Waste water faces many challenges and issues. New techniques which are introduced for the treatment of waste water should be eco friendly, pocket friendly, flexible and investment subsided should be used more effectively to support the first commercial scale implementation to validate new emerging and breakthrough technologies.

## INTRODUCTION:

Water being available in its pure state is necessary for all human beings and living organisms because life without water is beyond belief. Currently, world is facing a major issue of water contaminants such as sewage (waste water) waste water from domestic and industrial processes; agriculture pollution (pesticides, herbicides, oil spills, dairy spills, ploughing of the land, sheep dip and slurries and manure; oil pollution (oil spill affects water in number of ways, which also make drinkable water unsafe moreover not only water it also destroys wildlife and ecosystems); radioactive substances (nuclear power plants, medical, industrials and other scientific processes); marine pollution (dumping of waste in coastal water, plastics and materials blown or washed from land); River dumping (people dump daily garbage, cycle, electronic items, garden even after knowing that it's an illegal offense moreover river dumping not only causes water pollution but also harms wildlife and causes flood) are some of the causes of water pollution which affects the quality of water [1]. Water pollution has unfavourable effects on human health and as well as causes air pollution too. Contaminated water is water that is changed due to the presence of chemicals, microbes or physical alteration which causes flooding and other results of storms can cause chemicals and microbes from the ground to make their way into the water [5]. There are many chemical, physical and mechanical methods. Researchers are exploring new techniques and methods which should be cost effective and can be used in abundance. Newly, emerging field nanotechnology provides a potential over to purify water with a low expense, high working efficiency in removing pollutants and reusable ability [6]. Nanomaterials have potential for great impacts in electronics, medicine and other fields. Recently, when the world is facing serious crisis for water scientists have found that the nanomaterials due to its physical and chemical properties is the better option for treatment of water which are size, shape, specific surface area, size distribution, structure, solubility and aggregation state, strong mechanical property, porosity characters, hydrophilicity, dispersibility and hydrophobicity [9–11]. Some heavy metal like Pb, Mo, etc. organic (includes phenol, chlorinated phenol, endocrine disrupting chemicals, azo dyes, polyaromatic hydrocarbons, polychlorinated biphenyls, pesticides) and inorganic pollutants (includes a variety of toxic heavy metals such as cadmium, chromium, arsenic, lead mercury etc) and various harmful microbes are reported to be successfully removed by using different nanomaterials [12–16]. Currently, WHO (World Health Organization) reported that almost 1.7 million people died due to water pollution and four billion cases of different health issues were reported annually due to waterborne diseases [17]. Moreover, water is limited source for us, and water there is 97.5% of water is salty and only 2.5% of water is fresh water. And out of this 2/3 of water is locked in polar ice caps and glaciers which mean 0.5% is in form of lake and rivers, agricultural and industrial use. Everyday industrial and agricultural waste are discharged in sea and river and water streams. Which causes water pollution in high quantity. Everyday we use water in wide variety from our household work to every work which in turn uses 100 gallons of water per person. Waste water and sewer waste goes into single compiled sewer all of this head to waste water treatment and chemicals which are put together for industries work and chemicals and pesticides which are put on to soil are leached out and further added to ground water and causes pollution. Waste water treatment look like it has several steps first one is the systems separates solid and hard core substances from the fluid in tanks in which oxygen is supplied to micro organisms.

Typically, microbes require oxygen to degrade contaminated pollutants. And the resultant is further treated in its final step where contaminated water is disinfected. There are three methods of treatments biological, chemical and physical. And each of these has one short coming or the other and which introduces nanotechnology, and for this crisis nanotechnology for cleaning water is changing a business site in both developed and developing countries.

### CONCLUSIVE REMARKS AND FUTURE PERSPECTIVES:

Water is drive force of all nature. But we human being destroy each and every inch of it. Such plastics, acid, domestic waste, mining waste etc. Water distinguishes and makes our earth superior as compared to other planets. Though the demand of water in whole world is more which in turns makes important as well as difficult for us to supply pure water. Due to this supply and meeting everybodys need for pure water is getting difficult. Moreover, the world is facing several challenges in doing that, especially given a fluctuating and undefined future environment, a fast-rising population that is driving enlarged community and financial growth, urbanization and globalization. There are still some weaknesses that must be negotiated. Up to zow, no operational digital monitoring techniques Water **2020**, 12, 495-20 of 30 exist that offer consistent real-time measurement facts on the superiority of nanoparticles which are existing in small amounts in H<sub>2</sub>O [212]. Furthermore, to reduce the health risk, some research institutes and international research communities should prepare proper guidelines to overcome this issue. Another, further mechanical restriction of nano-engineered water approach is that they are infrequently flexible to mass developments, and at present-day, in several cases are not modest with conservative treatment approaches [213].

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# DEGRADATION METHODS OF N-CONTAINING HETEROCYCLIC COMPOUNDS FOR THE WASTE TREATMENT: A REVIEW

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**Abstract:** Heterocyclic compounds are widely distributed in nature. These compounds are essential to life and play a major role in the metabolism of living cells. These are widely used as pesticides and other chemical feedstock and present in waste of various industries. Nitrogen containing heterocyclic compounds are an important class of pollutants present in environment. As these are toxic there is a need to find the best degradation method for N-heterocyclic compounds for the efficient removal to achieve effluent of that quality which can be disposed off without causing any damage to the environment.

In this paper, an attempt was made to summarize the all useful methods for degradation of N-heterocyclic compounds. The review covers the research works that has been reported since 2000-2020 to treat N-heterocyclic compounds containing waste. This paper addresses the different physico-chemical methods and especially biological methods or combination of both for the degradation of N-heterocyclic compounds.

**Keywords:** Heterocyclic compounds, water treatment, Degradation.

## 1. INTRODUCTION

A heterocyclic compound is a cyclic compound that has atoms of atleast two different elements as members of its cycle. Nitrogenous heterocyclic compounds are those in which atleast one carbon atom of the ring is replaced by nitrogen atom. Many naturally occurring pigments, vitamins, and antibiotics are the heterocyclic compounds. Modern society is dependent on synthetic heterocycles for use as drugs, pesticides, dyes and plastics. N-heterocyclic compounds are generally present in ground water, coal gasification waste, cooking waste and in other industrial waste. Because of high mobility, they can leach into the water and contaminate both groundwater as well as drinking water. These heterocyclic compounds are widely used as pesticides and chemical feedstock. Nitrogen containing heterocyclic compounds have been detected in air, soil, marine environments and sewage sludge. These heterocyclic compounds are toxic and some are persistent in environment. Heterocyclic compounds have great impact on such diverse environments as agriculture and highly industrialized region.

Due to these reasons, there is a need to find out most appropriate method for degradation of N-heterocycles during waste treatment

## 2. LITERATURE SURVEY

### 2.1. Photo catalytic degradation methods:

Photocatalytic degradation of agricultural N-heterocyclic organic pollutants using immobilized nanoparticles of titania was given by Niyaj Mohammad Mahmoodi et al in 2007. Results show that the nanophotocatalysis using immobilized titania nanoparticle is an effective method for treatment Diazinon and Imidacloprid from contaminated water. Here the mineralization of diazinon and imidacloprid was evaluated by monitoring of the formed inorganic anions.

Titanium dioxide photoinduced degradation of some pesticide/fungicide precursor was given by Ivana Kuehr et al in 2007. Here five membered N-heterocycles such as pyrrole, and imidazole was degraded under solar radiation and titanium dioxide. The result showed that the degradation is first order except imidazole where it is pseudo first order equilibrium constant value decrease with heterocyclic basicity and the rate constant value increase with increase basicity.

Fast photocatalytic degradation of pyridine in nanoaluminium oxide suspension systems was given by Hong Zhao et al in 2011. During that study, the decomposition of pyridine under uv radiation taking alumina as catalyst was faster than without use of catalyst alumina. It was believed that the interaction between alumina hydroxyl and pyridine by chemisorptions weakened the carbon nitrogen bond and promotes the decomposition.

## 2.2. Electrochemical degradation methods:

Electrochemical degradation of heterocyclic compounds having an atom at boron doped diamond electrode was given by Xuanxaing et al in 2012. Here number and position of an atom effect was also included. Result showed that electrolysis is of pseudo first order. A linear relationship between degradation and delocalization energy was drawn from here. Active sites in the heterocyclic ring were found using quantum calculation and verified experimentally.

Mineralization of pyrrole by electrochemical method was done by Ajay Devidas high worker et al in 2017. Here multi response optimization and degradation mechanism was found out using full factoria central composite design matrix. Here 82.9% cod removal obtained 7.7 kwh/kg of cod removed.

Degradation of pyridine in drinking water by dielectric barrier discharge was given by Yang li et al in 2017. Here oxalic acid, fumaric acid, B-hydroxyl pyridine and many other intermediates were obtained. Nitrogen removed from pyridine in the form of nitrates. The study provided a base for application of DBD strong ionization discharge for the removal of nitrogen heterocycles from drinking water.

## 2.3. Oxidation degradation methods:

Ozonation of pyridine and other N-heterocyclic compounds was given by Agnes Tekle-Rottaring et al in 2016. An oxide formation was observed in case of pyridine and pyridazine, but with pyrimidine and pyrazine the reaction is very low. Here electron transfer is the primary process in reaction of ozone with pyridine, pyradazine, pyrimidine and pyrizine.

Super critical water oxidation (SCWO) was given by Al-Duri et al in 2016. That study showed heterocyclic compounds in hazardous waste get destructed by SCWO. The process enhancement occurs when isopropyl alcohol used. Rate is also affected by temperature and mechanism proceeds via free radical intermediate. In the next part of research work the mechanism was given to be pseudo first order.

Degradation of nitrogen heterocyclic compounds by anodic oxidation and electro fentons method was given by Y Songhu et al in 2007. In this study indole was used as model compound and removal of indole reached 68% by anodic oxidation and 97% by electro fentons method.

Pretreatment of heterocyclic pesticides waste water use in ultrasonic/ ozone combined process was employed by Z Xiong et al in 2011. From the results of the study it was found that ultrasonic/ozone process improved biodegradability and reduced the biological toxicity of waste water alkaline condition was found to be more favourable for the process.

Three dimensional electro-fenton oxidation of N-heterocyclic compounds with a novel catalytic partial electrode was given by B Hou et al in 2017. From the results of the study it was found that degradation of indole quinoline and pyridine in 3d EF with Sac-Fe was rapid with removal efficiency as 99.1%, 96.7% and 64.2% respectively. The degradation mechanism was found to be pseudo first order. The apparent rate constants for indole, quanine and pyridine were determined 0.0447, 0.0317 and 0.0097 min<sup>-1</sup> respectively.

Removal of selected nitrogenous heterocyclic compounds in biologically pre treated coal gasification waste water (BPCGW) using the catalytic ozonation process was given by H Zhu et al in 2017. The results demonstrate that efficiency of unsatisfactory single Mbr was remarkably improved using catalytic ozonation process as a pre treatment. Quinoline, pyridine and indole were completely removed in the integrated process. The total cost of this integrated process was estimated to be lower than that of MBR.

Improvement in the biodegradability of post hydrothermal liquefaction waste water with ozone was given by L Yang et al in 2018. Here ozone was used to convert phenols and N-heterocyclic compounds with dosage of O<sub>3</sub>. N-heterocyclics were converted with a low rate while phenol was fully converted to acid.

## 2.4. Biological methods of degradation:

Aerobic degradation of pyridine by a new bacterial strain, *Shinella zoogloeoides* BCO26 was given by Y Bai et al in 2009. Here the strain accomplish heterotrophic nitrification and aerobic denitrification simultaneous as converting pyridine N-into ammonium and then conversion of a portion of ammonium into nitrate, then to nitrite and finally to dinitrogen if enough extra carbon was provided. Anoxic degradation of nitrogenous heterocyclic compounds by acclimated activated sludge was given by Yang Li et al in 2001. Results showed that pyridine, indole, quinoline,

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isoquinoline, 2-methyl quinoline get effectively degraded by the denitrifiers in acclimated activated sludge and the degradation rate depends upon chemical structure.

Nitrogenous heterocyclic compounds degradation in the microbial fuel cells was given by Wen-John Hu et al in 2011. Here 413 mv, 494 mv and 524mv were obtained from pyridine quinoline and indole respectively. The maximum degradation efficiency was 90% and the COD removal was up to 88%.

Degradation of N-heterocyclic indole by a novel endophytic fungus *phomopsis liquidambari* was given by Yan Chen et al in 2013. Broad-spectrum endophytic *phomopsis liquidambari* converted indole to oxindol and isatin in the key steps of limiting indole degradation. Here indole is the sole source of carbon and nitrogen and the optimum concentration of indole was 100 mg/l, with 41.7% ratio of indole degradation within 120 hrs. When plant litter was added exogenously to indole the degradation rate became 99.1% within 60 hrs. In the next step oxindole get deoxidative to indole-2-dione, then hydroxylated to 2-dioxyindole with pyridine ring cleavage changing it to 2-amino benzenoic acid.

Effect of powdered activated carbon technology on short cut nitrogen removal for coal gasification waste water was given by Qian-Zhao in 2013. The process was developed to treat the effluent of an up flow anaerobic sludge bed reactor (SBNR) the SBNR performance was improved by increasing COD removal.

Biodegradation of various aromatic compounds by in reached bacterial cultures was given by as oberoi et al in 2015. Here pyridine quinoline benzothiophenes and benzofuran were used as target compound and naphthalene in reached culture was used. Substrate degradation rate was observed as pyridine >quinoline>benzofuran>benzothiophene. Quinoline and pyridine N-get converted to ammonium ions.

Biodegradability of some nitrogenous heterocyclic compounds and Co-degradation with phenol by denitrifiers in anoxic sludge reactor was given by Z Wang in 2015. From the results it was found that denitrifiers could degrade pyridine on the microbes by adding phenol in to effluent and degrade as sole carbon source. By addition of phenol degradation performance of quinoline and pyrrole was improved due to co-degradation. Anoxic degradation of nitrogenous heterocyclic compounds by activated sludge and their active sites was given by pxv et al in 2015. Results of this study showed NHCS could be degraded completely with in 60 hr if the initial conc. of NHCS is 50 mg/ltr. And the degradation rate depends upon chemical structure.

Enhanced anaerobic degradation efficiency and mechanism of quinoline, pyridine and indole in coal gasification waste water was given by I SHI et al in 2019. Results showed that the first step of degradation of NHCS is opening of nitrogen heterocyclic ring. The ammonia nitrogen release and opening of benzene ring is next step. The enhancement of micro-organism for the degradation of NHCS is done by Fe<sub>3</sub>O<sub>4</sub> addition.

Anaerobic bioaugmentation hydrolysis of selected nitrogen heterocyclic compounds in coal gasification waste water was given I SHI et al in 2019. The addition of Fe(OH)<sub>3</sub> and PAC improved the performance by increasing coagulation capacity of microorganism. The main functional groups for anaerobic biodegradation are enriched Acinetobacter, *evlinea*, *comamonas* and *logilinea*.

Enhanced anaerobic degradation of selected nitrogen heterocyclic compounds with the assistance of carboxy methyl cellulose was given by J Shi et al in 2019. Here carboxymethyl cellulose enriched the bacteria and archaea community structure improving the performance acetic acid metabolism as the primary mechanism here during the anaerobic degradation of NHCS.

A novel enhanced anaerobic biodegradation method using biochar and Fe(OH)<sub>3</sub> biochar for the removal of nitrogen heterocyclic compounds from Coal gasification was given by I SHI in 2019. Here *comomans* and *logilinea* used to degrade the typical NHCS heterocyclic compounds and Fe(OH)<sub>3</sub> biochar was used as an efficient biological carrier. Fe(OH)<sub>3</sub> decreased the toxicity on living organism.

Aromatic compounds degradation in a typical process of Coal pyrolysis waste water treatment was given by Han Hongjun et al in 2020. Here in results degradation performance of various coal pyrolysis treatment was done and SBR process was regarded as the core unit for aromatic compounds degradation.

An aerobic bio transformation and potential impact of quinoline in an aerobic methanogenic reactor treating synthetic coal gasification waste water and response of microbial community was studied by Benteng We et al in 2020. The results indicated that the rate determining step is degradation of 2(CH) quinoline. It was suggested that for illumination quinoline in anaerobic digestion is an effective method.

Enhanced anaerobic degradation of quinoline and indole with dried chlorala *pyranodosa* powdered as co-metabolic substance was given by Jingxin shi et al in 2020. Here chlorala promoted diversity and richness of bacteria community structure. And a quite toxicity of treated waste water is decreased. Quinoline and indole were degraded completely with 100 micro g/lr chlorala.



## CONCLUSION

This review covers progress of treatment methods of N containing heterocyclic compounds present in cooking waste water, industrial waste and coal gasification waste etc. The emphasis is put on the description of various biological, chemical and physical methods, mechanisms and results. By comparing the various degradation methods, further research on degradation of N-heterocycles in cooking wastewater is suggested. And it was also found that biological methods of degradation are of major importance and mainly used on larger scale.

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# BIOFLOCCULATION: A LOW COST OPTION FOR HARVESTING METHOD OF MICROALGAE

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**Abstract:** Climate change changes initiate to identify and utilize renewable energy. Microalgae biomass has been recognized potential source of biofuel production and animal feed. Chemical flocculants widely used for harvestation of microalgae but their impact on environment is serious problem. Bioflocculants are obtained from biological substance microorganism and plants, thus they are low cost and biodegradable which does not adverse impact of environment. This article aims to provide a brief about bioflocculation process, bioflocculants, their types and advantages and disadvantages of bioflocculants.

**Keywords:** Climate change, microalgae, bioflocculants

## 1. INTRODUCTION

The rising level of green house gas emission is alarming stage which is enhancing the global average temperature. The main reason of this is uncontrolled burning of fossil fuels for energy production and vehicular transportation. Drought, flood, cyclones are main consequences of these rising level of green house emission. Renewable energy sources are alternatives of conventional energy production and bioenergy is emerging sector that provides low carbon energy because net carbon emission of bioenergy sources considered as near to zero. First generation biofuels comprise food crops, second generation biofuels obtained from lignocellulosic biomass non food crops and algae comes into third generation biofuels.

Applications of algae are continue from ancient times and many beneficial economic importances are emerging to solve the current energy and environment problems. Microalgae easily grow in the wastewater and consume organic and inorganic pollutants from wastewater to produced high amount of biomass. This process reduces the pollutants load from wastewater and provides nutrients to microalgae. They consumed carbon dioxide from environment and fix it into biomass which reduces the carbon dioxide level from environment. Microalgal biomass contained 20-30% of lipid, 20-25% carbohydrates, 30-40% protein and many valuable biochemicals such as polyunsaturated acids, vitamins [1, 2, 3]. These biochemicals offer a broad range of commercial applications such as fuel, feed and medicines. However, economic viability of microalgal products still a change due to high cost of harvesting which shared about 30% of total cost.

Microalgae are free floating microorganisms but their collection/aggregation is a tedious process. Currently, three types of method applied for harvestation of microalgae; physical method which is cost and energy intensive, chemical methods which create environmental pollution and have high cost and biological method which are comparatively low cost.

## 2. BIOFLOCCULATION

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Flocculation induced by several microorganisms such as bacteria, fungi, yeast and even algae also involves to trigger flocculation process which is commonly a type of self-flocculation. However, microalgae secretes organic matters during the growth period and cell-lysis which are known as extracellular polymer substances (EPS), algogenic organic matter (AOM) and extracellular organic matter (EOM) and these materials are responsible for bioflocculation [4, 5]. EPS is uneconomic materials. Bioflocculants currently attracted of researcher for recovery of microalgae because of involvement of low cost and energy. Most of the bioflocculants are environmental friendly which is additional benefit over chemical flocculants because chemical flocculants are creating burdens for environment. The main challenge with bioflocculants is that the most of studies conducted in the lab condition so industrial viability is still matter of investigation.

### 2.1. Bacteria

*B. braunii*, *S. quadricauda* and *S. capricornuma* are harvested 91-95% efficiency by use of *Paenibacillus* sp. Similarly, *Pleurochrysis carterae* harvested 90-94% by microbial flocculants whereas *Solibacillus selvestris* had showed 88% flocculation efficiency for *Nannochloropsis oceanic* [4].

### 2.2. Fungi

*Aspergillus oryzae* and *C. echinulata* are showed 97% harvesting efficiency in the form of pallet for *Chlorella vulgaris* [4].

Bioflocculation process is species dependent because one microbial flocculant species does not uniformly effective such as *Ettlia texensis* showed 34% harvesting efficiency for *Scenedesmus obliquus* while *Chlorella vulgaris* harvested 55% [4]. Thus, it is challenge to identify and optimize an universal accepted species for microalgae harvestation.

### 2.3. Bio-products

Harvestation of microalgae by use of bio-products is another important and low cost method. Bio-products obtained from waste materials such as wastewater, biogas slurry, molasses, microbial biomass from fungi and bacteria, seeds and gum from plants. Gum from Guar and Cassia flocculated 92-94% to *Chlorella* sp. and *Chlamydomonas* sp [6,7], cationized natural tannin from *Acacia mearnsi* is showed 99% harvesting for *Nannochloropsis oculata* [8], seed of *Moringa oleifera* showed 98% harvesting for *Chlorella* sp. [9] Apart from this waste egg shell power is showed 98-99% harvesting for *Chlorella* sp. [10, 11]. Edible fungal species are also use for harvesting microalgae which does not create toxic effect in the harvested biomass. Similarly, agricultural wastes are also biodegradable bioflocculants that not harm to environment and local abundance provides an advantage over commercial flocculants.

## 3. SELF-FLOCCULATION

Self-flocculation of microalgae cells is spontaneous aggregation or sedimentation occurred with effect of environmental stresses such as alteration of nitrogen, pH, oxygen and CO<sub>2</sub> in culture medium. *S. quadricauda*, *Chlorella vulgaris*, *Scenedesmus* sp., *Phaeodactylum tricornutum*, *Nannochloropsis oculata*, *Chlorococcum nivale* are successfully harvested (78-90%) by change in the pH of culture medium. Magnesium and calcium ions are usually used for high pH, nutrient stress of metals ions can also help to aggregate microalgae [13]. Wastewater treatment and lipid production are also attainable by self-flocculation method [12]. Co-cultivation of microalgae with bacteria, fungi is another bioflocculant method that harvest to microalgae easily from the suspension. Bacterial cells are attached to microalgae surface which enhanced the flocs size, consequently sedimentation of microalgae. Fungi species are also used to harvest microalgae by co-cultivation which did not change the composition of bio-oil. *Chlorella vulgaris* is showed 75% harvesting efficiency with *Streptomyces* sp. [13] while Lee et al., (2013) [14] reported 94% harvesting efficiency by co-cultivation with *Flavobacterium* sp., *Terrimonas* sp., *Sphingobacterium* sp., *Rhizobium* sp., *Hyphomonas* sp., *M. aeruginosa* is showed 95% harvesting with *Halobacillus* sp., *Marinbacter* sp., *A funigatus* [15]

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and *S. obliquus* is showed 92% harvesting with *Cunninghamella echinulata* [16]. The additional substance such as NaOH, metal oxide, oxygen and CO<sub>2</sub> are economically viable alteration for flocculation because most of these are already used for cultivation of microalgae, act as growth parameters and only change in their concentration crate aggregate microalgae in the medium. Thus, the self-flocculation is an environmental friendly approach which has been providing a low cost solution of microalgae harvestation.

#### 4. BIOFLOCCULATION MECHANISM

There are three types of mechanism involves with bioflocculants to aggregate microalgae in culture medium. Fig. 1 representing the bioflocculation mechanism.

**4.1. Neutralization:** It is well established that the surface of microalgae contain negative charged functional groups which are mainly  $-NH_2$ ,  $-COO^-$ ,  $-PO^-$ . These negatively charged functional easily neutralized with opposite charges bioflocculants and form flocs. The electrostatic interaction forms the flocs by reduction of negative and positive charges between surface charge of microalgae and flocculants.

**4.2. Patching:** It is a kind of charge neutralization phenomenon in which electrostatic patch flocculation involves. The high charged electrolyte bioflocculants adsorbed on the surface of microalgae and result of this overall charge on the microalgae surface and flocculants are neutralized which form flocs.

**4.3. Bridging:** Basically long chain biopolymer shows this mechanism of flocculation in which long chain biopolymer bind with opposite charge microalgae cell surface and form large bridge like structure. These are heavier than the free floating microalgae and result is sedimentation process takes place in the culture medium.

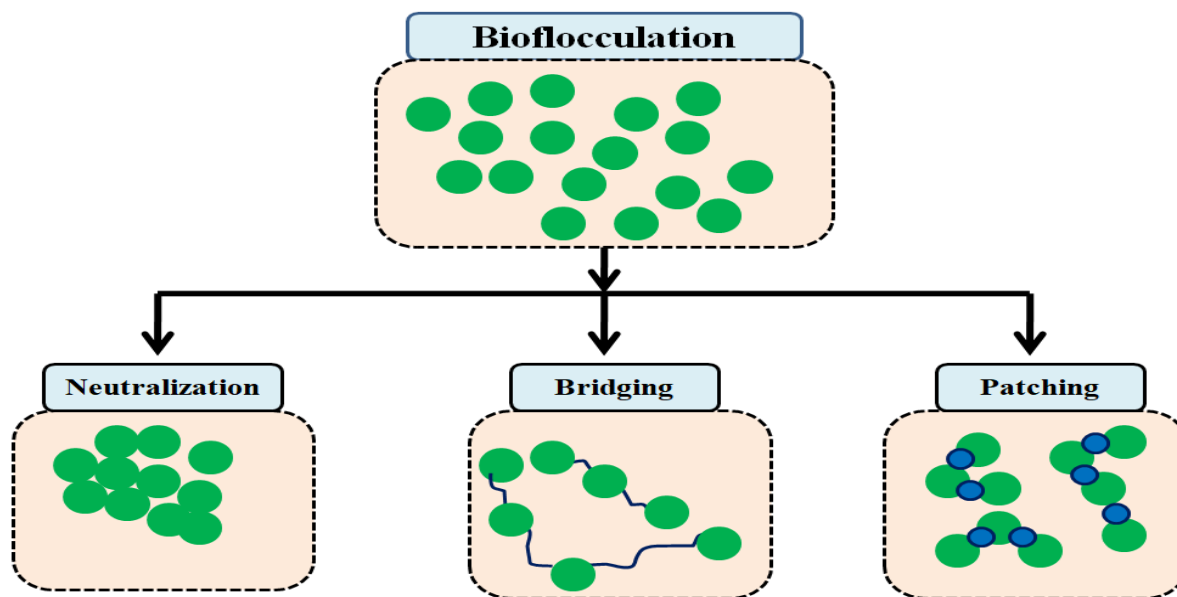


Fig.1.Mechanism for bioflocculation

Bioflocculation process involves several factors because it has complex mechanisms. Species of microalgae, pH, temperature, microbial species, flocculants dose, zeta potential are notable parameters which are potential to alter the harvesting efficiency of microalgae. pH, microalgae and flocculants dose/concentration are widely investigated by various researchers and they suggested that self-flocculation process can easily regulate by these three parameters, however temperature define the quality of harvested biomass because high temperature degrade the quality of harvested biomass but high temperature beneficial for rapid flocculation. Zeta potential defines the electrostatic interaction between microalgae and flocculants. Microbial bioflocculants are specific to their nature so, harvesting efficiency change with microalgae as well as bioflocculants.

## 5. ADVANTAGES AND DISADVANTAGES OF BIOFLOCCULANTS

There various advantages and disadvantages present with bioflocculants. Microbes based flocculants have major issues like culture purity, cost and sophistication operation, though bio-product based flocculants have more advantages over the microbes because they act as chemical flocculants and have capacity to mix with chemical flocculants to reduce the amount. Table 1. containing advantages and disadvantages of bioflocculants.

**Table 1. Advantages and disadvantages bioflocculants**

S.No.	Advantages	Disadvantages
1.	<b>High recovery rate-</b> Bioflocculants are showed high recovery rate of biomass about 70-99%.	<b>Long time-</b> Bioflocculation process takes long time and though bio-products comparatively fast from microbes.
2.	<b>Eco-friendly-</b> Bioflocculants are eco-friendly in nature and biodegradable.	<b>Contamination-</b> Due to involvement of bio-products and microbes which have chance to contaminate harvested biomass.
3.	<b>Cost-</b> Agricultural waste based bioflocculants have low cost. Operation cost minimum.	<b>Culture cost-</b> Pure microbial culture is high compared with bio-products. Nutrients cost is high.

## 6. CONCLUSION

Bioflocculants are low cost and biodegradable option for harvestation of microalgae. Microbial and bio-product based flocculant have potential to satisfy the demand of flocculant and an avail replacement of harmful chemical flocculants. The harvested biomass use for bioenergy energy application as well as nutraceutical applications of animal and fish. Agriculture waste based bioflocculants are not only harvest microalgae but also minimize waste from environment. Contamination of biomass still a challenge for bioflocculants harvested biomass which restricts their application only for bioenergy and animal feed. Thus, the rigorous research and development need for identification of suitable bioflocculants which reduced contamination chances and employed at commercial scale.

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THEME-V

ADVANCES IN CONSERVATION  
OF NATURAL RESOURCES



# WATER QUALITY STATUS OF RIVER GANGA AND ITS TRIBUTARY YAMUNA DURING LOCKDOWN

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**Abstract-** A clean environment and a healthy life are the two main indicators of a well functioned ecosystem. Many of the water resources, specifically the Ganga river has been observed to show some indications of improvement and rejuvenation during the nationwide lockdown. About 60% excess rainfall was observed in the regions surrounding the basin of Ganga river during this lockdown. And this increased discharge due to the excess of rainfall resulted in further dilution of pollutants. The storage data analysis revealed that the storage till May 6, 2020 was 82.83% more, which is nearly the double amount during the same period of last 10 years.<sup>[1]</sup> Some important parameters like- increased dissolved oxygen, while biochemical oxygen demand, faecal coliform, total coliform, and nitrate concentration decreased. The most important reason behind the decreased NO<sub>3</sub><sup>-</sup> concentration was limited industrial activities and the reduced agricultural runoff because of the harvesting season. This gradual improvement in the water quality has shown a sign of restoration. But the water quality has deteriorated once again post lockdown as the normal industrial activities have started.

**Keywords-** Ganga river, water quality, lockdown, industrial activities.

## 1.INTRODUCTION

The plains of Ganga river are among the most densely populated regions on the planet, inhabiting about 43% of the Indian population along its stretches.<sup>[2]</sup> This Ganga basin extends almost over every state.

River Ganga was declared as the “National River” of India in 2008. Various anthropogenic activities have played a significant role in modifying the natural biochemical and physicochemical functions of the river. The industrial and waste water discharges are among the major contributors to this pollution.<sup>[3]</sup> A nationwide lockdown in India was announced on March 23, 2020 to stop the spread of novel corona virus (COVID-19) outbreak. The lockdown continued to extend in three phases i.e., lockdown 1 (from Mar 25<sup>th</sup>, 2020 to April 14<sup>th</sup>, 2020), lockdown 2 (till May 03<sup>rd</sup>, 2020), and lockdown 3 (till May 17<sup>th</sup>, 2020). This nationwide lockdown of 8 weeks helped the Ganga river to improve its health and water quality. With the industries being closed and people staying home, the Ganga river has indeed witnessed a good improvement.<sup>[4]</sup> The objective of this paper is to study and analyse the impact of lockdown on the water resources and their water quality especially along Ganga river and its major tributary Yamuna in Delhi, India.



**Figure1 :** *Course of Ganga river and its tributaries*, Cleaning the River Ganga: Impact of lockdown on water quality and future implications on river rejuvenation strategies by [Venkatesh Dutta](#), [Divya Dubey](#), and [Saroj Kumar](#).

## 2.METHODOLOGY

The basic methodology used to analyse the water quality status is based on historical data and involves comparison of data with water quality observed during the lockdown phase on the basis of real – time monitoring data from the central pollution control board (CPCB) and various state boards.

## 3.CRUCIAL HOTSPOTS OF WATER POLLUTION

A huge quantity of wastewater from the various nearby cities and towns reaches to the river Ganga ultimately through their natural drainages. The water quality of the river is good in the upper hilly stretch of Rishikesh and start to decline downstream of Haridwar due to the continuous addition of domestic and industrial wastewater into it. Various heavy industries like paper & pulp, sugar, fertilizer, textiles, automobiles and distilleries further contribute to the pollution load of Ganga. The 20% of the volume of total wastewater entering the river Ganga comes from industries. And 55% of this 20% industrial drainage comes from Uttar Pradesh alone.<sup>[5]</sup> Due to high levels of BOD and Faecal coliform along the cities of Kanpur, Allahabad and Varanasi, the river water becomes unfit for outdoor bathing. Sah et al found 13 banned and restricted organochlorine pesticides in the surface water along the river Ganga, that poses high ecological risk.<sup>[6]</sup> The highest concentration of heavy metals like Fe, Mn, Zn, Cu, Ni, Pb and Cd were detected in the urban stretch of Varanasi.<sup>[7]</sup>

## 4.IMPACT OF LOCKDOWN ON THE WATER QUALITY

The significant improvement in water quality was due to the shutting of industries and due to the absence of industrial pollutants & bulk of solid waste during the lockdown period. Amid the countrywide lockdown, the water quality of Ganga in Haridwar was categorized as “fit for drinking” according to Uttarakhand pollution control board. While the water quality in Har-ki-Pauri was classified as class A for the first time in last 20 years.<sup>[8]</sup> This improvement was seen during the lockdown period along the entire stretch of river, especially upstream of Kanpur.

However, the organic load has not observed much change as the number of domestic discharges didn't changes during the lockdown. The dissolved oxygen concentration was more than 5 mg/l at all the locations. There were two important reasons behind this improvement in water quality- the first one is reduced industrial wastewater discharges, and the second one is the increase in fresh water inflows because of increased precipitation during the lockdown period. Also, as it was a harvesting season so, no large extraction of water for irrigation was there. That further acted as the source of dilution.

No great decrease in BOD was observed during the first three weeks but the fourth week observed a slightly low BOD values than the previous weeks. As the wastewater discharges continued from the municipal sources, only a minor decrease was observed in COD values during first four weeks of the lockdown. Nitrate levels seen decreasing with an average value between 0.69 – 2.0 mg/l during the start of third phase of the lockdown. Ammonical nitrogen has shown increased values at all the locations except in Bijnor during the first two weeks. But at the start of 3<sup>rd</sup> week, ammonical nitrogen was recorded to be less than 1.2 mg/l i.e., the prescribed limit for it. The reason behind the increased values during the first phase of the lockdown could be the increased discharge of wastewater or the slow dilution rate. The bacteriological quality of Ganga river has also improved during the lockdown phase as many regions were observed to have large decline in total coliform and faecal coliform counts.

Ganga's most polluted stretch and its important tributary- Yamuna river also witnessed some improvement in the water quality during the month of April 2020, if compared to last years. Decreasing BOD & COD levels were observed at almost all the sites except for first three sites of sampling. But the water quality was still not very good. Out of 36 monitoring locations of river Ganga, 27 locations observed water quality good for bathing (class B) and 9 stations observed a water quality of class C i.e., for wildlife and fisheries propagation according to the real time water monitoring data of the central pollution control board. Such a good recovery had not been observed in the last 30-40 years.

**Table 1 : Observed water quality of Ganga river during lockdown based on real time water quality data ,** Cleaning the River Ganga: Impact of lockdown on water quality and future implications on river rejuvenation strategies by [Venkatesh Dutta](#), [Divya Dubey](#), and [Saroj Kumar](#)

Parameter	Before lockdown	During lockdown	Overall quality trend
Dissolved oxygen (DO)	>7 mg/l at almost all locations.	DO decreased during phase 1 due to increased suspended solids & turbidity from rain. During phase2, DO increased from 3% to 20%. During phase 3, DO was > 5mg/l at all locations.	DO increased during 2 <sup>nd</sup> & 3 <sup>rd</sup> week due to reduced wastewater discharges from industries.
Biochemical oxygen demand (BOD)	Varied between 1.37 – 5.58 mg/l	BOD increased in Kanpur during phase1. BOD at most of the locations was <3mg/l during phase2 while in west Bengal ranged between 3-5mg/l.	BOD decreased at all the locations during 7 <sup>th</sup> week.
Chemical oxygen demand (COD)	Varied between 6.14-17.7mg/l	Highest in Kannauj & Fatehpur during first 2 weeks due the requirement of longer time to reduce. Found to be 9mg/l or less at all locations.	COD values ranged between 0.9- 9mg/l after 6 <sup>th</sup> week.
Nitrate (NO <sup>3-</sup> )	Highest in Madhya Ganga barrage	A little change was seen in 2 <sup>nd</sup> week but most locations observed <2.4mg/l during 3 <sup>rd</sup> week.	Average concentration observed between 0.69-2.0mg/l.
Ammonical nitrogen	Highest in U.P. Kanpur, West Bengal	Ammonical nitrogen increased during phase 1& 2 with highest recorded values in U.P & West Bengal. This value decreased to <1.2mg/l during phase 3.	Values ranging between 0.15- 2.0mg/l were recorded during phase 1 & 2 that changed to <1.2mg/l in phase 3.

## 5.CONCLUSION

A significant improvement has been observed in the water quality during the lockdown as all the major polluting industries were closed during that period. And due to this decreased pollution load from various industries and urban areas, the water quality of rivers started to improve within few weeks. However, the organic load entering the water resources from municipal sewerage remained almost the same due to its continued discharge. Also, an excessive rainfall was recorded during the lockdown period, further contributing to the dilution of various pollutants.

This improvement in the water quality of rivers in India during lockdown period can be taken as an evidence of the anthropogenic impact on the natural ecosystem. A number of highly funded and elaborate projects were initiated by the government but no apparent improvement was seen in the river water quality as no proper action was taken on the largely polluting industries. So, some necessary measures needs to be taken to retain the water quality observed during the lockdown and to prevent its future worsening.

## 6.FIGURES AND TABLES

1. Figure 1: Course of Ganga river and its tributaries
2. Table 1: Observed water quality of Ganga river during based on real time water quality data.

## 7.ACKNOWLEDGMENT

I am grateful to my teachers Dr. Renuka Gupta (Chairperson, Department of Environmental Sciences, J.C. Bose university of science & technology, YMCA, Faridabad) & Prof. M.L. Aggarwal (Dean, FET & Chairman, Civil Engineering, J.C. Bose university of science & technology, YMCA, Faridabad), who encouraged me and provided this opportunity to study and analyse the status of water quality of Indian river Ganga and its tributary Yamuna in Delhi during the 8 weeks nationwide lockdown period.

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# EVALUATION OF QUALITY OF SUTLEJ RIVER SURFACE WATER NEAR TATTAPANI, HIMACHAL PRADESH: A REVIEW

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**Abstract:** Water is universal and natural solvent required by every living species. We have different sources of water like river water, ground water and surface water which comes through the melting of glaciers and ice caps. But due to rapid advancement in natural surroundings, quality of water is getting depleting day by day. Quality of Sutlej river water is one of them. Due to the lack of awareness, pollution load is increasing in Sutlej river which cause problems to human as well as for aquatic species. This paper helps to determine the quality of surface water of Sutlej river, by which we can calculate physico chemical parameters, and can know the amount of pollution load and treatment required for it.

**Keywords:** Surface Water Pollution, Sutlej river, Pollution load, Water quality, physico chemical parameters.

## INTRODUCTION

Like other nutrients required for growth of life, water is also important part of living life. It's used by humans in everyday life. Himachal Pradesh is blessed with healthy environment and natural resources.

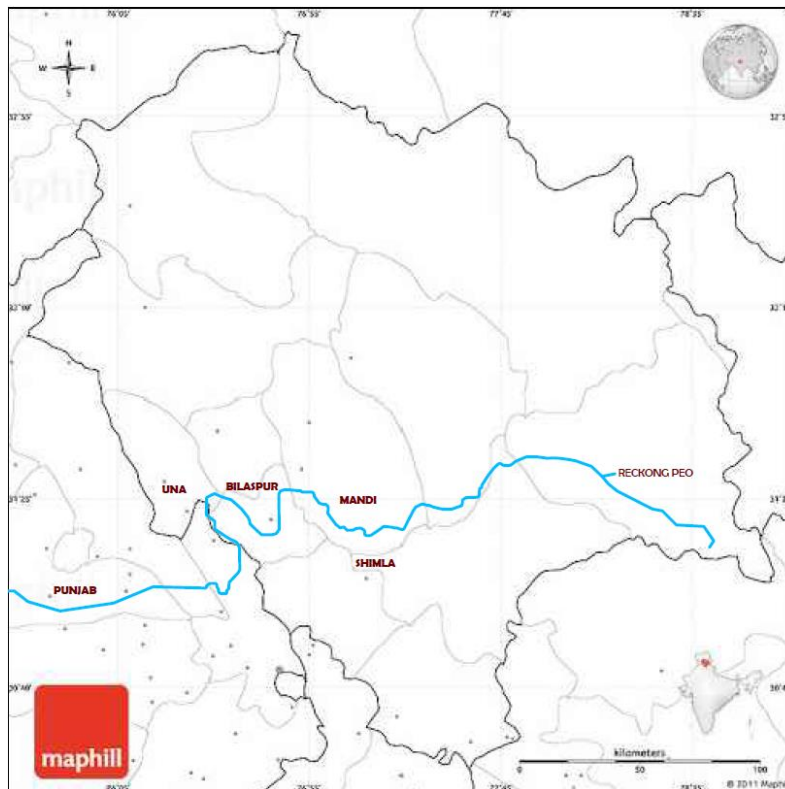
Sutlej river is the longest river (1450 km) run through the western slopes of Kailash range in Tibet. Many hydroelectric and irrigation projects are constructed over the Sutlej river. In Himachal Pradesh around 20,000 MW of hydroelectricity is generated, of which 50% is from Sutlej river.

**Table 1: Hydroelectric Power and Irrigation Projects**

PROJECTS NAME	ELECTRICITY GENERATED CAPACITY (MW)
Kol Dam	800
Bhakra Nangal Dam	1325
Karcham-wangtoo hydro project	1000
Baspa hydroelectric power project	300
NathpaJhakri Project	1500



**Figure 1: Sutlej River (Tattapani, HP)**



**Figure2: MAP OF SUTLEJ RIVER IN HIMACHAL PRADESH**

## LITERATURE REVIEW

Due to improper management presence of nickel, manganese and lead increased in river water. Which exceed the permissible limit of water (Datta et al., 2017). Increment in pollution load cause water pollution and other physical changes in water (Sharma et al., 2011). Physiographic and climatic change also cause changes in river water like flow and drinking quality of water (Singh et al., 2014).

Various schemes have been implemented by UN (water for sustainable development (March 2018-2028) and water for life (2005-2015) for the conservation of water by which we can gain access to drinking water. Government of Himachal Pradesh is also promoting sustainable and green economic growth by implementing hydroelectric projects (Harnessing Hydropower, 2014). River is having a capacity of self – cleansing and can reduce the amount of pollution load (Chauhan et al., 2013). Surface water is most exposable for this quality of water is determined at different stretches by physico-chemical method (Soni et al., 2017). Life of local people majorly depend on irrigation, HEP also play important role in economic growth but it occupies large amount of space for dam construction, which somehow affect tribal culture (Lata et al., 2017).

## MATERIALS AND METHODS

The life of aquatic ecosystem directly depends on quality of water, which may have biological, physico chemical, toxic, and pathogenic effects. Due to rapid industrialization, living standard and socialization, quality of water is getting depleting. Sometime pollution from household, offices and industries directly dump into the river water, which affect the quality as well life of aquatic species.

So, In order to calculate the quality of Sutlej river surface water, we have chosen the area of Tattapani. It is a tourist place and famous for hot Sulphur bath springs.

The major objective of this paper is to study the present status of quality of river Sutlej surface water, suitability of drinking water and data interpretation using XRD and XRF method.

Water sample from Sutlej river were collected in season basis at three different stretches (S<sub>1</sub>. near tattapani bridge, S<sub>2</sub>. near hanuman temple, S<sub>3</sub>. saror). Present status of quality of river water is checked by physico- chemical methods and co related with Indian standards. Sample is taken from same place all the time. All samples were collected in 1L plastic bottle.

## STUDY AREA

Sutlej river flows through the western Tibet Kailash range to Himachal Pradesh, Punjab and Pakistan. It's length in Himachal is 1450 km long. For testing water quality Tattapani area is selected and sample is collected from different stretches.

S<sub>1</sub> Near tattapani bridge

S<sub>2</sub> Near hanuman temple

S<sub>3</sub> Saror

S – Stations

Physico-chemical parameters of water is analysed with respect to Indian Standards. Water temperature test is done by Celsius thermometer, pH methods is done by pH paper method, transparency of river water is checked by secchi disc method, dissolved oxygen, three day BOD test is done and total hardness is checked by erichrome black T method, chloride, nitrate also measured. Suitability of safe drinking water is co related with Indian standards.

## CONCLUSION

Measuring the quality of water is important on seasonal or monthly basis because water is essential to all living things. Due to increment in pollution load by human activities, quality of river water is getting depleted. So, to check the status of quality of Sutlej river water various physico- chemical method is performed. By this we can know the amount of pollutants in river water and what type of curing method it requires. It also helps the Government of Himachal Pradesh to implement water preventing and pollution free programmes.

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# MONITORING OF WATER QUALITY OF INDIAN RIVERS: A REVIEW.

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**Abstract:** The rapid industrialization and the miscellaneous use of chemical fertilisers and pesticides in agriculture is causing significant and complex aquatic pollution, resulting in deterioration of the water quality and loss of aquatic biota. The human race suffers from diseases caused by water because of the use of dirty water. The state of the water must therefore be tested periodically. Parameters for tested include temperature, pH, turbidity, salinity, nitrate and phosphate. This study was primarily aimed at underlining water quality deterioration in India.

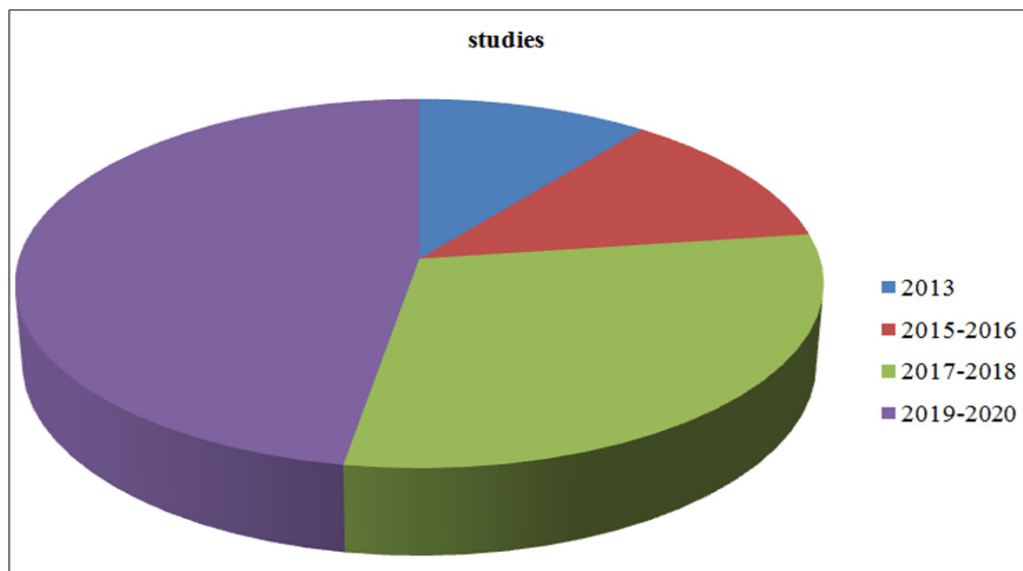
**Index Words:** purification; extraction; water quality; contaminants; sewage; waste.

## INTRODUCTION:

The key reasons responsible for rising pollution are raising urbanization, industrialization and over-population. To collect these contaminants, water sources are at the primary receiving end. Industrial waste, residential waste, soil runoff etc are collected from them (Sangeeta Dhote et al., 2009). Various traditional techniques for water purification and the elimination of these toxins are in practice. In fact, most of the traditional approaches are expensive and not eco-friendly. Several researchers have carried out various studies to improve the water quality in order to solve this problem by natural means (Conwell et al., 1977), (Boyd, 1970a), Pioneers who demonstrated the capacity to minimize nitrogen in aquatic plants include (Scheffield, 1967), (Stewart, 1970), (Wooten et al., 1976) and (Yount, 1964). In experimental proof shown by (Seidal 1976) (Wolverton et al, 1975) and (Wolverton et al., 1976), aquatic flora was important in the extraction of organic pollutants from aquatic ecosystems). Therefore, extraction methods need to be supplemented by another form of purification, which is both economical and eco-friendly. (Tam et al. 1994) and (Eger, 1994) for both natural and artificial wetlands have suggested an alternative purification process. These techniques are respected by conventional techniques because they are environmentally-friendly, require less energy and thus cost-effective.

In view of population growth and economic development India faces a serious problem of the shortage of natural resources particularly water. Many fresh water supplies in the world are polluted and so water potability is limited. All life relies on water which occurs in many ways in nature, such as oceans, rivers, lakes, clouds, rain, snow, fog, etc. A lake is a large body of water, with various waterforms surrounded by land. Pure water, known for all practical purposes, contains low dissolved or suspended solids and odious gas. This water quality can only be necessary for drinking, while water quality can be considered very flexible for other uses such as agriculture and fabrication, and water can be generally called pure. The wellbeing and ecological richness of the lakes have a strong relation with the health of almost all ecosystem members. Sea environments, such as the hydrological cycle, are also subject to many unprecedented natural cycles of construction; people shock a large number of lakes and kill them. Rain water runoff and the drainage of waste into lakes are just some of the common causes of the depletion of various nutrients in marine environments. For all water quality issues affecting lakes worldwide, eutrophication is a big concern. Eutrophication is a term used to describe the ageing of a lake which results from deposition of nutrients, sediments, silt and organic matter from the water of the surrounding lake. As sources and sinks of nutrients vegetation and sediment play a role. It describes the biological response to nutrient fortification in aquatic environments, which eventually contributes to irritation levels in primary production. The key explanation is an unnecessary addition of phosphor and nitrogen, which contributes to high algal biomass, cyanobacterial predominance and macrophyte degradation (S.P.Gorde, M.V.Jadav, 2013).





**Figure 1: Pie chart showing the number of studies in India in last 8 years.**

## LITERATURE REVIEW:

Many research papers from India were consulted for the purpose of this review paper from the Google scholar and the review made is as follows:

The quality of water was determined by (R. W. Gaikwad, V.V. Sasane[13]) by collection of groundwater samples and a complete physiochemical analysis of the samples. For water quality control, including overall hardness, pH, bicarbonate, chloride, nitrogen, and sulphate, the total dissolved solids of PH, iron, manganese, and fluoride are considered. Absolute hardness, chlorides, fluorides, calcium and magnesium are considered to be the most essential values, and

several publications have shown that nitrate toxicity has severely impacted the consistency of the soil water at Lonar Taluka. The study indicates that the area's groundwater requires some care before use, and must therefore be covered from pollution threats. Various local water treatment methods are available (S. Hussaina et al.,[14]) and chemical properties of Physico including pH, conductivity, turbidity, TDS, DO, fluoride, chloride, sodium, sulphate, etc have been checked. Samples have been collected from the Ahmedpur, Dist Latur treatment facility. After treatment of water, the values appear to shift. Different physical, chemical, ionic, and biological studies were performed (V. B. Y. Sheik, et al., [15]) (Maharashtra State, India). Water is aimed at assessing the nutritional status of water for both the consistency of drinking water and the purpose of irrigation. The seasonal fluctuations of chosen water parameters also were detected and the dam sources of contaminants are established. The physical and chemical parameters were tested in conjunction with the APHA results and the results obtained during the entire one-year study demonstrated a reduced difference in the analysis of physicochemicals, heavy metals and ionics, which indicate that water is very standard and within the permissible limit defined by the ISL. The results were obtained. (Dr.M. K. Mahesh and coll.,[16]) reported that for research into its effects on the aquatic, livestock and whether they're enough to be able to drink, and whether it's adequate, the water quality index (WQI) developed by the Canadian Council of Environment Ministers (CCME) was applied at Hebbal Lake of Mysore, Karnataka State, India. The lake index is poor, marginal in terms of marine life and excellent for irrigation with regard to drinking, tourism and livestock. The water is rated as low in complete quality. Water continuity is almost frequently challenged or impaired and conditions often vary from usual levels. Anabaena and Microcystis aeruginosa are produced by blooms, phacus pleuronectes are also reported and lake water is not suitable for aquatic living conditions.

The incidence of fish murder in the city of Kalwa and Jail Lake in 2011 was due to water contamination (M.M, et al. [17]); hence, study has been undertaken to detect water quality for 6 months, in accordance with various physical-chemical parameters, for the determination of the lake's pollution. The Jail lake is known to be more organic and the Kalwa lake has more eutrophic character. A strong association among water quality parameters was found among chlorophyll and temperature, suspended substances, pH, solved oxygen (not chlorophyll c), CO<sub>2</sub> (only with



chlorophyll C). Chlorophyll and light exposure have been shown to have a negative link. There was a negative association between chlorophyll a and b and CO<sub>2</sub> silicates and phosphates. The issue of waste disposal and surface water contamination in the lake is rising at a high rate as a result of urbanisation, modernisation and increasing population growth. Weeds overcome the water of the lake that is the result of increased Nitrate and Phosphorus levels which result in the siltation of the lake. In the water, which is the source of danger to the ecosystem of the lake, the lower concentration of dissolving oxygen often causes chronic toxicity of heavy metals such as Pb, Cr, Fe, Hg, etc. in aquatic animals (Dar et.al.,2017). Pollution from plastic waste in water bodies is a growing environmental issue (Bhateria et.al.,2016). Agricultural waste and urban wastewater are the primary source of deterioration (Mukhtar et.al.,2014). When assessing the Lake Water Quality Index, the results showed that the water is unfit for consumption (Kanakiya et al.,2014).

The main focus of this study was water quality of many Indian lakes.

## CONCLUSION:

Urbanization and industrialization is the main cause of water quality degradation in India. Careless attitude of people towards our water bodies have turned them into the dumping sites, because all the wastes from households, factories and industries end up flowing in our water bodies. The Government of India should coordinate many approaches and initiatives to protect our dying bodies of water.

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# WATER RESOURCES AND ADVANCES IN CONSERVATION TECHNIQUES

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**Abstract-** Water is one of the most important natural resources that meet all the major requirements of all living beings. Water is among the category of renewable resources but its increasing demand and overexploitation due to the increasing population has caused the deterioration of this important natural resource. Water is also an essential for crop plants, as both its excess and shortage can affect the quality, growth, development and yields of crop plants. India receives a good amount of annual precipitation (i.e., about 1190 mm). But it has become scarce due to its increased demand. A decreasing trend in the ground water table is also observed in various parts of the country. Hence, the linking of social and economic development with conservation and management of natural resources can be an effective tool in this direction. This paper highlights the advances in conservation and management of water resources.

**Keywords-** water, conservation, technology, crop plant, rain water harvesting, drip irrigation.

## 1. INTRODUCTION

Does water really needs an introduction? Each and every individual is aware of the importance of water. Everyone knows that how important is water for their basic living needs. Despite of being more aware of everything, this so essential and precious resource is being wasted and polluted every second like anything. Of the world's total water, less than 1% is available for domestic and industrial usage. Many parts of India and around the whole world are already facing severe water scarcity. There are a number of reasons behind this scarcity. A few of them are- reduced precipitation, man-made climate change, decline in ground water table level, population explosion and industrialization, etc.

Ground water resources are classified mainly into static resources and dynamic resources. Dynamic resources are present in zone of water table fluctuations while the static resources are present below the dynamic resource. According to National Water Policy 2002, dynamic ground water resources are exploitable and are also termed as replenishable resources. Water resources are also being affected by the climate changes. The snow line and glacier boundaries are found to be very sensitive to the climate changes. Apart from them, water pollution, improper sanitation, unavailability of drinking water and improper management of waste water have crucial consequences on the economic growth and human health of a country. Each one of these needs a good management and immediate action.

**WATER CONSERVATION-** Water conservation may be defined as-

- Implementation of conservation measures that can reduce water usage, or
- Any reduction in the amount of water usage, water loss or water wastage, or
- Any tool that results in reduced water demand due to more efficient use of water.

Objectives of water conservation:

- To ensure the withdrawal of fresh water in a sustainable manner and its availability to the upcoming generations also.
- To conserve the energy consumed during processes like water pumping, delivery and waste water treatment facilities.
- To conserve the habitats by reducing the man-water usage.

## 2. CONSERVATION TECHNOLOGIES

Conservation may also be called as the preservation of water and preventing its loss or wastage. The main objective of water conservation is to balance the demand and supply amounts. Conservation techniques can vary based on the field and pattern of water usage.

## 2.1 RAIN WATER HARVESTING

Rain water harvesting is the technique of collecting the rainwater falling on building rooftops and storing it underground so that it can be used whenever required. This technique not only stops the ground water table from declining but also helps to raise the declining water table level.

There are many advantages of rain water harvesting . Some of them are:

- a. Makes the water supply more efficient.
- b. Lowers the cost used for ground water pumping.
- c. Provides good and high quality of water.
- d. Helps to reduce the incidences of soil erosion urban flooding.
- e. One of the least expensive and easy to construct technique.

## 2.2. ADVANCED IRRIGATION PRACTICES

Since water is an essential requirement for crop plants , the increased usage of chemical fertilizers, pesticides and the declining water table level have made serious impact on agriculture. The increasing use of chemical fertilizers and pesticides has resulted in the problem of soil salinity. Soil salinity tends to further deteriorate the soil quality.

A good water efficiency involves reducing the losses due to evaporation and runoff. The amount of water required for irrigation can also be estimated with the help of a device called evaporation pan. Overhead irrigation gives an equal and regulated pattern of water distribution while the drip irrigation gives the best results in providing water to the plant roots with least wastage.

## 2.3. MULCHING

Mulching involves the application of mulch onto the crop field. Mulch is a layer of organic or inorganic materials such as compost that helps in slowing down the surface runoff rates and it also improves the soil fertility and soil moisture content.

## 2.4. FOG & DEW

The water contained in **fog and dew** can also be useful to some of the adapted species of crop plants. This water can be directly trapped with the help of polythene sheets or with some netting surfaced traps.

## 2.5. CONTOUR CROPPING

It has been used and is being used along the hilly regions as a measure to conserve water and soil both.

## 2.6. TIPPY TAPS

These type of taps are found to be very efficient in dispersing a very limited amount of water. One can have a very good hand wash experience with just 60-80 ml of water using a tippy tap.

## 2.7. ECO LAWNS OR DRY GARDENS

The purpose of eco lawns/ dry gardens is to encourage the propagation of drought resistant plant varieties or the plants that require least amount of water to grow.

## 2.8. CONSTRUCTION OF SOAK PIT

Soak pit near a water point ( for e.g. near a hand pump) can help to prevent problems like water runoff and water logging.

## 2.9. DESALINATION

Desalination can be used along the coastal regions to overcome the problem of fresh water depletion.

## 2.10. WATER TRANSFER

Transferring water from a surplus basin to a long distance and interlinking a number of water resource systems is an another beneficial technique.

## 2.11.PLANTATION OF TREES

Plantation along the catchment areas , riverbanks and the river clean up drives are some another initiatives taken to conserve water.

## 3.MEASURES TO CONSERVE WATER IN INDUSTRIES

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Some effective measures that can help in water conservation in an industrial plant can be-

- One should always look at the alternatives for excessive water consuming techniques and procedures.
- Water sound practices should be adopted along spill and leak reductions.
- Consumed water should be recycled as much as possible.

#### **4.WAYS OF IMPROVING THE WATER MANAGEMENT**

- The close relationship existing between the water and crop plants or forests is a matter that need to be recognized.
- Impact of trade in water intensive goods from water rich areas should be incorporated at national level policies.
- More emphasis should be given to rain water harvesting .
- Water pricing should be included in national policies while ensuring the access to socially disadvantaged and poor.
- The effect of subsidies on water use should be monitored and analysed in a regulated manner.
- Authentic water management techniques should be revived, as they were both accountable and sustainable.
- Two most important principles of reuse and recycling must be included into water management strategies.
- Awareness about the importance of coastal and marine environment should also be linked with social and economic development of the country.

#### **5. CONCLUSION**

Water is indeed an essential for the sustenance of life. Issues like water management and water wastage will not go away on their own. Some really good and strict actions are need to be taken on global level. This should be the responsibility of each individual, each family, each industry and each institution to use this precious source wisely. We still have some time to conserve such important life giving source and also to let our future generations to enjoy this priceless happiness of feeling and touch of water.

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# INDIAN STATUS IN ASSESSING THE CEMENT DUST POLLUTION ON TOP SOIL WITH SPECIAL REFERENCE TO KHREW AREA OF KASHMIR: A REVIEW

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**Abstract:** Cement dust is known to be one of the key contaminants released from cement manufacturing plants. During different phases of cement processing, the particulates and dust emitted are likely to have an adverse effect on the soil. The key components of the substance are calcium silicates, aluminates, and aluminoferrites depending on the desired concrete properties, other constituents are then added. Soil alkalization and chemical composition alterations are direct results of the contamination of cement dust. The accumulation of dust from cement factories on the surface soil, strong and crystalline material shapes that eventually forms a hard thin layer crust on the surface of soil. The ultimately affects the properties of the soil. In the present study, the source data for centralizing and updating a revised soil impact of cement dust have been obtained from various papers published between 1976 and 2019. The present review is to undermine the impact of cement dust on soil using various physico-chemical parameters in India with special reference to Khrew area of Kashmir.

**Keywords:** Cement dust, Cement dust pollution, Physico-chemical properties, Cement manufacturing plants.

## INTRODUCTION

After china, the Indian cement industry marks the second largest producer of cement in the world which has been consented to be a hub accounting for about 1.3% of GDP and providing employment to over 0.14 million people. Through excise and sales taxes, the Indian cement industry is a major contributor to the revenue which is collected by both the state and central governments. However, the cement industries are considered one of the world's biggest polluting industries for the cement, ranking 17 identified by the pollution control board (tripathi and gautam 2007). In surrounding areas the release of particulate matter is limestone, gypsum, limestone, red alluvium in the kiln and coal in the factory. During different phases of cement processing, particulates and dust released are likely to have adverse effects on various components of soil (Rafiq et al., 2016). Wind quickly transports and disperses the plant generated dust and then widely deposits it in the surrounding areas.

Due to its continuous distribution and fall on the land, longterm deposits of dust impart pollutants to soil, plants and water bodies. The location viability plays the key role in the economics of manufacturing cement. In selected states of India, the location of reserves of limestone has resulted in its development in the form of clusters. Being a low value commodity and a high bulk, competition of cement manufacturing is localized due to its transportation cost to far areas that often result in the uncompetitive product in those areas. In order to meet the demand of cement materials for the construction purposes, the existing cement factories have been expanded at an alarming rate since the last decades with an increase in the dust emission from cement plants. India has seven cement clusters in which Satna cluster located in Madhya Pradesh leads in capacity as well as production followed by Chanderia in South Rajasthan, Chandrapur in North Andhra Pradesh and Maharashtra, Nalgonda in Central Andhra Pradesh, Gulbarga in North Karnataka and East Andhra Pradesh, Bilaspur in Chhattisgarh, Yerraguntla in South Andhra Pradesh and Jawad and Neemuch in Madhya Pradesh). Jammu and Kashmir is an industrially backward union territory after Uttaranchal and Himachal Pradesh, has been given tax concessions as the special incentives from Government of India for attracting investments in the industrial sectors. The sole aim of government is to make Jammu and Kashmir an industrial hub by higher allocations in cement industrial sector. The union territory of Jammu and Kashmir has extensive and diverse types of mineral deposits in all its districts. The commercially exploited minerals of the union territory include bauxite, coal lignite, gypsum and limestone etc.



Khrew is a town in the Pulwama district of the Indian Union territory of Jammu and Kashmir and is a notified area committee. The present review has mainly focused the Khrew area which is polluted by cement dust by the cement dust and located at an altitude of 1607 meters above the sea level at a distance of approximately 23 km in Khrew zone. At latitude  $34^{\circ} 1' N$  and longitude  $75^{\circ} 1' E$  within the geographical coordinates. Khrew which is situated at the base of the mountain has twenty more neighbouring hamlets with the population of 18820. Six cement factories are currently operating in the area, which has contributed to a lot of pollution in the area, although they are a big source of jobs for locals. The first cement factory in the area was built by the Kashmir cement project. JK cement, TCI max, HK cements, Cemtac, ARCO, ICCO, funded by governments, cements are among six cement plants. In the nearby areas these cement factories have led to a large amount of cement dust (Singh O. et al., 2019).

In December, 1974, Jammu & Kashmir Cements Ltd. was incorporated as a wholly owned government corporation. Installation work for a capacity of 600 tonnes per day dry processing plant.

Rotary Horizontal Kiln, began nearly 23 Kms at Khrew in Pulwama- Kashmir district.

(Dar S. et al., 2015). In 1975 and was completed in October, 1981, away from Srinagar. Sandstone ( $SiO_2$ ), Limestone ( $CaCO_3$ ), bauxite ( $N_2O_3$ ), clay and gypsum are the major raw material for cement industry here. The dust falls on the surrounding fields degrading the quality of the soil.

**Table 1. Summary of production capacity tons per day (tpd) by Cement manufacturing plants in Kashmir.**

Cement manufacturing plants in Kashmir	Production capacity tons per day (tpd)
Jammu Kashmir (JK) cements Limited, Srinagar.	700 tones per day.
Trumboo Cement Max (TCI) Industries Private Limited.	1000 tons per day.
Hassan Khati (HK) cements Private Limited.	800 tons per day.
Cemtac cements Private Limited.	600 tons per day.
Abdul rehman and co. (ARCO) cements Private Limited.	500 tons per day.
ICC cements Private Limited.	600 tons per day.

## REVIEW OF LITERATURE

The cement industry has been known to play the significant role in the environmental imbalances.

Sheikh *et al.* (1976) studied various soil characteristics in the contaminated and non polluted regions of the factory locations and reported that the dust reported that the cement had formed the crust 1 cm thick on the soil surface I the contaminated region

Adak P *et al.* (2001) has investigated different parameters of five contaminated surface and sub-surface soils which resulted in the drastic increase in percentage of  $Al_2O_3$ , CaO and MgO and decrease in pH of surface soils as well as conductivity with disparity in exchangeable  $Ca_2^+$ ,  $Mg_2^+$  and  $Al_3^+$  with an increase in CEC of the surface soils.

Shanthi *et al.* (2004) in their study has found are duction in nitrogen fractions like nitrite and nitrate and total nitrogen content with significant increase in ammonia content of soil in the polluted soil.

Ghadebo and Bankole (2007) found the concentration level of the toxic elements ranged between 40 and 280,000 $\mu$ g g-1 in the cement dust soil samples indicating the elevation in the concentrations of all the elements.

Rajasubramanian *et al.* (2011) found the concentration of Iron, calcium, magnesium, phosphorus, potassium prominently higher in the polluted soil.

Amal *et al.* (2011) shows Increase in pH, calcium carbonate, sulphate electrical conductivity, salinity, total alkalinity and content of the soil solution were observed due to cement dust accumulation.

Al-Oud *et al.* (2011) reported the increase in the concentration of metals Cd, Cr and Zn on the surface of the soil relative to sub-soil samples.

Al-Omran *et al.* (2011) found that the soil samples collected at two depths (0-5 and 20-30 cm), in the vicinity of cement plant showed heavy metal concentration which indicated the soil samples to be calcareous in nature.

Dar S. *et al.* (2015) found the decrease in a pH,  $CaCO_3$ , and dust emission with the increase in distance from the cement factory in kms by estimating the impact of emission particles on the Edaphic factors of soil.

Singh O. *et al.* 2019 found compared to control sites, the soil pH was slightly alkaline near cement plants, low water capacity, soil moisture content. Soil organic carbon and nitrogen content.

## METHODS OF SOIL ANALYSIS

The effect of cement dust on soil is determined by various physico-chemical parameters such as pH, moisture content, loss of ignition, conductivity, heavy metal content, organic carbon, organic matter, exchangeable calcium and magnesium, chloride, exchangeable potassium, sodium, phosphorous, etc. 2 sites were selected as site 1 and site 2. Site 1 is 0.5 kms from the cement factory and site 2 1 km away from the cement factory. Out of these parameters, following parameters play a key role in evaluating the effect of the cement dust on soil. Henceforth, the present review has focused primarily on the parameters given in table 2.

**Table 2. Various parameters for analyzing soil quality with the defined methods**

Soil analysis Parameter	Proposed Method	Findings
Moisture content	Oven dry method by Michael (1984).	Moisture content Increases with the increase in the distance from the cement plant
pH	Electrometric method by Gliessman (2000)	pH was found to be slightly alkaline near the cement plant.
Conductivity	Conductivity method by Gliessman (2000)	Conductivity decreased as we move away from the cement plant. It was highest near the cement plant.

<b>Organic carbon</b>	Titration method by Walkley and Black (1934)	Concentration of organic carbon were found to gradually increase in percentage as distance from the factory increase
<b>Organic matter</b>	%age of estimated organic carbon x 1.724	Organic matter increases with the increase in distance from the cement plant.
<b>Calcium magnesium</b>	EDTA (Versanate) method given by schollenberger and simon (1945)	Values of calcium and magnesium were decreasing as we move away from cement factory.
<b>Nitrogen</b>	Kjeldahl method	Concentration of nitrogen was found to improve with increasing distance from the cement plant
<b>Phosphorus</b>	Spectrophotometer	Concentration of phosphorus was increasing as moving away from the cement plant.
<b>Potassium</b>	Flame	Concentration of potassium Decreases with the increase in distance from cement factory.

## CONCLUSION

The current review has mainly focused on the effect of cement dust on soil in India with special reference to Khrew area of Kashmir. The review concludes the effect of the various cement factories growing in the Khrew area poses alarming threats to the environment and is responsible for the considerable amount of dust in the soil affecting the quality of soil and enables the government to take the required mitigation steps necessary to reduce pollution in the region.

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# A STUDY OF DIATOMS IN RESPONSE TO WATER QUALITY IN WETLAND OF YAMUNA BIODIVERSITY PARK (PHASE- II), NEW DELHI, INDIA

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**Abstract-** Water quality assessment mainly depends on the physical and chemical characteristics of the water, however aquatic organisms especially macro invertebrates are also largely used as indicators of water quality. Diatoms perform a variety of ecological function which is critical in evaluating the water bodies as efficient, productive and ideal environment for the aquatic species. The current study was to examine the responses of diatoms communities to water quality in the water body of Phase II of Yamuna Biodiversity Park. Overall water quality of the lake is good; however, the raw water cannot be used as drinking water.

**Key words:** diatoms, species richness, water quality

## Introduction

Water quality refers to the measure of physical, chemical and biological characteristics of water. The monitoring of water quality is an important task which helps in evaluating the water quality parameters. Drinking water quality is primarily assessed with the help of chemical and physical properties. Biological assessment of water quality is entering as a newer addition to the set of tools used for monitoring water body as lake, river. It includes uses of biological indicator as fish, insects, plants, algae, diatoms, amphibian and other micro invertebrates which provide accurate information about the health of aquatic ecosystems ([www.epa.gov](http://www.epa.gov)). In recent years, biological communities like macro invertebrates and algae are being used to assess the overall health and stress on the ecosystem because richness and diversity of these communities respond to the water quality (Walley et al., 2001; Bhatt and Pandit, 2010).

The study of these factors as a way of evaluating the health of a body of water is called biological assessment ([www.epa.gov](http://www.epa.gov)). Diatoms belonging to the class bacillariophyceae are one of the important biological communities of aquatic ecosystems. They consist of two valves which fit one inside the other to make up cell frustules (Saini and Kushwaha, 2016). They have bilateral symmetry. Generally diatoms are found in every aquatic environment including both fresh and marine water, springs and dump soils. Diatoms are divided into orders based on the frustule structures and symmetry. Diatoms play an important role in socio-economic, forensic, biostratigraphy and paleolimnology and ecological sciences (Mann, 1917., Platt, 1988).

Diatoms are an important source of food and energy to aquatic animals and it produces the basis of the food chain in the aquatic ecosystems (Peterson and Howarth, 1987). In addition, diatoms are known as significant indicators of water quality (Kelly and Whitton, 1995; Kelly, 2002). Each diatoms species has different requirements for the temperature, pH, Salinity, turbidity, nutrient availability, sediment concentration, flow regime, elevation and different types of human disturbance in which it will grow and sustain whole life period. Generally, different species compositions of diatoms are found under different conditions in aquatic ecosystems. Diatoms has universal occurrence in both lotic and lentic water ecosystems (Round, 1930). In general, we can say diatom species are very particular about the water chemistry in which they live. Their small size and ability to multiply rapidly enables them to respond quickly to changing environmental conditions.

Patrick (1973) concluded in his study that the impact of a pollutant can be observed by change in species abundance and composition of the community. His species cultural experiment in laboratory also gave a valuable understanding

of physiological and structural change in the species due to change in concentration of chemical and physical characteristics of water. Round (1991) emphasize in his study that diatom communities have been used in monitoring of water quality. Gomez (1997) used epipelagic diatom abundance and its relative composition to evaluate the water quality in Matanza-Riachuelo river basin in Argentina. He found a better correlation between diatom composition and organic pollutant in great area of the basin as the mostly abundant diatoms species were the pollution tolerant species. Anderson et al. (1992) gave detail idea about the diatom responses to lack acidification (pH). They did study on lack Gaffeln in the Gardsjon catchment area in south-west Sweden. They found a rapid decrease in diatom abundance after 1900 with decreasing pH or acidification of lake and correlated increase in low pH tolerant species like *Eunotia sp.* and *Tabellaria binalis*.

Ramakrishnan (2003) used bio-monitoring approaches for water quality assessment in two water bodies at Tiruvannamalai, Tamil Nadu, India. Thakur et al. (2013) revealed that the distribution of planktonic species depended upon the physiochemical parameters of the environment. Rao and Mohanchand (1988) were also showed a strong correlation between phytoplankton and water quality.

Bhatt et al. (2008) emphasized his study on the occurrence of *Didymosphenia geminata* diatom in some Indian Himalayan rivers. This diatom has wide range of tolerance which allows is to inhibit both hot and cold water. Badoniet et al. (1997) in their studies on river Ganga concluded that stream regulation alters the nature of diatoms association and its community structure in general.

## Material and methods

### Study Area

Yamuna biodiversity Park in Delhi is one of the restored ecosystems thriving in the middle of urbanization. The present study was conducted in Yamuna Biodiversity Park, situated at 28° 44'N and 77° 12'E on the west-bank floodplains of the Yamuna River near Wazirabad village in Delhi is a joint collaborative programme of Delhi Development Authority (DDA) and centre for Environmental Management of Degraded Ecosystem (CEMDE), Delhi University. The park was originally a flood plain area and often experienced flooding in every monsoon seasons at about 3-4 decades ago. An area of 185 ha of degraded land with heavily silted marshes was taken up for the establishment of Yamuna Biodiversity Park with objectives to restore the wetland and riparian communities of the Yamuna River Basin using ecological restoration principles (Fig.2). A Biodiversity Park is, thus, defined as —a designated area with an assemblage or association of species in the form of biotic communities belonging to the particular ecological range which can perform the necessary ecosystem functions including conservation, environmental awareness, nature conservation, and education and recreation values. It also has a mosaic of wetlands that sustain the rich aquatic flora and fauna of Delhi. It provides ideal alternative habitats for migratory and residents birds species.

Presently, The Yamuna Biodiversity Park is spread over an area of approximately 457 acres on the flat alluvial plains of the Yamuna River. It was developed in two phases in two different area- phase I on inactive flood plains of river and phase II on active flood plains. Phase I spread over 157 acres.

My area of study mainly focused on water body of Phase II in Yamuna Biodiversity Park. Phase II is spread out over an area of 300 acres. It consists of a mosaic of landscape of wetlands, grasslands and flood plains forests. The wetland which is spread in 100 acres is currently under development phase. The source of water in this zone is flood water of Yamuna River. Once it will be completed it can store flood waters to the extent of 500 million gallon. It will be used to recharge aquifers and helps in minimizing impact of flood water on nearby floods area.

## Methodology

### Physical and Chemical Characteristics

The study was conducted during the month of January. A total of 4 sites in phase II wetland were selected for sampling (Table 1). To assess the water quality of water body a total number of 22 physical and chemical characteristics were selected (Table 2). In order to collect the samples standard methods were followed. For each parameter three replicates were obtained from different locations of a site and the average value for each parameter at each site was presented for the final result.

Water temperature was recorded with the help of graduated mercury thermometer. Average values of these readings were computed for final results at each site. For the turbidity of water, samples were collected in sampling bottles

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from different sites in the field and brought to the laboratory for analysis. The turbidity was recorded with the help of digital turbidity meter (TN 100; Eutech).

The pH was recorded with the help of pH Scan (pHtestr 30; Eutech) in the field. Dissolved oxygen was measured by iodometric titration method using Oxygengen test kit (Aquamerck). The total dissolved solids were measured with the help of TDS testr 11+ (Eutech) at each site. Similarly, Electrical conductivity was recorded with the help of EC testr 11+ (Eutech) at the sites. Total salt contents were measured by using Salt testr (Eutech). Total alkalinity, alkalinity as carbonates and bicarbonates, total hardness, Ca and Mg contents, and chloride were measured with the help of APHA (2005) and Adoni (1985).

Nitrate ( $\text{NO}_3 - \text{N}$ ), Sulphate and phosphate ( $\text{PO}_4 - \text{P}$ ) were measured by photometric method using UV/visible spectrophotometer (Ultrospec 3000).

Other ions like Na, and K and a few heavy metals (Iron, Cu, Cd, Zn) were detected by Atomic Absorption Spectrometry (AA 6300).

### 3.2 Biological Characteristics

Biotic communities namely phytoplankton (Diatoms), were sampled to assess the aquatic richness. Phytoplanktons were collected by filtering 100 to 150 liters of water at each site using a sieve of  $25\mu$  mesh size. The residue left in the sieve was collected in a 50 ml vial. Phytoplankton samples were preserved using Lugol's solution.

Further analysis was conducted in laboratory. The volume of phytoplankton was made up to 50 to 60 ml with distilled water and 0.1 ml of this diluted sample was transferred to glass slide. The total density of phytoplankton was calculated using 'Drop-count' method, described by Adoni (1983). The final densities were expressed in the individuals cells per liter. The density of diatoms species was calculated as:

$$\text{Density of diatoms} = A \times 1/L \times n/V$$

Where, A= average Number of organisms per drop

L = volume of original sample in liter.

n= total volume of concentrated sample in ml

v= volume of one drop in ml

Identification of diatoms was carried out using permanent slide mounts of samples from all the sites. For treatment of samples, the standard method was followed (APHA, 2005). The samples were centrifuged and treated with an equal volume of nitric acid. A few grains of potassium dichromate were also added to the sample to oxidize the organic matter. The samples were left overnight. Next day samples were thoroughly washed with distilled water to get the cleared samples. One drop of clear sample was placed on a clean micro slide that was smeared with Mayer's egg albumin and allowed to dry. These slides were then dehydrated for 2-3 minutes in 95% alcohol and followed by absolute alcohol and finally washed twice in xylol. The permanent slides were prepared by mounting the material in Canada Balsam. These slides were examined under a Nikon Optiphot 2 phase-contrast microscope in oil immersion ( $100 \cdot 10x$ ). These slides were examined using standard literature (Lange- Bertalot&Krammer 2000, 2001, 2002; Hustedt and Jenson, 1985; Sarod and Kamat, 1983).

The Relative abundance of each species of diatoms was calculated at each site as (number of cells of a species/ total no of cells counted)\*100. The diversity of diatoms was calculated using Shannon-Wiener diversity index (Shannon-Weiner, 1963) as:

$$H = (N_1 / N) \times \log N_1 \times N$$

Where,  $N_1$  = density of a species

N = total density

## Results and Discussion

The water quality analysis in the water body of Yamuna Biodiversity Park (Phase II) revealed that values of various parameters like total dissolved solids, Electrical conductivity, hardness, chloride contents and nutrients were found at higher side. It can be inferred that raw water is not suitable for drinking purpose but it can be conducive for high diatom growth as our study on density and diversity showed.

In the present study, Shannon index value found to be in range of 3-3.5 at all site except site S 3 which found to be 2.53. Typically, the Shannon index in real ecosystems ranges between 1.5 and 3.5 (MacDonald, 2003). As the Shannon index value increases, both the species richness and the evenness of the community increase (Magurran, 2004). Our results indicate a highly diverse and equally distributed diatoms community. In the present study, the density of diatoms was significantly correlated with the pH condition. All the sites have pH range in 8.2 to 8.5. Diatoms are usually found more in alkaline condition pH > 8. Relatively high diversity of *Nitzschia sp.* and *Navicula sp.* shows alkaline condition of water (Kamat, 1981). Ecologists have earlier attributed the presence of a few genera to the quality of water and revealed their value as indicators. For instance, the species like *Achnanthes sp.*, *Cymbella sp.*, *Fragillaria sp.*, *Gomphonema sp.*, *Gyrosigma sp.* (Plate 4b), *Pinnularia sp.* (Plate 4a) appeared to be found in clear waters which indicate that they are pollution sensitive (Pejaver, 2010). *Cyclotella stelligera* (Plate 2b) is characteristic of less polluted waters (Hustedt, 1957). It may be used as an indicator of the relative purity of this water body. In prior studies, Species like *Achnanthes*, *Synedra*, *Cymbella*, and *Navicula* were reported and characterized as indicator of clean water. (Venkateswarlu, 1981; Pareek et al. 2011).

The species like *Achnanthes sp.*, *Navicula sp.*, *Nitzschia sp.*, *Pinnularia sp.* and *Synedra sp.* are cosmopolitan in nature as they were found at all the sites. *Cymbella* as calcium loving organism found in water with high conductivity (Potapova and Charles, 2003). In the present study *Cymbella sp.* found at all the site. *Synedra sp.* is an indicator of eutrophic or enriched condition (Lowe, 1972). It was also distributed throughout the water body. *Gomphonema parvulaum* is also an indicator of typical eutrophic condition (Juttner, 1996). However, the relation of diatom taxa with certain water quality parameter as mentioned above would rely on their abundance. For example *Cyclotella stelligera* is indicator of less polluted water, in our study, however, it does not seem true because the abundance value of this taxon is only 1.46 at site 2 and is not common.

Based on the abundance of a few diatom taxa like *Achnanthes affinis*, *Achnanthes subsalsa*, *Cymbella laevis*, *Gomphonema augur*, *Gomphonema parvulum*, *Navicula radiosa var. minutissima*; accounting for more than 5% of total species, we can infer the indicative values. It can be concluded that they are tolerant of high hardness and nutrients enrichment (Kumar et al., 2008).

As the present study did in month of January (winter season) and based on the relative abundance of some common species like *cymbella*, *gomphonema*, *navicula*, *nitzschia* and *synedra* so it can be concluded that diatoms were found more in winter than summer and rainy seasons. This view can be supported by Singh et al (2010). Nautiyal et al. (1996) also concluded that winter months were more favorable for multiplication of diatoms. They could attain maximum development in winter months.

## Conclusion

This study was based on one season only. In order to find the major conclusion, a detailed multi-seasonal study is required. However, I was able to infer some conclusion. Overall water quality of the lake is good; however, the raw water cannot be used as drinking water. The lake water quality seems conducive for diatom flora as evidenced from high diversity and richness among diatoms community at all the sites.

**Table.1 Description of sampling sites in Phase II of Yamuna Biodiversity Park**

Site code	Location	Land use
S 1	28°44'01.41''N Latitude and 77°12'59.3'' E Longitude	Human intervention
S 2	28°44'04.46'' N Latitude and 77° 12'57.91E Longitude	Agricultural land area
S 3	28°44'02.67'' N Latitude and 77°13'01.13 E Longitude	Middle of the lake
S 4	28°44'03.59''N Latitude and 77° 13'03.49'' E Longitude	Relatively undisturbed

<b>Temperature (°C)</b>	<b>19.00</b>	<b>17.50</b>	<b>20.00</b>	<b>21.00</b>
<b>pH</b>	<b>8.20</b>	<b>8.50</b>	<b>8.40</b>	<b>8.47</b>
<b>TDS (mg/l)</b>	<b>288</b>	<b>271</b>	<b>267</b>	<b>257</b>
<b>Conductivity (µS/cm<sup>2</sup>)</b>	<b>413</b>	<b>407</b>	<b>405</b>	<b>393</b>
<b>Turbidity (NTU)</b>	<b>3.84</b>	<b>11.49</b>	<b>4.97</b>	<b>3.86</b>
<b>Salinity</b>	<b>0.20</b>	<b>0.20</b>	<b>0.20</b>	<b>0.20</b>
<b>Dissolved Oxygen (mg/l)</b>	<b>5.80</b>	<b>5.90</b>	<b>5.80</b>	<b>8.00</b>
<b>BOD (mg/l)</b>	<b>4.60</b>	<b>4.80</b>	<b>4.00</b>	<b>4.20</b>
<b>Total Alkalinity (mg/l)</b>	<b>45.00</b>	<b>47.00</b>	<b>28.00</b>	<b>26.00</b>
<b>Carbonate alkalinity (mg/l)</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Total Hardness (mg/l)</b>	<b>460.00</b>	<b>530.00</b>	<b>570.00</b>	<b>610.00</b>
<b>Ca Hardness (mg/l)</b>	<b>183.75</b>	<b>145.95</b>	<b>162.75</b>	<b>133.35</b>
<b>Mg Hardness (mg/l)</b>	<b>276.25</b>	<b>384.05</b>	<b>407.25</b>	<b>476.65</b>
<b>Chloride (mg/l)</b>	<b>209.99</b>	<b>199.99</b>	<b>244.99</b>	<b>249.99</b>

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<b>Phosphate (mg/l)</b>	<b>1.662</b>	<b>1.996</b>	<b>1.852</b>	<b>1.607</b>
<b>Sulphate (mg/l)</b>	<b>1.979</b>	<b>1.753</b>	<b>2.040</b>	<b>1.657</b>
<b>Iron (ppm)</b>	<b>0.34</b>	<b>0.32</b>	<b>0.38</b>	<b>0.05</b>
<b>Zinc (ppm)</b>	<b>0.10</b>	<b>0.04</b>	<b>0.083</b>	<b>0.08</b>
<b>Cadmium (ppm)</b>	<b>0.02</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Copper (ppm)</b>	<b>0.009</b>	<b>0.01</b>	<b>0.00</b>	<b>0.008</b>
<b>Sodium (ppm)</b>	<b>10.04</b>	<b>10.13</b>	<b>10.34</b>	<b>10.03</b>
<b>Potassium (ppm)</b>	<b>10.72</b>	<b>10.57</b>	<b>11.45</b>	<b>11.15</b>

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Table.2 Physical and chemical characteristics of water at different sampling sites

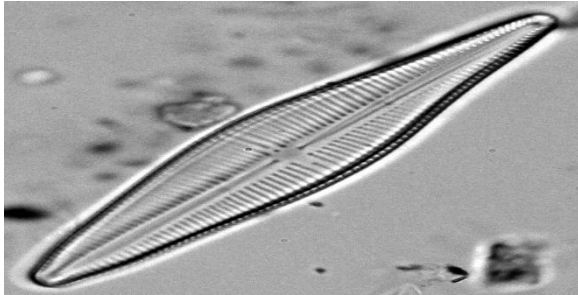


Plate 1a. *Gomphonema parvulum*

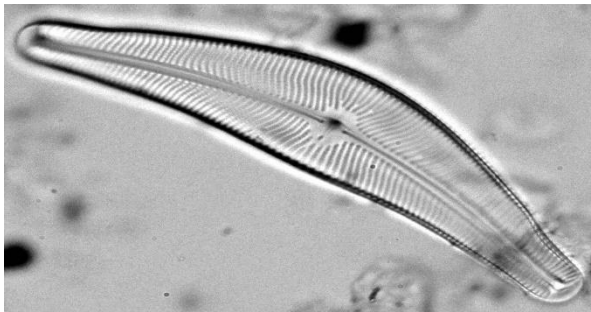


Plate 2a. *Cymbella laevis*

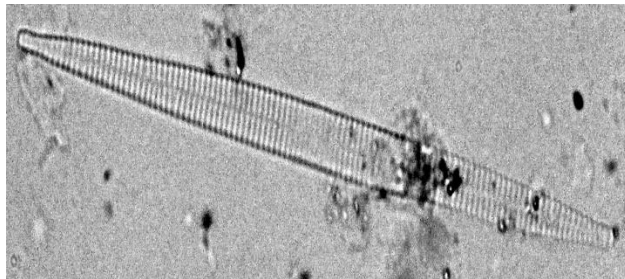


Plate 3a. *Synedra acus*

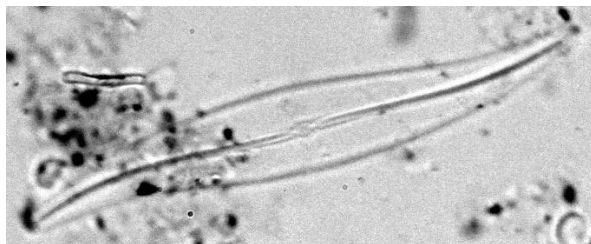


Plate 4b. *Gyrosigma baikalenis*

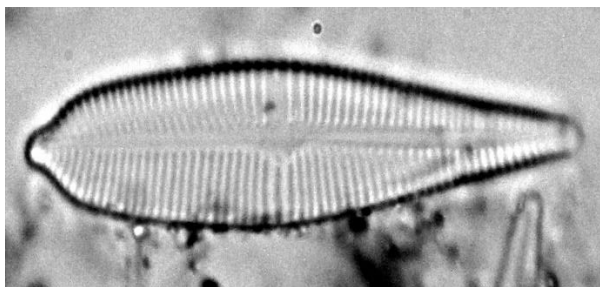


Plate 1b. *Gomphonema augur*

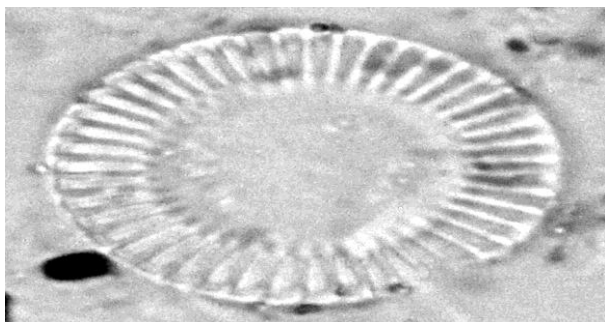


Plate 2b. *Cyclotella stelligera*

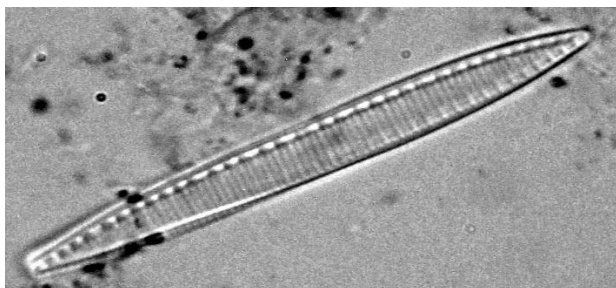


Plate 3b. *Nitzschia recta*

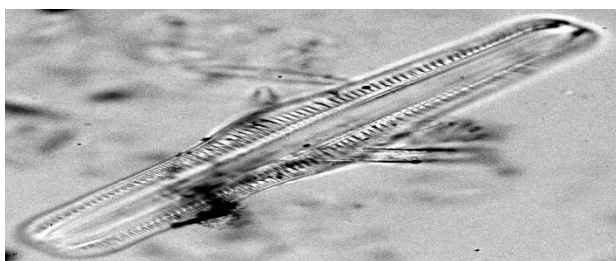


Plate 4a. *Pinnularia dolosa*

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# WATER QUALITY ASSESSMENT OF SOME MAJOR CITIES OF HARYANA: A REVIEW

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**Abstract** - As per the Central Ground Water Board report, the quality of water within major districts of Haryana is unfit for consumption. In districts like Faridabad, only 30% to 50% of water was found to be of potable quality. Many different parameters such as temperature, hardness, TDS, alkalinity, EC, alkalinity, pH have been assessed to check the quality of the water using conventional methods. The parameters have been observed to vary during different seasons and at various locations depending largely on the sources and the meteorological conditions of the region. For many districts, underground water is found to be inappropriate for consumption and for irrigating purposes due to the presence of high concentrations of pollutants. Yamuna river has been reported to be highly polluted at Faridabad along with Delhi, Gautam Buddha Nagar, Mathura and Agra. The data observed is compared to allowed permissible limits of the Bureau of Indian Standards and the World Health Organization. The water supplies are highly polluted and require urgent action. Monitoring of water at regular intervals is essential to maintain and perfect the quality of water. About 76% of all districts in the state of Haryana face problems related to either surface and groundwater quality or availability or both. The current review aims to summarize the previous investigations carried out by researchers regarding the assessment of the water quality of Haryana state and attempts to create acute awareness about water quality to minimize water pollution by simple housekeeping and management practices.

**Keywords** - Physico-chemical, Water quality, Heavy metals; WHO, Haryana, BIS.

## 1. INTRODUCTION

Water is an essential natural wealth that has a significant meaning in all life forms [1]. In previous decades, the requirement for portable water enhances due to the quick expansion in total population and industrial development [2]. Water pollution affects the whole ecosystem, impacting human beings, animals and aquatic life [3]. In India, about 70% of the whole population relies on underground water for consumption, and if it becomes contaminated, the intake of the same way leads to severe health-related problems [4]. Surface water bodies are impure due to the expansion of urban development and exploitation of natural wealth although the underground water is impacted due to the lack of control on some natural and human activities. The surface and subsurface water supplies are mostly highly polluted, therefore require urgent action. The river water is highly contaminated by major origins (like domestic and industrial wastes, surface drains carrying municipal sewage) and non-major origins (like agricultural run-off and soil erosion) [1]. Apart from the natural and anthropogenic sources of contamination, environmental factors like changes in temperature, climatic changes, storms also affect the water quality [5].

Around 50% of groundwater in India is reported to be polluted. The concentrations of fluoride, nitrate and arsenic have been recorded to be higher in as many as 276, 387 and 86 districts, respectively, as per the report given by the Central Ground Water Board (CGWB) [6]. As reported by Water Aid, about 37.7 million of the total population in Indian are affected by water carried diseases yearly [7]. Following the report of the World Health Organization (WHO), about 80% of diseases are caused by the consumption of poor water quality [8].

### 1.1 The State of Haryana

Haryana state spans over an area of 44, 212 km<sup>2</sup> in North India. In the East, it is bounded by U.P., and the state of Punjab meets its Western border, Uttranchal and Himachal Pradesh lie on its North and on its South, bounded by Delhi and Rajasthan [9]. Various studies have been conducted regarding the water quality assessment for various districts of the state. About 98% of the cultivated land is irrigated through tube-wells. Statistical data shows that about 50% of the total geographical place is badly influenced by the issues of salinity and flooding and there is unequal availability of groundwater among the districts of Haryana [10].

### 1.2 Water Quality Assessment in Haryana

Many industrial units in Haryana discharge their wastewater without treatment and are the main cause of the deterioration of Yamuna river water [11]. Yamuna river water is used for agricultural, industrial, domestic and transport purposes [11,12].

About 70% of water is utilized for irrigating purposes, 22% is used for industrial purposes and about 8% is used for different domestic activities [3]. The water quality has been studied at different stretches of river Yamuna in various seasons viz. summer, monsoon, post-monsoon, winter and spring to assess contamination level [1]. These parameters include pH, temperature, hardness, electrical conductance (EC), chemical oxygen demand (COD), suspended solids (SS), total solids (TS), chloride ( $\text{Cl}^-$ ), nitrates ( $\text{NO}_3^-$ ), dissolved oxygen (DO), turbidity, salinity, acidity, biochemical oxygen demand (BOD), alkalinity, and total coliform [25,12] which have been applied to check the quality of the water of the River Yamuna [1]. The heavy metals like As, Zn, Co, Cu, Pb, Ni, Cr, Hg, Cd, Mn, Fe have been analyzed in the river [5,12].

There has been an increased flux of heavy minerals within the river that is a matter of serious concern not only for the present but also for future generations [12]. The high concentration of these heavy metals affects human beings, animals and aquatic life which is very hazardous to health. These metals are not degradable and lead to undesirable effects on living organisms. The animals feed on contaminated vegetation or drink from polluted water bodies (mainly around industrial areas); enabling the non-biodegradable chemicals like heavy metals and pesticides to enter into the food chain [13]. The heavy metals get bioaccumulated and biomagnified with the food web which causes many health-related risks for living organisms affecting various physiological and hormonal activities and causing harmful diseases like lung cancer, kidney and lung failure, and impacting the immune system [12].

## 2. RESEARCH ELABORATIONS

Certain districts of Haryana like Faridabad are highly developed industrial areas. Faridabad has been ranked as the 9<sup>th</sup> leading industrial city in Asia. Faridabad industrial complex has major importance in the industrial map of India accommodating various small, medium and large-scale industrial sectors including metallurgy, electroplating, dyes, pharmaceuticals, ceramics, production of lubricants, electrical appliances and batteries [2]. These industries release their toxic industrial waste into nearby lakes, rivers and reservoirs [10]. The river Yamuna collects a large amount of municipal waste and industrial effluents and dirty water from such giant industrial plants at Faridabad [1]. The water quality of different districts of Haryana has been assessed in terms of various physico-chemical parameters including heavy metals to check the quality of the water for usage, recreation and other aims and to ascertain the relation between various water quality parameters and their respective health effects [4,9]. The current review attempts to summarize the previous investigations carried out by researchers regarding the evaluation of the quality of surface and underground water of Haryana state.

## 3. RESULT AND DISCUSSION

### 3.1 The State of Water Pollution

Groundwater quality is monitored in different places and also in different seasons by collecting water samples which are evaluated by using physico-chemical parameters to determine [8,16]. Groundwater quality in Haryana is highly affected by the presence of pollutants. Borewell water is polluted due to natural activities (including rocks weathering and improper discharge from wells and natural minerals with high salinity include, As,  $\text{F}^-$ ,  $\text{Cl}^-$ ,  $\text{NO}_3^-$ , Fe and Mn) and anthropogenic sources (including usage of large quantities of fertilizers and pesticides, untreated sewage treatment systems and mixing of untreated municipal and industrial wastes) and many other factors reach groundwater through groundwater recharge and deteriorate the groundwater quality [16-18]. The water samples have different elements in different concentrations which are compared to their respective permissible limits, hence it is difficult to study water quality based on independent assessment [18].

The quality of groundwater has been examined in different districts of Haryana. The water quality is assessed by using various physico-chemical parameters, such as EC,  $\text{F}^-$ , TDS, pH, Na,  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{CO}_3^{2-}$ ,  $\text{NO}_3^-$ ,  $\text{HCO}_3^-$ ,  $\text{CO}_3^{2-}$ , hardness, alkalinity, Na, K, Ca and Mg concentrations [9-20]. Among fourteen major districts of Haryana i.e. Faridabad, Gurgaon, Kaithal, Sonapat, Hissar, Mahendragarh, Jind, Panipat, Rohtak and Sirsa,  $\text{F}^-$  concentration was recorded to be greater than the permissible limits as per the Bureau of Indian Standards (BIS). The majority of the samples in Hisar city were found to contain  $\text{F}^-$  in higher concentrations resulting in dental and skeletal fluorosis among the residents. It was also revealed that water quality in the city was found unsatisfactory for drinking purposes without any treatment [9]. A yet another study conducted in the Faridabad area to ascertain the causes and the practices leading to groundwater contamination, based on hydro-geochemistry in integration with GIS, revealed contributions from multiple sources with highly alkaline pH, EC (384–11,108  $\mu\text{S}/\text{cm}$ ); TDS (192–5554 mg/l);  $\text{Cl}^-$  (6.3–2406.6 mg/l) with much of the NaCl compound indicating salinity in groundwater [21]. The groundwater was observed to be dominated with  $\text{Na}^+$ ,  $\text{Mg}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Cl}^-$ , and  $\text{HCO}_3^-$  indicating that the groundwater was not suitable for drinking purposes.

The quality of underground water in Samalkhan, Panipat, was analyzed by various physico-chemical parameters, Water Quality Index (WQI) and correlation metrics. In all water samples, all the parameters contents were beyond the permissible

limits of drinking water. The higher values of total solids (TS), hardness and alkalinity were due to mixing of waste with sewage and leaching [20]. In a similar study, the average total dissolved solids (TDS) content was greater ranging from 1,692 (Bhiwani block) to 2,560 mg/l (Siwani block), and other important parameters like total alkalinity (442–1,232 mg/l), TH (437–864 mg/l) and bicarbonate (554–672 mg/l), were also higher than maximum permissible limits. The  $F^-$  appeared as a major problem of safe drinking water in the region. The  $F^-$  concentration as high as 86.0 mg/l from Motipura village (the highest ever for Haryana state) were recorded. The average  $F^-$  concentration was found to be in the range of 7.1 and 0.8 mg/l in different blocks of western Haryana. Based on  $F^-$  concentration, the Siwani block showed the maximum number of water samples (84%) [19].

In the study conducted by Rout and Sharma [22], the physico-chemical parameters of groundwater from twenty-five tube wells at different locations in the Ambala Cantonment area was carried out. The groundwater was found to be safe for drinking purposes from the point of view of levels of pH, EC, TDS,  $Ca^{2+}$ ,  $Mg^{2+}$ ,  $Na^+$ ,  $K^+$ ,  $CO_3^{2-}$ ,  $HCO_3^-$ , alkalinity,  $Cl^-$ ,  $F^-$  and  $SO_4^{2-}$ .

Sahni and Yadav [23] conducted a study on seasonal variations in some important physico-chemical parameters of Bharawas pond, district Rewari. The study showed that most of the physico-chemical parameters were found beyond the permissible limits while pH and nitrate were found within the range. The findings indicating that the pond was highly polluted.

Yet another study on the assessment of  $F^-$  contamination in drinking water conducted by Kaur and Rishi [24] revealed a high  $F^-$  concentration in 42.9% of groundwater samples in Panipat city. The study conducted on the groundwater quality of Haryana revealed that its quality and quantity are declining rapidly due to the increasing demand for groundwater from the agriculture sector which is one of the major causes of overexploitation. About 76% of all districts in the state of Haryana face problems related to either groundwater quality or groundwater availability or both [10]. The CGWB observed the groundwater in Haryana to be contaminated with Fe, Cr, Cu, Cd, Ni, Pb, As in concentrations higher than the BIS and WHO standards for drinking water. [10]. There have been reports regarding the deterioration in the groundwater quality of major districts of Haryana like Faridabad, Jhajjar, Jind, Hisar and Bhiwani [4,9,10].

### 3.2 River Yamuna Pollution

River Yamuna has been reported to be one of the most contaminated rivers of India (CPCB 2010). According to CPCB (2009) report, the industries including textile, sugar, chemical, paper, leather, thermal power, fertilizers, pharmaceuticals, oil refineries and food processing are located in many cities in the Yamuna basin having poor environment management systems [11]. The main causes of pollution include an increase in population, rapid developmental activities and industrialization. In Delhi and Faridabad, various human activities take place at a faster rate and also are the most populated and developed industrial areas [5,2]. The industries are involved in the processes involving toxic heavy metals which are released into river Yamuna without any prior treatment. The heavy metals concentration is observed in various states mainly in Haryana, Uttar Pradesh, Delhi. Industrial cities like Sonapat, Yamuna Nagar and Faridabad are developed on its bank. In a study conducted to examine the Yamuna water quality at different stretches in Faridabad, from 2016 (May) to 2017 (April) eleven different sampling sites of river Yamuna from upstream (entry point in Faridabad) to downstream (exit point of Faridabad) were included to assess the physico-chemical parameters (like temperature, EC, pH, SS, TDS, TS, hardness, Mg,  $Cl^-$  and DO). The study revealed the quality of the river water requires continuous supervision and monitoring because the river's water quality is heavily degraded at drain areas [1]. According to the study, a higher concentration of Pb and Ni beyond their permissible limit was found in water samples at different sites [2]. The main source for the replenishment of underground water is the Yamuna within the study area [14]. Sharma et al. (2020), undertook a study assessing the concentration of heavy metals in the River Yamuna during different seasons. During the summer season, the concentration of heavy metals in water and sediments increased due to a decrease in the river's water level whereas during the rainy season heavy rainfall and an increase in the river's water level dilute the heavy metal concentration [15].

## 4. CONCLUSION

The water quality of the Haryana state is contaminated with contaminants from various sources. Yamuna river, the lifeline of the state, has been recorded to be polluted because of the release of untreated wastewater by various industries, drains, sewage and municipal sources which are unfit for intake and also for household aims. The groundwater quality in various districts of Haryana has also deteriorated due to increasing population and developmental activities and urbanization. This issue needs immediate action to improve the surface and groundwater quality to protect the nearby populations from various contaminants and heavy metals dissolved in the water. The Government of India (GOI) has proposed various strategies and

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policies like the YAP. Various new strategies and policies need to be implemented to check the heavy metal levels in the Yamuna river. Strict actions must be taken against the firms which do not meet the laid down standards. Various remedial steps should be taken not just by the way of state and national government but also at the community front such as NGO doctors and philanthropists to avoid this problem. Apart from anthropogenic sources of pollution, area-specific factors such as unplanned land use pattern and waste management, sewage as well as the blending of underground water play important role in water contamination apart from the geochemistry system. Borewell water pollution is reduced by individuals, the community and Municipal Corporation by straightforward housework and management practices. The groundwater level can be increased by rooftop harvesting and by enriching annual recharge capacity and in- and ex-situ measures. Water conservation and management techniques improve groundwater quality and prevent water table depletion. The households should avoid direct consumption of water from borewells and handpumps. However, in the order to control the problem of water pollution and the resulting health effects, there is an urgent requirement to have continuous pollution monitoring and better control and check on untreated wastewater being discharged.

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THEME-VI

ADVANCES IN COVID-19  
PANDEMIC



## IMPACT OF COVID-19 ON INDIAN CONSTRUCTION INDUSTRY

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**Abstract:** The Indian construction industry, which encloses Real state, infrastructure, and various commercial structures, is the largest Contributor to the Indian economy, accounting for 10% of Indian GDP. The industry has always been an important indicator of development and has effectively delivered ever challenging projects; however, due to the unprecedented situation of COVID-19, the construction industry is severely affected and is not on the right end of the curve. In the present paper impact of COVID19 on construction industry and measures taken by construction sector, have been discussed.

**Keywords:** Construction, COVID-19, project, management etc.

### 1.Introduction:

The automation level in the industry is very low which highly increases the level of dependency on both skilled and unskilled Labour. Outlining the impact of COVID-19, there has been a huge impact on capitalization, Labour deployment, supply chain, and most importantly contractual as well as schedule impact. As lockdown period came into effect since 25 March 2020 and got further extended to 03 May 2020 and thereupon to 17 May 2020, assisting to reverse migration with workers leaving the city and going back to their villages. According to the Labour statue, 60-65% of Labour is in reverse migration mode while only 30-35% are at respective sites during lockdown (As per KPMG Edition- April,20). Thus, there is an emerging need for strengthening the guidelines for the stay of laborers at the site and using appropriate digital technologies to enable the timely detection and prevention of disease. Returning to sites and working again in a safe and healthy environment is not just a lofty thought but wishful thinking, hence it becomes the duty of the management to take care of these thoughts and take corrective actions.

### 2.Measures are taken to overcome COVID-19 on Construction Sector

All our construction sites operating during the Covid-19 pandemic requires to ensure they were protecting the workforce and minimizing the risk of spread of infection. Site Operating Procedures have been developed to introduce consistent measures on sites of all sizes in line with the Government's recommendations on social distancing. We, at Ahluwalia Contracts (India) Limited, give paramount significance to the health and safety of staff at the site as well as in offices. Work must go on however at the same time, the health and safety requirements of our construction activity must also not be compromised. "If an activity cannot be undertaken safely due to a lack of suitably qualified personnel being available or social distancing being implemented, it should not take place." We were aware that emergency services were also under excessive pressure and were not be in a position to respond as quickly as usual. All company sites needed to remind the

workforce to consistently implement the measures set out in SOPs which intended at protecting them, their colleagues, their families, and the Country's population.

**2.1 Induction and awareness training:** PICs as COVID-19 Marshals held accountability of the site's safety and worker's health. 25-30 workers as mentees were assigned under each mentor by PICs at their respective sites. Every mentor ensured awareness of the protocols to his group of mentees through training, daily motivational talks, and closely observes that they are following and implementing the protocols during work. Appropriate signage at construction site spelling out safety practices in the language which is understood by all were mounted at all the prominent places.

**2.2 Self-Isolation rooms:** The workers coming from outside were self-quarantined for 7-14 days. Anyone who had a high temperature, new persistent cough, was a vulnerable person under their age, underlying health condition, clinical condition or were pregnant were to maintain social distancing and self-quarantine



**2.3 Medical check-ups:** On the first day post lockdown period, mandatory medical check-ups were organized for all workers. ACIL Care application has been developed for regular screening of staff's health at all sites and offices and also to keep a record of the same. Medical assistance was provided to the unfit workers. Routine medical check-ups were also arranged for all the staff and workers. 24x7 ambulances were made available at the sites for emergencies.



**2.4 Site access points:** All non-essential visitors at the entry gates and hutment areas were restricted. Face masks and gloves were provided to all the staff and workers daily which was properly disposed of while leaving the site.



Disinfectant tunnels were made at the access points. Seating arrangements for visitors were made keeping a minimum of 2 meters' distance. All construction material arriving at the site was left idle for 3 days before use to ensure safe usage.

**2.5 Sanitization & Hand washing facility:** Sanitisation of all the vehicles entering the site was performed. No-contact handwashing facilities with a clean water supply and sanitizers were provided at all prominent places across the site.





**House-keeping and cleaning regimes for labour camps and all common contact surfaces in reception, office, toilets, access control, and delivery areas e.g. scanners, turnstiles, screens,**



telephone handsets, desks, particularly during peak flow times were enhanced and given precise importance.

**2.6 Provisions for workers:** Ration and other essentials were provided to the laborers besides the stock was maintained in the inventory for a few days to avoid shortage of food and going out of the site frequently. Separate mess and eating arrangements were done according to the protocols and disposable plates and cups were used which were then properly disposed of in covered bins. Garbage was appropriately emptied daily at the end of the day.



**2.7 Protocols at the site:** Proper sanitization and thermal screening of all the personnel at the site were made mandatory. Biometric/fingerprint scanner attendance systems were disabled at sites and offices.



Physical social distancing was tightly followed and congestion was reduced at every point. A Strict ban on tobacco and pan was instigated.

Avoiding close working: Non-essential works that require close contact between workers were avoided and plans were made to minimize any physical contact between them. Using stairs was given preference over lifts or hoists. Ventilation in enclosed spaces was increased.

Virtual meetings: All the meetings were held through video conferencing as far as possible. In case, the physical meeting was unavoidable, it was conducted in well-ventilated rooms with only necessary participants following all the COVID-19 protocols.



### 3. Conclusions

Even at this unprecedented situation of COVID-19, Construction sector like ACIL has put its remarkable footprint by completing one of its hospital project name PICU in Muzaffarpur ,Bihar by following proper safety measures and norms laid down by the company. Consequently not even a single case of COVID-19 found during construction.

PICU project is an essential need of the Bihar Government and is of utmost priority to them, as it was constructed to fight with special deadly disease name Japanese encephalitis and AES. It is a 100- bed Paediatrics Intensive Care Unit (PICU) hospital and a 60-bed specially designed and developed AES ward .

By completing the project in a marvelous journey of 234 days, the Project sets an example for the nation that pandemic can only affect the project emotionally, nevertheless, if projects are well managed with full consideration of all risk and uncertainties at the pre-planning stage only, then this set up a trouble-free environment even at such devastating situation. One of the greatest learning from this project is that the mutual understanding of client and contractor always results in faster approval and permits and delays can be managed properly. Hence building relationships among the stakeholder is very necessary.

"We at Ahluwalia Contracts are proud of our 'CORONA WARRIORS' Who without being daunted have faced this unprecedented challenge on the ground on projects sites and our various offices, to ensure that all workers & staff stay safe and work goes on even in face of this extreme adversity."

## WORLD ON PAUSE

### How a Mystery Virus Stopped a Globalized World in its Track

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**Abstract-** COVID-19 has a very profound effect on our lives. This new disease announced as COVID-19 on 11 February 2020 by WHO. To prevent from this disease masks, gloves, hand sanitizer are being used daily. Disposing them including issue medical waste is big challenge for waste management. Several safety measures were adopted to reduced transmission including social distancing. The infected are being quarantine. It is a major issue for Informal settlements or slum areas as they don't have proper shelter and less availability of water, drainage system. In these regions social distancing is not so possible. All data and information in this paper are collected from scientific research papers and some specialized agencies.

**Keywords:** COVID-19; Pandemic; Ecosystem; Social distancing measures; Municipal Solid Waste

#### 1. INTRODUCTION

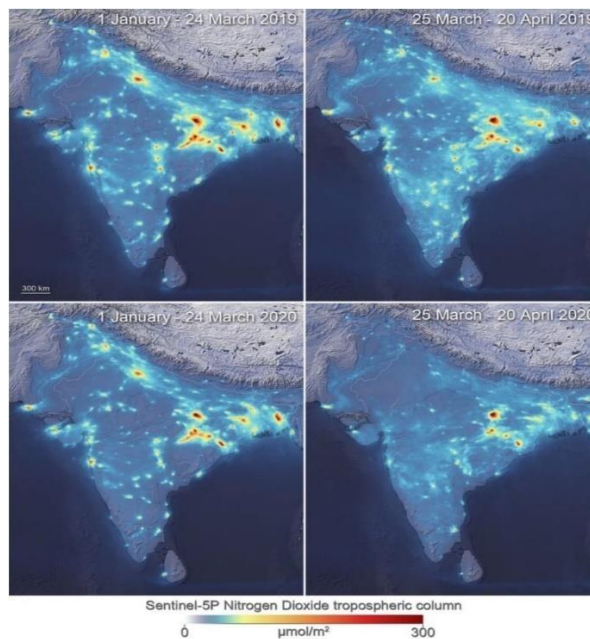
In 2019, a new virus coronavirus was identified as the cause of disease outbreak that originated in Wuhan, China. Currently there are over approximately 65.7 million global confirmed cases and ~1.51 million death cases. Distribution of confirmed COVID-19 cases in top ten countries include USA (14,417,000 persons), India (9,606,595 persons), Brazil (6,580,434 persons), Russia (2,427,403 persons), France (2,282,221 persons), Spain (1,688,745 persons), UK (1,706,298 persons), Argentina (1,457,627 persons), Colombia (1,369,233 persons) (Table 1). COVID-19 affects the socio-economic health and health related sectors across countries (Owusu and Asumadu 2020). In a very short span of time coronavirus become a pandemic.

Table 1. Global distribution of confirmed COVID-19. Data source: The New York Times and JHU CSSE COVID-19 Data

Country	Total confirmed cases	Total Deaths
United States	14,417,000	278,857
India	9,606,595	139,540
Brazil	6,580,434	176,755
Russia	2,427,403	42772
France	2,281,221	55394
United Kingdom	1,706,298	61,121
Italy	1,714,110	59,666
Spain	1,688,745	46,252
Argentina	1,457,627	39,661
Colombia	1,369,233	27,655

Coronavirus (CoV) are a large family of viruses that cause illness ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS-CoV). The official name of disease is coronavirus (COVID-19) and virus is Severe Acute Respiratory Syndrome (SARS-CoV-2). The disease name coronavirus was announced by World health Organization (WHO) and ICTV announced SARS-CoV-2 as a name of new virus on 11 February 2020. This virus is genetically related to coronavirus responsible for the SARS outbreak of 2003. Fever, cough, fatigue, loss of taste and smell, shortness of breath are some symptoms of coronavirus. Sometimes no symptoms at all (U.S. Centers for disease Control and Prevention (CDC)).

Impacts of Lockdown on Environment: This pandemic effect all the things but not equally. COVID-19 has not only affected the worldwide economy but also minimize the transportation throughout the world. Due to which oil consumption and energy utilization reduced. These deviations have greatly influenced the environmental quality. In lockdown there is significant improvement in environmental quality. Level of Nitrogen Dioxide



dwindled up to 30% (NASA and ESA).

**Figure 1:** Nitrogen Dioxide Emission Before and After a Lockdown in India

Figure 1 represents environmental condition in India from January 01, 2020 to March 24, 2020 (before lockdown) and March 25, 2020 to April 20, 2020 (after lockdown). It also makes a comparison with same dates of 2019. This figure is given by the Copernicus Sentinel-5P satellite (Shehzad, Sarfraz, Meran Shah, 2020). This figure represents remarkable reduction in concentration of Nitrogen Dioxide gas. Red dots in image show a high value of Nitrogen Dioxide emission in northeast India. Air quality significantly improved just after few days of lockdown (Mahato et. al. 2020).

Day-by-day humans over exploit the nature and its natural resources. It is major cause which deleterious the ecosystem. Scientists and researchers are continuously trying to emerge from this.

Now, in this pandemic, humans are busy to overcome this situation. They involved to get rid from the virus and doing nothing to save this environment. Due to this, self-nurturing of environment begins (Paital 2020)

To reduce the transmission among people, lockdown is being carried out in many countries. Since, the industrial work and humans' activities have been closed for a month or more in

many parts of countries, there is improvement in surface water quality in Vembanad Lake. Suspended particulate matter results in high turbidity in water bodies. After lockdown the concentration of suspended particulate matter (SPM) decreased by 15.9% on average compared with before lockdown.

Turbidity has been used to access overall water quality (Yunus, Masago, Hijioka,2020).

The slum areas are least prepared for the pandemic of COVID -19 as there is short supply of basic needs, like adequate housing, drainage system, sewers, waste collection sources, water.

Transmission of virus is much higher in these areas. To manage the condition of informal settlements/ slum areas various organizations are involved, namely, country and local governments, bilateral and multilateral agencies, foundations, community-based-organizations (CBOs) and non- governmental organization (NGOs) (8).

### **Solid Waste Management during coronavirus:**

The coronavirus outbreak has faced many major environmental challenges including Municipal Solid Waste management (MSW). Uses of masks, gloves, hand sanitizers now become daily need of humans. Disposal of these medical waste is a special concern for solid waste management. No proper method of disposal of infectious solid waste has yet been found. World Health Organization (WHO) has prepared some guidelines for the disposal of infectious and non-infectious healthcare waste during COVID-19 outbreak. The proportion of non-infectious waste is more than 80% from healthcare waste. So, the non-infectious waste has to be collected and disposed separately as municipal waste (WHO, 2020). The waste material of infected people and quarantined facilities may contain possible SARS-CoV-2. They could be source of transmission of virus from people outside the facility (Naghiem et al.,2020). Activities of MSW management worsen by the excess of waste generated during pandemic. This problem can be solved by integrating decentralized approach with the existing MSW management system. This involve treatment and recycling the waste in the vicinity of waste generation source. It lessens the risk of spreading the infection to workers involved (Kulkarni, Anantharama 2020).

## Guidelines Related to Safety Measures of COVID-19:

According to available data, the COVID-19 virus is transmitted between humans via respiratory droplets and contact routes. Social distancing is better option to prevent from this virus. Since, there is no particular treatment to cure coronavirus. Scientists are moving at record speed to create new coronavirus vaccines and drugs, but still it's taken time to develop.

### Measures to keep yourself safe

- Clean your hands often
- Keep social distancing
- Use a hand sanitizer
- Without washing hands do not touch your eyes and nose

### Measures to protect everyone

- avoid leaving home when you are ill
- Cover coughs and sneezes
- Use sanitizers frequently
- When you're ill wear a facemask

Figure 2: Protective measures to be followed to avoid the spread of COVID-19

They are actively involved to overcome this situation. It is necessary to quarantine the infected people from others. Some prevention methods can be shield against coronavirus such as (1) by keeping social distancing (2) wipe hands regularly (3) stop touching hand, mouth and nose without washing hands (4) If you have cold, fever and difficulty in breathing, seek medical assistance early.

**Conclusion:** The COVID-19 pandemic is spreading very quickly and affecting ecosystem. Lockdown improves the air quality index as well as surface water quality. Since there is no particular treatment to cure corona virus, all the safety measures should be followed to reduce transmission. To reduce the infectious or non-infectious solid waste, future research should aim at developing biodegradable and environmentally friendly including face masks, gloves. Lessons should be learned from earlier epidemics such as Ebola and pandemics such as HIV.

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## Advances in COVID -19 Pandemic

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**Abstract:** Originally reported first in Wuhan, China, the COVID-19 virus traveled throughout the world and infected millions. COVID-19 is unstoppable unless a vaccine is developed. The Corona virus has been isolated from asymptomatic individuals, and affected patients continue to be infectious 2 weeks after cessation of symptoms. Precautions are taken against corona virus,

**Keywords:** Covid-19, World Health Organization, pandemic, social distancing.

**Introduction:** Coronavirus disease 2019 (COVID-19) is a contagious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The first case was identified in last week of December 2019 in Wuhan city of China. On 11<sup>th</sup> March 2020, World Health Organization (WHO) declared COVID-19 as a world-wide pandemic situation. India also becomes a part of this pandemic situation from 30<sup>th</sup> Jan 2020. First case of COVID-19 was confirmed in Kerala. To overcome this situation our government start thermal scanning at airports for passengers who are coming from other countries. People coming from other countries are advised to stay at home at least for 14 days, although they have not any symptoms.

To prevent the spread of covid-19 in the workplace, adopt flexible working hours, wear a mask on public transport, check body temperature when entering office buildings, avoid crowded lifts as far as possible, avoid holding or joining large-scale meetings, reduce face-to-face contact with co-workers, arrange flexible meal hours also avoid meal gatherings, wash hands frequently and maintain good environment hygiene at the workplace. After work, avoid crowded places, if you feel unwell, don't go to workplace and take medical advice.

When a person with corona virus coughs and sneezes they spread the virus through droplets. These droplets remain in the air for few hours and also land on other people and surfaces. Someone catch the virus by breathing in these droplets or by touching the surface that has the virus on it and then touching mouth and nose. Approximately 80% of infections in COVID-19 are mild or asymptomatic; 15% are severe, requiring supplemental oxygen; and 5% are critical, requiring mechanical ventilation. [2]

“Social distancing”, reducing social interactions with others, may save millions of lives during the COVID-19 pandemic[1].

Social distancing slows down the spreading of Corona virus. One should avoid shaking hands and gathering in groups. Stay away from surfaces and maintain a six feet distance from people outside your house.

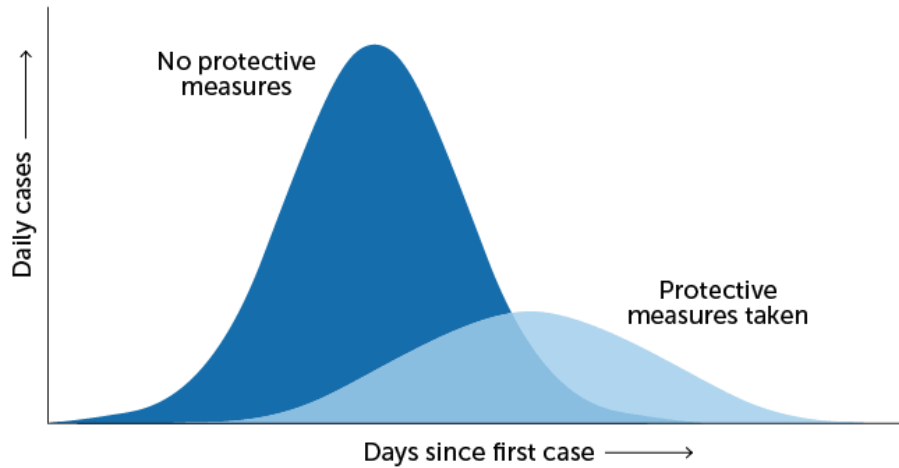


Fig 1: Increase in Covid-19 cases with and without protection

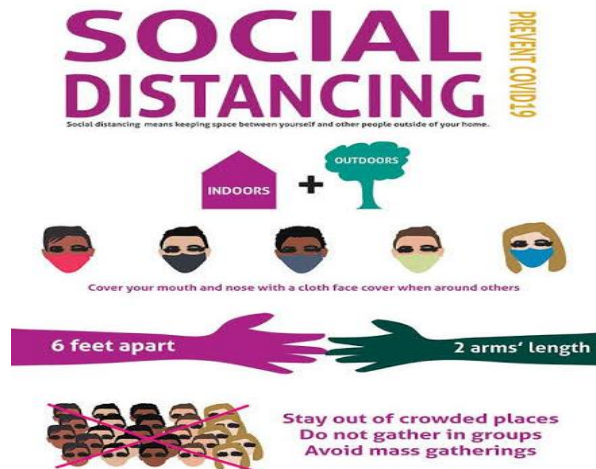


Fig 2: precautions to prevent spreading of COVID-19

In fig.1 the blue curve shows that this infection will spread quickly if we don't do anything. Our hospitals would not be able to care for so many sick patients at once. With social distancing and

good hygiene, we can slow down the spread of the disease. To maintain this we have to put on hold the events like parties, group classes. Don't share objects such as toys, etc.

To reduce the effect and spreading of virus, the prime minister "Narendra Modi" announced a nationwide lockdown in different phases. To follow the guidelines of lockdown all schools, colleges, industries, offices, markets and public places are closed till the further guidelines. This decision saved life of many people. A very less number of deaths are reported in India as compared to other countries

- Lockdown Phase 1: March 24<sup>th</sup> to April 14<sup>th</sup>, 2020.
- Lockdown Phase 2: April 15<sup>th</sup> to May 3<sup>rd</sup>, 2020.
- Lockdown Phase 3: May 4<sup>th</sup> to May 17<sup>th</sup>, 2020.
- Lockdown Phase 4: May 18<sup>th</sup> to May 31<sup>st</sup>, 2020.
- O<sub>3</sub> and CO averages are for day-time only.
- PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub>, and NO<sub>2</sub> averages are all-time

Air quality is also improved. Fig.3 shows the reduction in air pollution is more than 50% in New Delhi [3]

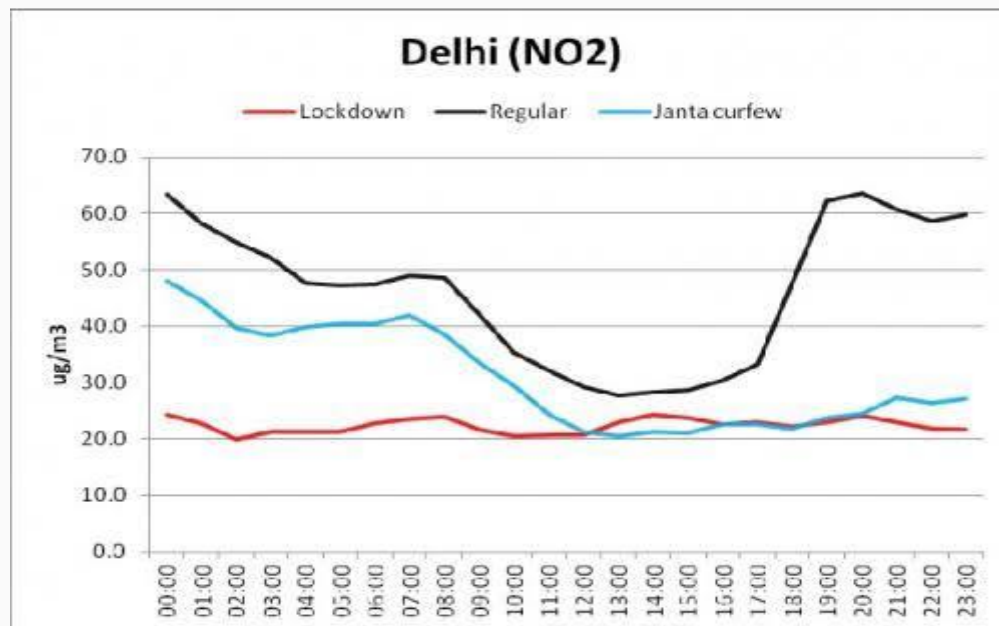


Fig.3: Decline in air pollution

**Impact on various Sectors of Indian Economy:** The corona virus outbreak and the lockdown deeply impact the economy. It hit hard the income of all Indian retailers selling all the non-essential items like cars, furniture, etc. There is sharp decline in crude oil prices due to absence of demand. Many pharmacy companies to get benefit for huge demand of Paracetamol. This pandemic has also made people realise the important of life and medical insurance. Thus these sectors can see some good order book. Indian stock market fell by around 35% giving an opportunity for long term investor to invest. The poultry sector which is the fastest growing sub-sector of the Indian agriculture eco-system and where India has created a foothold at the global level (India is the third-largest producer of eggs and fifth largest producer of broilers) is already facing losses to the tune of 150-200 crore each day[4].

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# Covid-19 on environment: Positives and Negatives

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**Abstract-** Coronavirus disease has impacted the environment worldwide. The objective of the paper is to inspect and present the effect of COVID-19 on Environment. It is observed that air quality has been improved at many places. Paper presents the studies done on various factors that impact environment like nitrogen dioxide (NO<sub>2</sub>), black carbon, carbon dioxide, and carbon monoxide, greenhouse gas (GHG), OZONE (O<sub>3</sub>) and Particulate Matter (PM).

Along with the advantages there are some ill effects of COVID 19 on environment in terms of medical waste and domestic waste. Critical review of many papers is done here

**Keywords:** Corona Virus, Covid-19, environmental impact, social distancing, air pollution

## 1. INTRODUCTION

Covid-19 outbreak in Wuhan city of China in December 2019. This Pandemic is proved a disaster for the whole world. Earlier SARS and MARs were broke out and symptoms of COVID-19 was quite similar to them [1]. Due to COVID-19 World health organization (WHO) has to declare health emergency in the world. As of today, around 6, 43, 63,629 confirmed cases and 14, 90,357 deaths are reported around the world. Symptoms of Coronavirus are body ache, cough, severe headache which leads to infection in lungs and attacks both upper and lower respiratory system which causes death of people at later stages.[3] WHO then put forward a suggestion of implementing social distancing and avoiding social interaction to decrease the effect of COVID-19 as it was diagnosed as communicable disease. Many countries had to start a lockdown movement. During lockdown many activities were blocked like transportation, airline, office, educational institutes, worship places, resorts, and monuments. People were restrained to stay at home.

## 2. Effect of Covid-19 on Environment

Coronavirus has effected environment on both positive and negative way. According to literature survey done, many parts of environment are effected by coronavirus. They include air, water, noise, medical waste, beaches, medical litter and domestic waste [4].



Figure 1: Positives and Negatives of Covid-19(SARS-Cov2)

The implementation of lockdown during Covid-19 has positive impact on air quality. As local transport and other activities were not happening during lockdown, burning of oil and transport fumes reduced significantly [2]. Air pollution is a global issue. India is capturing 18% the world population of globe and pollution in India is 26 % of the world population, which is a great cause of concern. During lockdown Covid-19 air pollution was reduced significantly. Important indicators of air pollution are nitrogen dioxide (NO<sub>2</sub>), greenhouse gas emissions (GHG), ozone (O<sub>3</sub>), and absorbing aerosol index (AAI), black carbon, carbon monoxide (CO), and particulate matter (PM). Main reason for generation of NO<sub>2</sub> is partial fossil fuel combustion, motor vehicle exhaust, burning of biomass, soil emissions and natural lightning [5]. Nitrogen dioxide is very dangerous for human health and plant growth. Untimely climate change is happening due to NO<sub>2</sub>. If person is exposed to NO<sub>2</sub> for long term, it decreases the respiratory function of the human body [6]. Ozone (O<sub>3</sub>) is also another major pollutant. Ozone(O<sub>3</sub>) is caused due to photochemical reaction of Nitrogen dioxide and volatile organic compound(VOC). US EPA considers O<sub>3</sub> as major factor for causing mortality[7]. Humans are facing major problem of asthma and lungs inflammation due to O<sub>3</sub>[8]. Another environment indicator AAI indicates the presence of elevated absorbing aerosols like dust and smoke in environment [9]. Another air pollutant is Carbon Monoxide (CO) which is caused due to incomplete combustion of fuel containing carbon. Presence of CO in environment is very hazardous to health, it replaces oxygen in hemoglobin which leads to around 10 % of the heart failure in elderly people [10]. Green House gases is another factor for air pollution. GHG has ability to absorb infra-red radiations emitted from earth surface and transferring it back to earth. Greenhouse gases majorly consist of Carbon dioxide (CO<sub>2</sub>), water vapors and methane [11].



Figure 2: AQI of most polluted cities during lockdown

Lockdown campaign during coronavirus spread has drastically improved quality of ground water as industrial activities were stopped, tourist activities on beaches are suspended, no spilling of oil from ships. Pollutants in sea and canal also reduced during lockdown.

Sound pollution has also reduced during lockdown due to restricted movement of transport and halt of industrial activities. These activities are the major cause of noise pollution [12].

Sudden decrease in air pollution was noticed at the time of lockdown. The national Aeronautics (NASA) and European Space Agency (ESA) released data which showed significant improvement in air quality. Concentration of nitrogen dioxide (NO<sub>2</sub>) and black carbon (BC) reduced by 50%, ozone, carbon monoxide (CO) and particulate matter (PM) was very less at the time of lockdown. GHG emission also reduced due to reduction in fossil fuels and electricity consumption. Central pollution control board (CPCB) monitored 11 cities of India at the time of lockdown and observed that air quality index (AQI) of 78% cities were good and satisfactory at the time of lockdown as compared to 44% in pre lockdown phase. This drop was due to complete lockdown of country. It was observed that there was 30% drop in air pollution with mobility restriction of around 90% [14].

But after removal of lockdown when day today activities are on full swing. Energy consumption has returned to normal and industrial activities have started again. So more GHG, NO<sub>2</sub> and O<sub>3</sub> gases are causing the hazard to health of human being, which needs to be controlled.

There are some adverse effects of coronavirus on environment due to increased domestic litter and medical waste. According to a study hospital generated 240 metric tons of medical waste which was 50 tons per day prior to Covid-19 and safe disposal of medical waste is also required because waste was coming from infected residents as well as infected personal protectives such as mask and gloves [12]. Domestic waste drastically increased as people were at home and proper collection and decomposition of domestic waste was a major concern.

So Covid-19 impacted the environment in both positive and negative way and figure shows the same

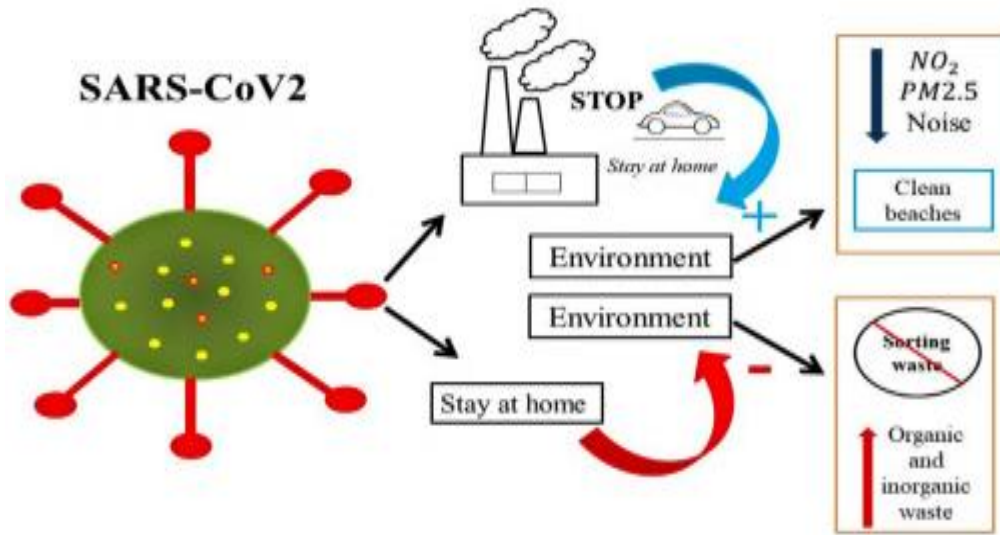


Figure 3: Covid-19 and Environment

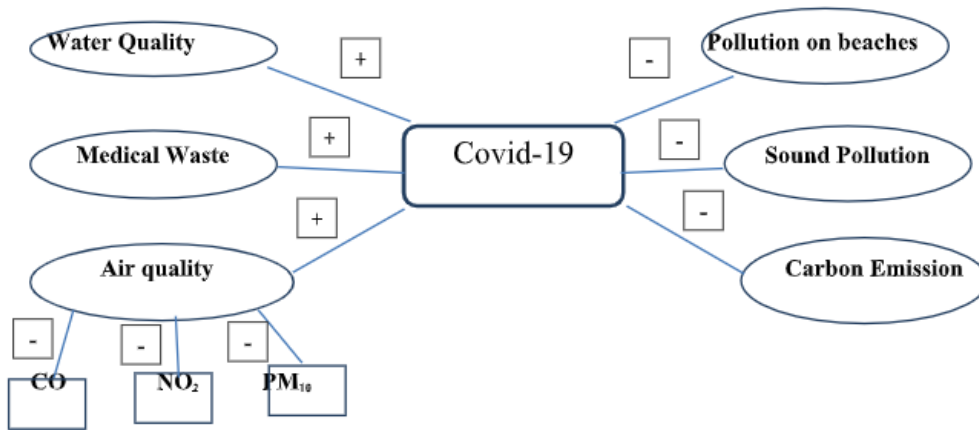


Figure 4: Impact of Covid-19 on Environment

**Effect of Environment on COVID-19**

Covid-19 is a communicable disease and just like other communicable disease, covid-19 transmission is also effected by many environmental factors like temperature, rain, humidity and wind speed. These meteorological factors are significant in finding the intensity of coronavirus spread [14]. It is observed that regions where the wind speed is more coronavirus spread is more that is covid-19 spread has positive association with wind speed and temperature and humidity has negative association with the spread. It was observed that with the increase in temperature covid-19 cases are decreasing by 36 to 57 % where humidity is between 65 to 85.5 %. It was observed that rain fall is directly associated with covid-19 spread.

## CONCLUSION

This study reveals that coronavirus has impacted the environment in both positive and negative way. Positive effects are reduction in noise pollution, improvement in air quality, decreased ground water and surface pollution, decreased concentration of CO (carbon monooxide), NO<sub>2</sub>(Nitrogen Dioxide), methane, black carbon, SO<sub>2</sub> and particulate Matter(PM 2.5 and PM 10) in environment. So many of the environmental pollution issues were resolved at the time of lockdown. But coronavirus spread has some disadvantages also as medical litter and domestic was abundant and there was reduction in recycling So properly discarding the medical waste was also a concern. Also as lockdown has been released at most of the places so decrease of GHG for short period of time was not very useful

Effect of environment on coronavirus spread also evaluated and it is observed that coronavirus is spreading more in cold regins and in the regions where wind speed is less

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# IMPACT OF COVID -19 ON HUMAN LIFE, ECONOMY AND ENVIRONMENT: A SURVEY

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**Abstract:** The NOVAL Corona virus outbreak has started from the Wuhan city which is in the Hubei province of china in December 2019. Since first occurrence of CIVID 19 in December 2019, it has spread around 220 countries of the world and affected various aspects of human life including environment, economy, health etc. it was declared as public health emergency of international concern by WHO on Jan 30, 2020. As of today, around 6,43,63,629 confirmed cases and 14,90,357 deaths are reported around the world.

To control the spread of COVID 19, different measured have been adopted by various countries across the world. The pandemic has Counter measures like lock-down taken by various countries has positive impact on nature and wildlife as the air quality is improved while greatly affected the human life economically and psychologically. In this survey the impact of corona virus pandemic and its counter measures on socio-economic and psychological aspect of human life is reviewed.

**Index Terms-**COVID-19, lockdown, economy, Quarantine

## INTRODUCTION

Novel COVID-19 is the general name in parallel to scientific name SARS-CoV-2, studied by the group of International Committee on Taxonomy of Viruses. This group found the symptoms from COVID-19 virus in form of acute respiratory syndrome coronavirus (SARS-CoV). The virus SARS-CoV came into existence in year 2002 and this virus was called with another name as Middle East respiratory syndrome coronavirus (MERS-CoV) [1]. As per the survey done on COVID-19, various investigation said that this virus came from the family of single-stranded RNA viruses. The COVID virus disease which started from Wuhan city of China spread at very rapid rate across china and other countries of the world and it causes an outburst of acute infectious pneumonia [2][3]. As per the data given by the website [www.worldometers.info](http://www.worldometers.info) there were 64,363,629 confirmed cases (including 106000 severe cases) and 18,140,919 still active cases of COVID-19 worldwide as of 02 December 2020 [4]. Due to this exponential growth in COVID-19 19 cases, government took various procedures to control the spread of disease like lockdown, restriction on public gatherings, suspension of educations activities etc. It creates enormous pressure on health care, industry, supply chain etc. As we are living in a strongly connected and integrated world, the impacts of the disease beyond humanity and morbidity (those who are unable to work for a period) has become visible since the outburst [5].

Due to interruption of production the global economy slowed down which resulted in an interruption in supply chain. Restrictions on the transport (air, road, and sea) among countries further impacted the world economy.

Various restrictions enforced by the government to control the COVID 19 outburst has a huge impact on human being as people are forced to stay inside their home, infected people are socially and physically isolated to prevent the infection spread [6]. Due to COVID-19, the human being suffers from psychosocial disorder, like fear and anxiety, social isolation etc.

Although various restrictions imposed by the governments all over the world has adverse effect on economy, health etc. there are some encouraging effect of the environment like the air quality has improved, rivers become cleaner, blue sky is visible etc. During the lockdown period around the world, the clear blue sky established a perception of positivity among the people towards a cleaner and healthier environment [7].

The rest of the paper is further divided into three sections. The first section consist survey on Impact of COVID 19 on Human health. While in the second section discuss the effect of COVID 19 on Global Economy and the last section throws light on the positive impact of restrictions imposed to control the outburst on environment [8].

### COVID -19 IMPACT ON HUMAN LIFE

The COVID-19 spread across the countries at a rapid rate. This pandemic situation leads to a human death throughout the world and also lead to various serious health issues. This impact on this pandemic has a lрге impact on socio economic. A large number of people have lost their jobs, a large number of people migrated from their job place to native place. [9].

COVID-19 (Coronavirus) has badly affected the daily life of human beings. It has affected thousands of peoples around the globe. The commonly seen symptoms of this infection are muscular pain, fever, throat irritation and respiration problems and pneumonia. Due to the unavailability of vaccine, the focus is on various precautionary measures such as regular hand wash, social distancing, and wearing of protective gears etc. Number of countries are forcing their population to stay inside and enforcing strict home/hospital isolation to break the spread of this COVID-19 virus chain [10].

A large number of people has suffered from anxiety, depression, and other trauma-related issues. The impact of this pandemic on psychosocial health of human being seems to be higher during isolation time. Due to physical isolation diseases such as stress, depression and sleeping related disorder has increased in individual. The major effect of COVID-19 virus is on the person with aged above 60 years or having other disease like diabetic or respiratory related disease etc. [11]. The below figures shows the increase in the number of patients and deaths.

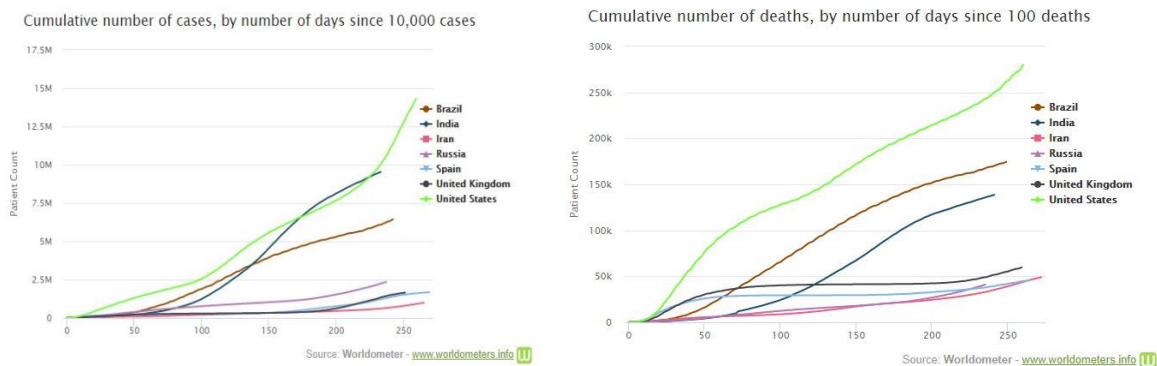


Figure 1: COVID-19 cases and death

Currently the effect of COVID-19 in daily life has bad effect on human life and other are extensive and have far reaching consequences. Few of the effects of COVID 19 on human life are as listed below [9]:

- People with diseases like heart disease, diabetic, cancer etc are getting neglected because of large number of COVID-19 cases.
- Healthcare professionals are overburdened and are at high risk of getting infected.

- Requirement for protective gears.
- Service sector is highly effected by counter measures like lockdown, travel restrictions etc.
- Deferment and rescheduling of large-scale sports activities created panic in communities.
- Restrictions on national and international travel has impacted the transportation industry as revenue is reduced to a minimum because of suspension of services.
- Suspension of celebration of various cultural, spiritual and festive events.
- Physical and Social distancing.
- Shutdown of hotels, restaurants and other places of social gatherings.
- Effect on Education system (Suspension / Postponement of examinations and classes)

### **COVID-19 AND GLOBAL ECONOMY**

COVID-19 has greatly affected almost every fragment of human life, businesses, interrupted the world trade and other economic and social activities. It is very important to identify the disease at an early stage to control the spread of the virus which spreads very rapidly from person to person. Most of the countries enforced lockdown to flatten the curve of number of infections. The lockdown meant forcing the millions of people to confined to their homes, shutting the businesses down and thereby stopping almost all economic activities [12]. The industries shutdown because of Lockdown greatly reduced the demand of metals. Restrictions on travel effected the tourism industry. Some of the various business affected by this disease include the pharmaceuticals industry, solar Energy sector, travel and tourism, Information and broadcasting, entertainment and electronics industry.

The outbreak of the disease reduces labor supply and hence productivity, while lockdowns, business closures, and social distancing also cause shortage of labor and the raw material. As a effect of economic slowdown, many people lost their jobs. The unemployability is at all time high during the pandemic. The loss of income (from quarantines, and unemployment) worsened household consumption [13]. Key challenges in the analysis of COVID -19 impact on economy are how to identify the unprecedented shock, how to reason for its non-linear effects, and how to measure the uncertainty surrounding calculations [14].

The Covid-19 pandemic is unique in nature as it has affected the population all around the globe, posing tough challenges to governments and to the pragmatic investigation of its direct and indirect effects on the global economy. Following are the main issues causing the economic slowdown [9]:

- Shutdown of manufacturing units producing essential goods.
- Halt or interruption in the supply chain of products.
- Losses in all type's businesses
- Movement of cash flow is stopped because of slowdown in tourism, transport, manufacturing sectors.
- Revenue growth is slowed to a greater extent.

### **COVID-19 AND ENVIRONMENT**

The COVID-19 pandemic has a large effect on human being and the business economy. Second or third wave of COVID-19 is in few countries. All countries are waiting for the COVID vaccine and it is in trial phase. May be the vaccine will come in the January 2021 in some countries. There are so many deaths happened daily across the world [15]. Different countries governments adopted different measures to control the severe impact of COVID-19 virus. These counter measures include travel restrictions and lockdown to contain the spread of the highly infectious virus.

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The outcome of lockdown activities gives people a ray of hope towards a better and healthy environment. The major source of air pollutions are industries, transports (road, air and rail), power generators etc. During lockdown many industrial activities are suspended resulting in improvement in air quality.

Due to lockdown in several countries, NASA (National Aeronautics and Space Administration) and ESA (European Space Agency) said that air quality has been significantly changes and air pollution is significantly decreased.

The lockdown and other counter measures were taken to break the spread of CORONA virus. This has positive effects on global environment as it improved air purity and water quality and waste production. Air pollution contents Nitrogen Dioxide and Sulphur Dioxide emissions is drastically reduced in lockdown duration. This analysis was given by CBCB (Central Pollution Control Board) across 115 Indian cities. CPCB collected data during lockdown in between 16 March to 15 April, 2020 and analyzed that air quality index become 'good' and 'satisfactory' level [17].

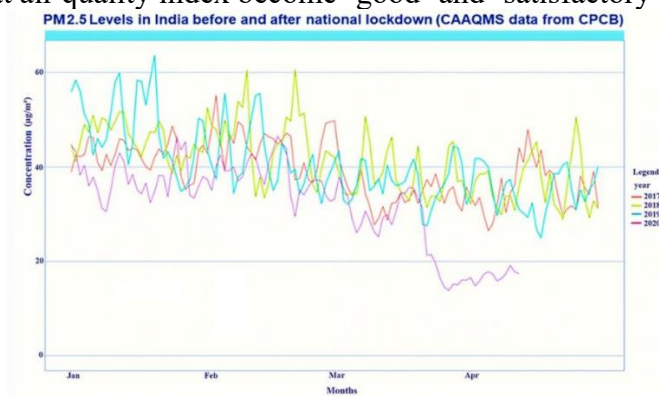
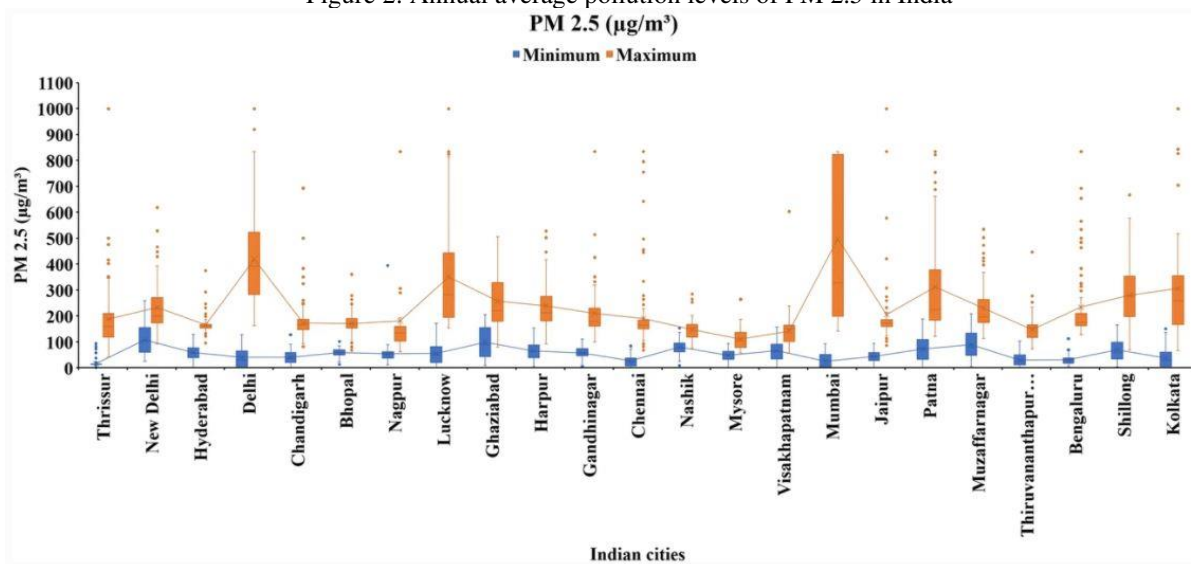


Figure 2: Annual average pollution levels of PM 2.5 in India



PM 2.5 level in South Asia (COVID-19 pandemic before and during lockdown)

Figure 3: PM 2.5 level in South Asia (COVID-19 pandemic before and during lockdown)

CPCB along with UPPCB (Uttar Pradesh Pollution Control Board) collected data for water quality and analyzed that the quality of Ganga's water and other rivers water improved with significant level of oxygen.

Not only there is improvement in air quality and water resources but the noise pollution was also reduced greatly during the lockdown period.

## CONCLUSION

Social distancing, lockdown and wearing mask are some important action to save human lives and break the chain to spread COVID-19 virus. This impact good on air, water quality but it impacts badly for socio-economic culture.

The lockdown damaged the economy of most of the country, as business were closed, transport closed.

The government of different countries are preparing to scale up to minimize the economic slowdown and to provide a way for economic recovery. The countries ensure to frame and limit the exercise of discretion in order to avoid long-term damage to the economy.

COVID-19 and its impacted lockdown has given a rare opportunity to assess the impact on the environment change. Due to lockdown, it has been observed that the environment has clean air, the river water was clean and polluted cities become livable cities. Therefore, it should be committed to instill the principles of sustainable development in our social behavior, life style and public policy making to make our environment clean and sustainable.

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# COVID 19 PANDEMIC AND ENVIRONMENTAL EFFECTS

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**Abstract-** Corona virus disease 2019 (COVID-19) was started first in Wuhan, China, and outspread worldwide with very fast speed. The COVID-19 is affecting every part of human lives, including the physical world [3]. This disease is spread from human to human being very fast. The measures taken to control the disease affects the economic activities. Flights have been canceled worldwide and transportation has been closed nationwide and across international borders. These measures to control the virus have several significant effects on the environment. The study of various scientific literatures says that COVID-19 pandemic has both positive and negative impacts on the environment. The positive impacts are the pandemic situation significantly improves air quality in different most polluted cities across the world, noise pollution reduced, water pollution reduced and also reduces carbon emission due to reduce transport and industrial activities. In addition, some negative impacts are increase of medical waste, disposal of disinfectants, mask, gloves and burden of untreated wastes continuously endangering the environment. It seems that, situation might change and the economic activities will return soon after the pandemic. Hence, this study may describe the best possible ways to achieve long-term environmental benefits. It is expected that the proper implementation of the proposed strategies might be helpful for the global environmental sustainability.

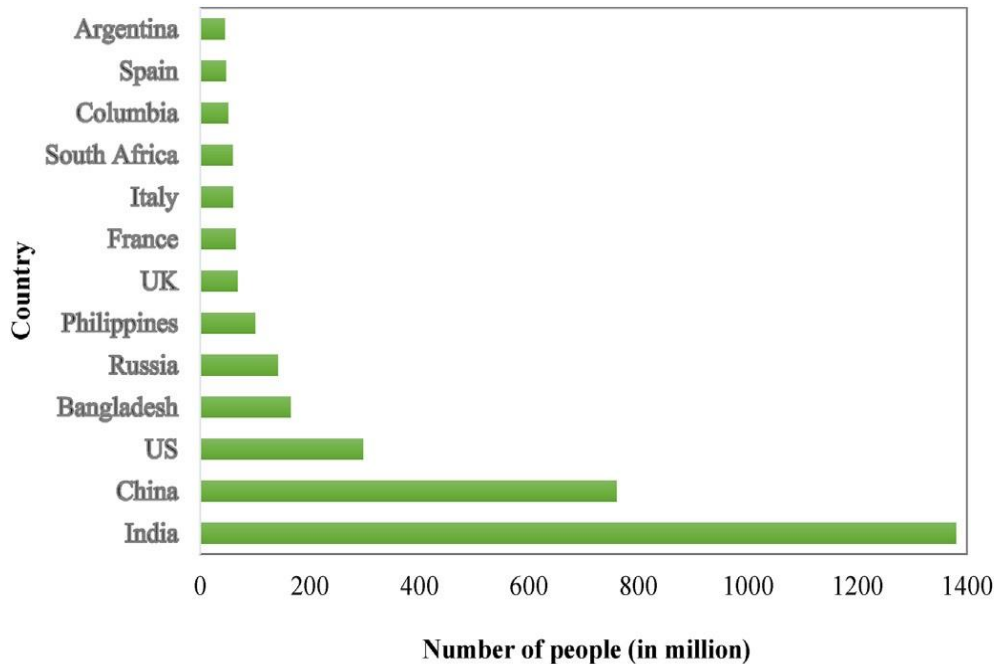
**Keywords:** COVID-19, Environmental Effect, Positive Impact, Negative Impact, Sustainable Environment

## 1. INTRODUCTION

Corona virus disease 2019 (COVID-19) was started first sea food market in Wuhan, China at the end of December 2019 and outspread worldwide with very fast speed. After that it was declared as an international public health emergency week by the World Health Organization (WHO). The transmission of the virus mainly occurred through human-to-human via direct contact or droplets produced by coughing, sneezing and talking [1]. National and international authorities and experts suggest the use of non-pharmaceutical measures like wearing face masks and hand gloves, washing hands with soap, frequent use of antiseptic solution and maintaining social distance [4]. The measures taken to control the disease affects the economic activities. Flights have been canceled worldwide and transportation has been closed nationwide and across international borders [2]. Figure 1 illustrates global examples of the country wise number of people placed on enforced lockdown due to the corona virus pandemic [1]. It is found that India restricted the movement of the largest number of people (approximately 1.3 billion) as a

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preventive measure of COVID-19, which started from March 24, 2020 [1]. Except emergency services (e.g., fire, police, medical, food supply etc.), all other organizations including educational institutions are being closed to encourage people to stay at home. All the public transport services (e.g., train, bus, airplanes, truck, etc.) were suspended, with exceptions of the transportation of essential goods and emergency services [1]. These measures to control the virus have several significant effects on the environment. The study of various scientific literatures says that COVID-19 pandemic has both positive and negative impacts on the environment. The positive impacts are the pandemic situation significantly improves air quality in different most polluted cities across the world, noise pollution reduced, water pollution reduced and also reduces carbon emission due to reduction of transport and industrial activities. In addition, some negative impacts have increased like medical waste, disposal of disinfectants, mask, gloves and burden of untreated wastes continuously endangering the environment [5]. It seems that, situation might change and the economic activities will return soon after the pandemic. Hence, this study may describe the best possible ways to achieve long-term environmental benefits. It is expected that the proper implementation of the proposed strategies might be helpful for the global environmental sustainability.



A. Fig. 1 Global example of the number of people placed on enforced lockdown during the outbreak of COVID-19 (as of April 23, 2020) [1]

## 2. METHODOLOGY

This study was performed by reviewing the available case studies, published literatures, and different non-government and government organizations information from reports and official websites. Scientific literatures were collected through electronic means from the database of

Springer, Science Direct, Research Gate, and Google Scholar but not in a systematic manner. From a large number of studies, this study compiles and presents the data and information which are relevant to the environmental effects of COVID-19 and meet the study goals.

### **3. COVID-19 ENVIRONMENTAL EFFECTS**

The study of various scientific literatures says that COVID-19 pandemic has both positive and negative impacts on the environment. The positive impacts are the pandemic situation significantly improves air quality in different most polluted cities across the world, noise pollution reduced, water pollution reduced and also reduction of carbon emission due to reduce transport and industrial activities. In addition, some negative impacts are increase of medical waste, disposal of disinfectants, mask, gloves and burden of untreated wastes continuously endangering the environment. Fig. 2 explains both positive and negative impacts of COVID-19 pandemic on environment.

#### *3.1 POSITIVE IMPACT ON ENVIRONMENT*

Due to pandemic situation Flights have been canceled worldwide and transportation has been closed nationwide and across international borders [2]. Most of the countries apply lockdown to handle the situation. Due to lockdown transportation was not working and industries were also closed. Fuel consumption is reduced due to that emission of greenhouse gases (GHGs) was also reduced. Industries were closed due to that waste of industries were not mixed into rivers so water pollution is also reduced in lockdown. Due to less traffic noise pollution also reduced and air quality improved.

#### *3.2 NEGATIVE IMPACT ON ENVIRONMENT*

Since the outbreak of COVID-19, medical waste generation has increased globally. This waste is a major threat to public health and environment. For sample collection of the suspected COVID-19 patients, diagnosis, treatment of huge number of patients, and disinfection purpose lots of infectious and biomedical wastes are generated from hospitals. To protect from the COVID-19 infection, presently we are using face mask, hand gloves and other safety equipment, which increase the amount of healthcare waste. The production and consumption of this plastic waste has increased day by day. It is a big challenge for environment to dispose this medical waste. Due to pandemic situation waste recycling chain is also not working properly which also generates problem for environment.

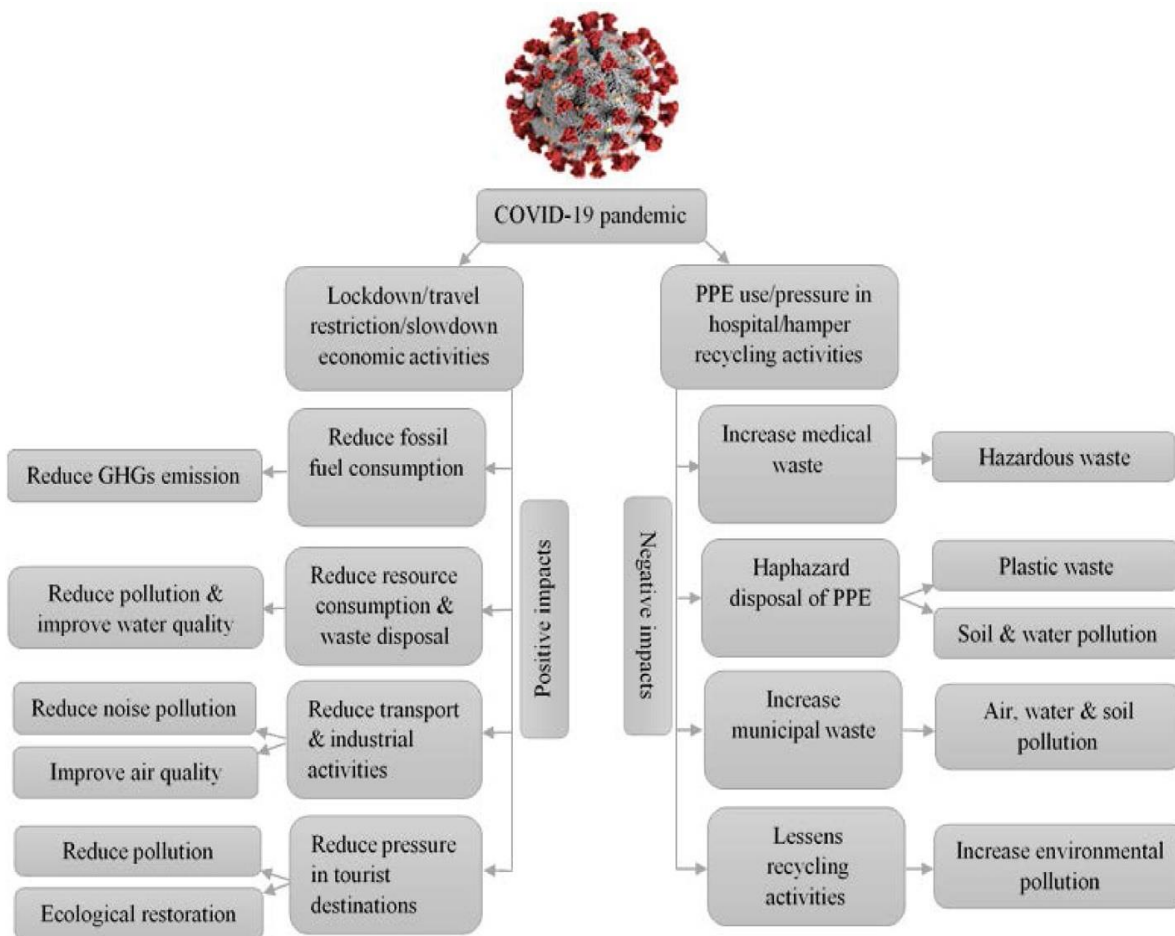


Fig. 2 COVID-19 pandemic positive and negative impacts on Environment

#### 4. POTENTIAL STRATEGIES OF ENVIRONMENTAL SUSTAINABILITY

It is assumed that, this pandemic situation is for short duration. Now it is the time to make a proper strategy for sustainable environment management as well as for long-term benefit. During this pandemic for healthcare we are dependent on face mask, hand gloves and other safety equipment such as PPE kits which are made up with the help of single use plastic, so medical waste is increased due to this consumption of single-use plastics (including personal protective equipment such as masks and gloves) in COVID-19 pandemic. Thus, it is a big challenge for environment to degrade or compose this single-use plastic waste. To handle this situation, we must shift towards sustainable alternatives, such as bio-based plastics. Bio-based plastic is Environment friendly. It is easy to compose bio-based plastic as compare to ordinary single-use plastic. It will reduce plastic leakage and soil pollution [6]. It also promotes sustainable growth and to stimulate both green and blue- economies. For sustainable environment we must also shift towards sustainable industrialization. In sustainable industrialization our main focus towards energy-intensive industries, use of cleaner fuels and technologies, and strong energy efficient policies.

To reduce emissions and pollution, it is necessary to encourage people to use public transport, rather private vehicles. We also encourage people to use Green vehicles. Besides, people should encourage using bicycle for short distance, which is useful for health as well as for environment. For sustainable environment we should focus on renewable energy which can lower the demand of fossil fuels like coal, oil, and natural gas. So, this can play an important role in reducing the GHGs emissions. To reduce the water pollution, we should focus on Wastewater treatment and reusability.

### CONCLUSION

COVID-19 pandemic is affecting the whole world and the global economy. In this literature we discussed about both positive and negative impacts on the environment. Directly or indirectly, the pandemic is affecting environment and climate. It reminds us how we have neglected the environmental components and enforced human induced climate change. Moreover, the global response of COVID-19 also teaches us to work together to fight against the virus. It is assumed that, this pandemic situation is for short duration. Now it is the time to make a proper strategy for sustainable environment management as well as for long-term benefit. We must make efforts for environmental sustainability and save the earth from the effects of global climate change.

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## Impact of covid19 on CSR practices of firm's

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### Abstract

The purpose of the paper is to find out the impact of COVID19 on CSR practices of the firm. This pandemic has impacted the profitability of the firms due to lockdown imposed in the economy. To find out the trend of CSR spending, the study used secondary data from sources like annual reports, websites, published articles and other related sources. As a result of COVID19, we see rising CSR spending in the firms during lockdown. Thus we can say that COVID19 has created opportunity for the firms to indulge more in CSR practices by promoting social awareness and increasing the donation amount.

Keywords: CSR, COVID19

### Introduction

Entire world is facing covid19 pandemic. In India cases of coronavirus cases is rising day by day. It has crossed the landmark of 1 crore cases. Government imposed lockdown in various phases to control the rising cases. People were bound to follow the rules imposed, hence no option left except staying home. Problems are not only faced by customers end but business also faced lot of disruption in their operations. They faced huge losses during lockdown period. In pre covid times, companies were more inclined towards CSR activities. Thus there is need arises to see the CSR spending of companies during and post covid19 in India.

Corporate social responsibility refers to the practices and responsibilities of companies towards society besides earning profit only. India is the first country to mandate minimum CSR spending under the companies act, 2013. Section 135 of companies act, 2013 says it is now compulsory for the companies of net worth of Rs 500 crores or more, or turnover of Rs 1,000 crore or more, or net profit of Rs 5 crore or more in previous financial year, to spend 2% of their past three years net profit on CSR activities.



CSR has played an important role in development of nation, from being achieving goal of sustainable development to “Atam nirbhar bharat”. In light with the spread of covid19, government has declared that companies spending for COVID19 will be considered as CSR activities. In this tough time, government initiated some relief funds to support people in this challenging time. Companies have contributed as well at their part.

### **Research objective:**

The objective of this study is to find the impact of covid19 on CSR activities of companies. The study is worth doing in the era of pandemic as due to lockdown business has suffered losses and some of them have shut down. The study examines whether in this crucial situation, corporates has come at front part to create social awareness and payback to the society or not.

### **Literature review**

Corporate social responsibility is not a new concept in corporate world. Some companies are into CSR practices for social cause and some do just as a practice of window dressing (kolk, 2014). There are number of reasons which make this study worth doing. CSR practices have already observed a rising trend in past few years. According to one estimate (nseinfobase.com), CSR spending in 2019 has increased to 11961 crore from 10179 crores in 2018 and number of firms who have missed the mandatory requirement of 2% has also decreased from 353 to 332. Study by (Maqbool, 2018) has observed a positive impact of corporate social responsibility practices on firm’s financial performance like profitability and number of sales. Positive impact is not only limited to financial performance of the firms but also had an impact on customer’s perception towards brand and their willingness to buy the product. The study W. H. (2014) found that sound CSR policy can attract the customers towards their product which ultimately results into improved sales.

### **Research methodology**

This study used secondary data from sources like published articles, websites, reports, research papers, company’s annual reports and other relevant sources. The study made sure to use maximum accessible sources to highlight the true picture.

## Findings and conclusion

Covid19 has created opportunity for the organization to indulge more in CSR practices by promoting social awareness and donating to relief funds. As per gazette notification, “Any company engaged in research and development activity of new vaccine, drugs and medical devices in their normal course of business may undertake research and development activity of new vaccine, drugs and medical devices related to COVID-19 for financial years 2020-21, 2021-22 and 2022-23 subject to the conditions,”. This means not only donation to relief funds but amount spent to help for vaccine development, medical kits etc. will also be considered as CSR activity as per government notification. For example Infosys donated 50 crores to PM care fund and spent extra 500 crore on providing masks, medicines, ventilators, test kits etc.

- Reliance industry limited has contributed total 530 crore towards PM care fund and other relief funds as well. Reliance foundation have also contributed around 5 crore towards Telangana chief minister relief fund. Largest insurance company of India also contributed 100 crores to PM care fund.
- Founder of PAYTM also contributed 5 crore to provide medical help like ventilators and covid testing kits. Beside this Hindustan unilever limited reduced the prices of its soap, hand wash, alcohol contained sanitizers. HUL helped with the amount of 100 crore to defeat the novel corona virus. Along with monetary help, various companies created social awareness among people to maintain social distancing which also comes under CSR.
- McDonald’s, have made their logo “m” separated into two parts “n” and “n” which represent social distancing. In similar way, famous automobile company “Audi” has separated its four rings in their logo to aware people about social distancing. Along with social distancing, brands made advertisement slogans to stay inside. Hindustan Unilever limited run advertisement to spread the message of wash hands frequently for 20 seconds or use alcohol based sanitizers to defeat covid19.

Hence we can say that covid19 has created opportunities for the companies to discharge their responsibilities towards society whose resources they use on continuous basis. Without any doubt, corporates took this opportunity to show that they care for the nation and along with that they expanded their CSR activities as well, which is now a mandatory as per companies act.

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According to report by (<https://economictimes.indiatimes.com/news>), total Rs 7537 crores of amount has been spent within 2 months for covid related concerns, out of which Rs 4316 crore amount is towards PM CARES FUND and rest Rs 3221 crores towards other funds for vaccines, ventilators, medical kits etc.

Above data shows that large amount of CSR spending has occurred for year 2020-2021. Big amount has been contributed towards PM care fund, small companies have joined hands with NGO to provide daily ration and food to needy people during lockdown.

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# A SURVEY ON MATERNAL RISK FACTORS OF NEONATAL MORTALITY

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**Abstract-** The neonatal period which initiates the neonates to adapt the extrauterine life that is separated from the placenta and function independently. There are challenges in survival during this period. Since it is a serious concern for both mother and baby as neonatal phase is the vulnerable to the child's survival.

To identify the issues that has to be occurred in future is to be done using the machine learning techniques. By the use of Machine Learning techniques, predictive analysis is to be performed for this case. Prediction of this case can be done on the basis of the two factors that is mother side and infant side factors. Machine Learning (ML) is the branch of computer science in which the scientific study of algorithms and models based on statistics is performed, that computer systems used to perform a specific task effectively without using the explicit instructions. It relies on patterns and inference to do task. Generally, ML is considered as a subset of Artificial Intelligence (AI). Here learning process consists of 2 phases: estimation of unknown dependencies in a system from a given dataset and use of estimated dependencies to predict new outputs of the system.

**Index Terms:** maternal factors, neonatal mortality, occupation, maternal disease.

## IV. INTRODUCTION

Neonatal Phase is very critical phase for the newly born babies. There are various factors before the birth of baby may be responsible for the problems occurred in the neonatal period. New born babies are called neonates. The period of first four weeks of a child's life after birth is termed as neonatal period. The neonatal period which initiates the neonates to adapt the extrauterine life that is separated from the placenta and function independently. There are challenges in survival during this period. Hence neonatal phase is vulnerable to the child's survival.

The mortality happened within a month after the birth of babies comes under Neonatal mortality. It is measured in number of deaths occurred per thousand live births in a specified period of time that is Yearly, half-yearly, quarterly e.tc. There are different types of neonatal mortality based on which particular day the death happened. If death is happened within first seven days of life after birth then it falls under the perinatal mortality, and if death is happened between seventh day and twentieth day then it falls late neonatal mortality.

Since it is a serious concern for both mother and baby as it can be seen in the statistics that it affects severely both mother and infant. To identify the issues that has to be occurred in future is to be done using the machine learning techniques. Prediction can be done on the basis of the two factors that is mother side and infant side factors.

**Table1: Mortality Rates 2019**

Life Expectancy	Rank 165	69.40 Years
Death per 1000	Rank 126	7.26 per 1000
Mortality Rate (< 5 )	Rank 52	48.77 per 1000
Mortality Rate (1-4 )	Rank 52	12.63 per 1000
Infant Mortality Rate	Rank 52	36.60 per 1000

To identify the issues that has to be occurred in future is to be done using the machine learning techniques. By the use of Machine Learning techniques, predictive analysis is to be performed for this case. Prediction of this case can be done on the basis of the two factors that is mother side and infant side factors. By the use of Machine learning techniques, we generally deal with the study of algorithms in scientific manner, and statistical models that is used by computer systems to perform some specific instructions without using explicit instructions relying on inference and patterns instead. The two phases of Learning Process:

- i. In a system, the unknown dependencies is to be estimated from a given set of data in the first phase.
- ii. New outputs of the system are to be predicted using estimated dependencies in the second phase.

It is a multi-disciplinary approach as it is related to various areas that is Statistics, Health Science and Computer Science. [1]

## REVIEW OF LITERATURE

Based on the various studies performed on neonatal mortality, some of the risk factors for neonatal mortality from the maternal's perspective are concluded below:

1. Birth Asphyxia: A condition where body is deprived of oxygen which can lead to unconsciousness or death. It can be determined through type of delivery. This factor is taken in consideration by various authors in their papers. [2][3][4][7][8][9][11][12][13]
2. Prematurity- Gestation Period is the term period for the development of the fetal from the time of conception until birth in terms of weeks. Range of normal pregnancy is from 38 to 42 weeks and if an infant born before the minimum value of range that is 38 weeks considered as premature baby. It can be determined through screening report of Ultrasound (USG). This factor is taken in consideration by various authors in their papers. [1][3][5][7][8][10][11] [15].
3. Occupation- High metal consumption also plays a vital role in the mortality of neonates.

**Table 2: Agents with their side-effects**

Agent	Effects on neonates
Carbon Monoxide	Intrauterine Death, Preterm Birth
Lead	Preterm Birth, , Birth Defects, Low Birth Weight, Fetal loss
Tetrachloroethylene Toluene	Fetal loss
Organic Solvents	Fetal loss, birth defects
Benzene	Low birth Weight, fetal loss
Mercury	Fetal loss
Nitrous Oxide	Reduced birth weight, fetal loss
Pesticides	childhood leukemia , Fetal loss, birth defects, reduced fetal growth , preterm births.
Ethylene glycol ethers and their acetates	Fetal loss and birth defects



This factor is taken in consideration by various authors in their papers. [3][6][7][13][14][15]

1. Parity is the term defined as the number of times that a woman has delivered a foetus with gestational age 24 weeks or more. Multiple gestation is defined as a pregnant woman carrying more than one foetus in her womb. These terms have been taken into considerations by various authors in their papers. [2][7][8][13]

2. Maternal Disease- There are several maternal diseases that can cause the severe effect on neonates. Below is the list of

such significant diseases.

- a. Chronic hypertension
- b. Diabetes before or during pregnancy
- c. Heart Disease
- d. Asthma
- e. Epilepsy
- f. Thyroid (hyper or hypothyroidism)
- g. polycystic ovarian disease
- h. Any others [2][6][7][8][11][12][13][15]

6. Infectious diseases during pregnancy- There are several maternal side infections that can cause the severe effect on

neonates. Below is the list of such significant infectious diseases.

- a. Malaria
- b. HIV aids
- c. hepatitis (A, B or C)
- d. Zika virus
- e. Renal infection
- f. Bladder infection
- g. Pneumonia
- h. Other [7][11]

7. Socio/Demographic Factors- The living standards of the pregnant woman can also be one of the significant factors that

can cause severe effects on neonates. It can be determined on the basis of the following factors.

- a. Education Level

- b. Income
- c. Nutrition [1][2][3][5][7][8][11][12][15]

The above-mentioned maternal factors may have the following outcomes on the neonates.

1. Still Birth
2. Preterm Baby
3. Mortality
4. Morbidity/Congenital Disease
5. Birth Defects
6. Birth Weight
7. Birth Asphyxia
8. Infection
9. Apgar

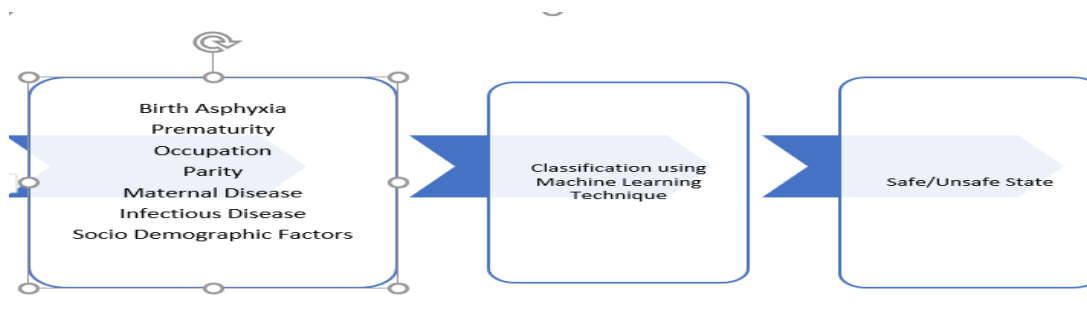


Fig.1. Process Diagram

## CONCLUSION

We can train the model to predict the health issues in neonatal mortality. Claudine Irlles et al. had proposed Artificial Neural Network (ANN) model for maternal morbidities classification. Classification based on the error back propagation neural network was used on NICU data set [16]. In this paper, it is concluded that the neonatal mortality depends on the several factors occurred on maternal side. In this paper, it is limited to the maternal factors for neonatal mortality. In future we can design a predictive modelling with these variables using different machine learning techniques. In future, we can also study the impact of covid-19 on neonatal in case mother has been infected.

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## DESIGN MODIFICATIONS IN E- RICKSHAW FOR COVID-19

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**ABSTRACT-** This review paper focuses on BOSCEV i.e., Battery Operated COVID-19 E-vehicle. Due to the current pandemic, we are facing many challenges and one of the challenges is transportation and traversing from one place to another. This vehicle is to be made so as to solely face the challenge of travel in the current scenario. The design of it and applications of it for why this vehicle is beneficial will be discussed in the paper.

**Keywords:** BOSCEV, Battery Operated, COVID-19, E-vehicle

### 1. INTRODUCTION

Although the novel coronavirus (SARS-CoV-2), the virus that causes COVID-19, has infected more than 24 million people all over the world and left more than 800,000 dead as of this writing, the early projections of mortality were much worse. Fears of millions of deaths by June 2020 have proven wrong—not because the disease is less lethal than anticipated, but because those fears ignored the ability of people to learn and change behaviours. Pockets of resistance against wearing masks and complying with other measures notwithstanding, the global public health response has saved millions of lives. Increasingly, countries are restarting more aspects of normal life while keeping case numbers tenuously in check. Yet the threat to lives and livelihoods persists.

### 2. APPLICATIONS:

#### 2.1 Current Pandemic Point of View:

Talking about India, as the cases are on rise and there is constant fear of the spreading of the virus therefore travelling from one place to another is another big challenge. Therefore, this project is solely playing a key role in improving the conditions of our pandemic, when we will look at this whole project, we can see that it will improve the chances of not spreading of infection.

## 2.2 From environmental point of view:

When we look at the automobile usage, we can see that it's been almost a decade we are using vehicles which uses fuel like petrol, diesel etc. From recent years, As the scientists and public are getting aware of the rise in pollution levels therefore, they have introduced CNG fuel as an alternative which is good but release some fumes as well. But if we talk about e-vehicle, we know we have three types of them: Here we will be using the third type that is Battery electric where we will only be using battery where there will be no harmful fumes produced and hence no pollution is there.

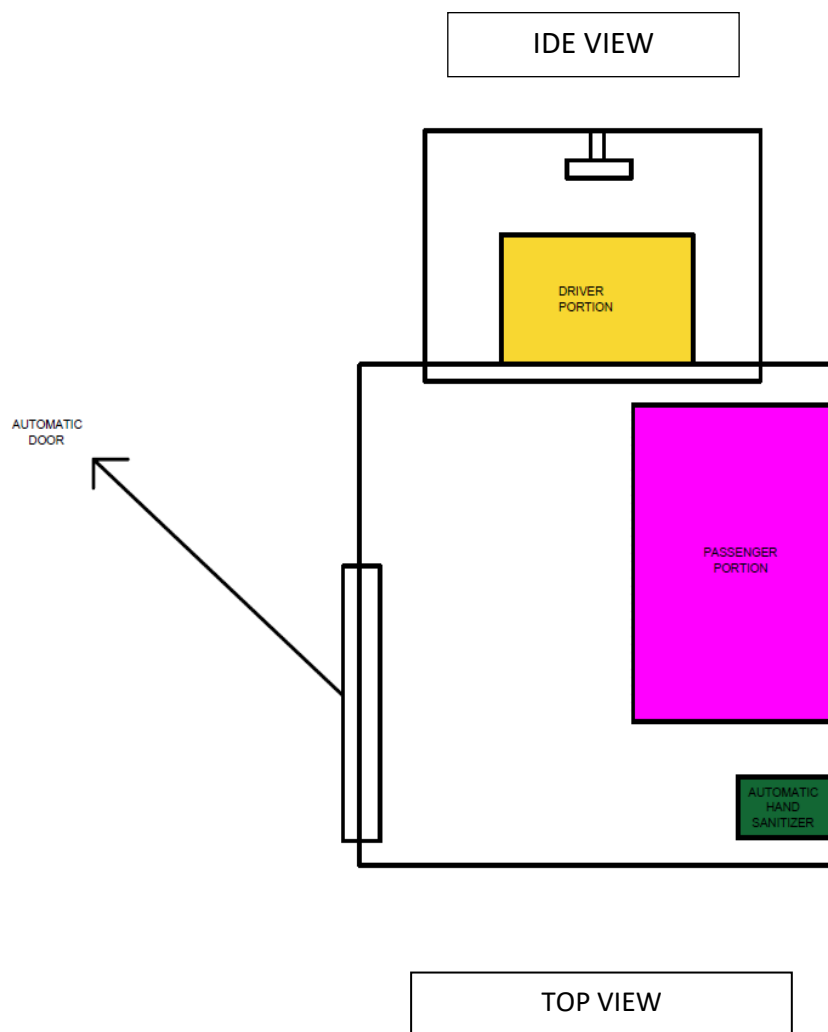
Fumes which result in pollution are: Nitrogen oxides, Carbon Monoxide, Particulate matter, Carbon dioxide etc.

1. This vehicle will have various advantages which is described as follows:

- a) Has various health benefits.
- b) Quieter
- c) No use of fuel, then no emission
- d) It's cheaper to maintain
- e) Safety improvement
- f) Cheaper to run

## 2.3 Designing the E-Rickshaw





The portions for both the types of e-rickshaw that is one seater and two is seater is mentioned as follows:

- Driver portion where the driver is seated.
- Passenger portion where the passenger is seated.
  - & In this portion we have installed automatic hand sanitizer inside of the e rickshaw right by the seat which is on the right side of the e-rickshaw.
  - & The sieve-like structure is installed on the side of the automatic door facing opposite to the driver portion of the e-rickshaw.
  - & All the four walls of the e – rickshaw which is made of foldable material as mentioned earlier.
  - & In this passenger portion there is the automatic door for entering into the rickshaw. This automatic door will sense the person and will gain entry. The door can also be operated manually in case of an emergency situation occurs or if there is any malfunction in the sensors. The entry is provided from the left side of the e-rickshaw.

**COST:**

- 5) Whole e-rickshaw cost- Rs 80,000/-
- 6) Automatic door with sensors- Rs 20,000/-
- 7) Automatic hand sanitizer- Rs 6,000/-
- 8) Transparent High-density polythene sheets for walls- Rs 3000/-
- 9) Fibre glass E-rickshaw FRP proof- Rs 2000/-
- 10) Other furnishings -Rs 9000/-

**3. CONCLUSION**

- Travel is the most crucial part in this scenario where we have to face both the challenges the COVID pandemic and the rising pollution levels.
- Our vehicle BOSCEV is the solution to safe travel. It's a one-seater e-rickshaw where we have installed the automatic hand sanitizer, automatic door just to ensure the safety of the passengers.
- Sanitizer is used to kill germs on hands next we have automatic door so that the person doesn't have to touch the door by hand. The walls of the e-rickshaw are made from high density polythene which will act as barrier from the outer surrounding's. Also, as it is battery operated therefore there is no fuel emission which will take place therefore reducing the pollution levels.

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## MINI AMBULANCE FOR PATEINT DURING PANDEMIC

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**ABSTRACT-** This review paper focuses on BOSCEV i.e., Battery Operated COVID-19 E-vehicle. Due to the current pandemic, we are facing many challenges and one of the challenges is transferring / travelling of patients from one place to another. The design of it and the how it will help in dealing with the current scenario will be discussed in the paper.

### 1. INTRODUCTION

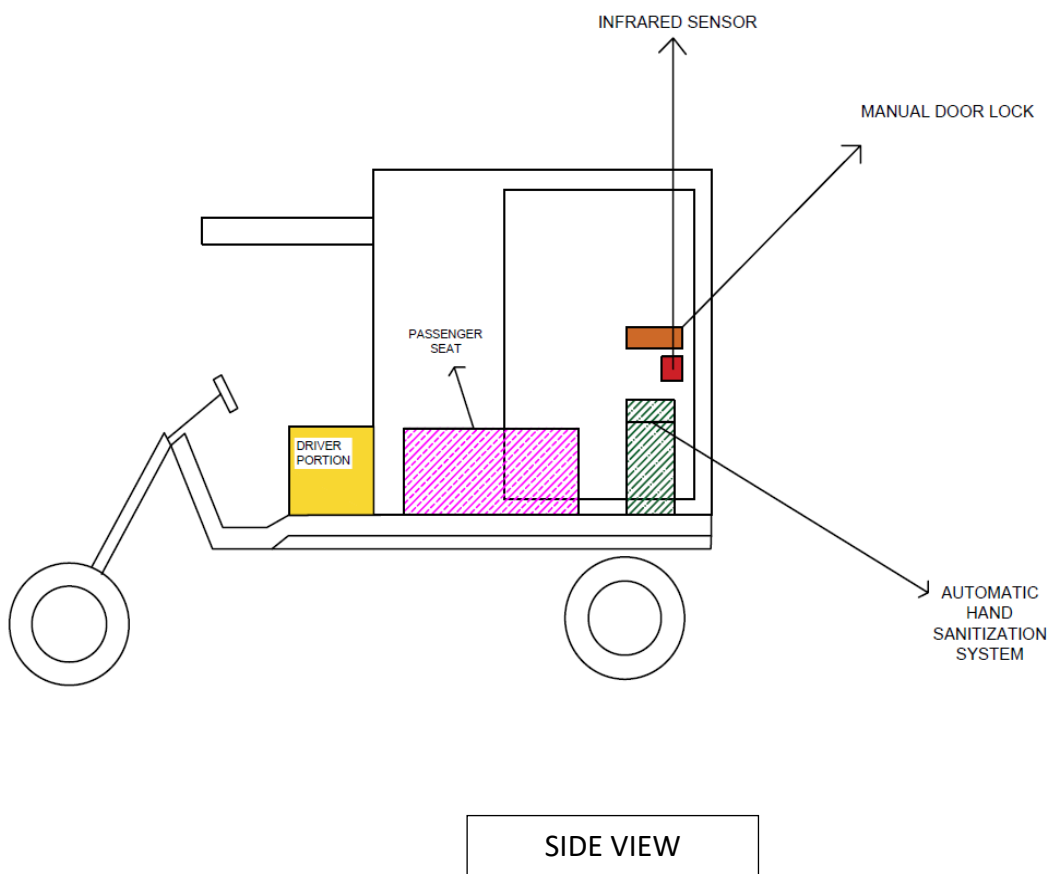
Although the novel coronavirus (SARS-CoV-2), the virus that causes COVID-19, has infected more than 24 million people all over the world and left more than 800,000 dead as of this writing, the early projections of mortality were much worse. Fears of millions of deaths by June 2020 have proven wrong—not because the disease is less lethal than anticipated, but because those fears ignored the ability of people to learn and change behaviours. Pockets of resistance against wearing masks and complying with other measures notwithstanding, the global public health response has saved millions of lives. Increasingly, countries are restarting more aspects of normal life while keeping case numbers tenuously in check. Yet the threat to lives and livelihoods persists.

### 2. APPLICATIONS

#### 2.1 Current Pandemic Point of View:

Talking about India, as the cases are on rise and there is constant fear of the spreading of the virus therefore travelling from one place to another is another big challenge. Therefore, this project is solely playing a key role in improving the conditions of our pandemic. Looking at our current situation we are lacking ambulances as the cases are on its rise.

#### 2.2 Designing of The Ambulance



The portions for both the types of e-rickshaw that is one seater and two is seater is mentioned as follows:

- Driver portion where the driver is seated.
- Passenger portion where the passenger is seated.
  - & In this portion we have installed automatic hand sanitizer inside of the e rickshaw right by the seat which is on the right side of the e-rickshaw.
  - & The sieve-like structure is installed on the side of the automatic door facing opposite to the driver portion of the e-rickshaw.
  - & All the four walls of the e – rickshaw which is made of foldable material as mentioned earlier.
  - & In this passenger portion there is the automatic door for entering into the rickshaw. This automatic door will sense the person and will gain entry. The door can also be operated manually in case of an emergency situation occurs or if there is any malfunction in the sensors. The entry is provided from the left side of the e-rickshaw.

### 3.CONCLUSION

The traversing of the patients is the must in the scenario and as the condition is worsening day by day the need of the ambulances is a necessity. This project will act as the mini ambulance plus the cost of making it is also budget able. And hence could help the hospitals in this time of need.

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## **Dynamics influencing the transferral patterns from traditional Television viewing to Over-The-Top platforms in Delhi NCR during Covid-19 times**

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### **Abstract**

This research paper shows the effect of Covid-19 on the home viewing patterns among the residents of Delhi NCR. The traditional pattern of television viewing has been transformed into mobile viewing, and a huge part of this is contributed by various Over-the-top platforms and the advantages of viewing them. People across the world is fast adopting this new method for own viewing pleasure, and the people of Delhi NCR are not any different to this. This study clearly shows the changing patterns towards new viewing experience and the reasons for it. Television watching phenomena is a popular way to get information and entertainment, but the flexibility of Over-the-top platforms with all their advantages is fast turning the traditional television viewers into Over-the-top users. This study is focusing onto the people who reside in Delhi NCR and their reasons for adapting this new pattern and also add the Covid-19 influence to this.

Keywords: Covid-19, traditional television viewing, over-the-top platforms

### **Introduction**

The pattern of people getting information and be entertained is dependent on various factors since centuries. Times were those when people used to meet others face-to-face for communication and others means of entertainment. Then print media and audio-visual media took their positions and times. After that with the advent and mass use of internet has enabled people to come up with new ideas of having information and entertainment.

It can be noticed that even traditional media are also coming up with various augmented products to serve the people more closely so that they don't leave any stone unturned to their competitors. And that shows the vast and fast adaptability of Over-the-top platforms among the masses. According to the Global Web Index report - India's streaming market is one of the biggest and



fastest-growing in the world with biggies like Voot, AltBalaji, Zee5 and MX-Player. India's video market is valued at over \$700 million and is expected to grow to \$2.4 billion by 2023, with the Over-The-Top industry projected to have the highest growth. That clearly shows how fast people of our country are getting adapted with the new viewing pleasure, and of course, Delhi NCR (comprises of Gurugram, Noida, Ghaziabad and Faridabad, among others) are not any exception because of huge population.

Some popular International as well as some Indian platforms is the biggest contributors in this field with innovative programmes, movies, news etc. These overcome the barriers of language and culture to be adopted by people, especially in Delhi NCR, a place of cosmopolitan population. It is also noticed that during the time of Covid-19 lockdown people had time in their hand after finishing their official and other domestic functions. That pushed people to watch television and use other means of entertainment. Getting familiar with Over-the-top platforms was another way people started exploring, and found the advantages. These new found advantages accelerated fast adoption of these platforms into their regular viewing.

The timings of lockdown and thereafter have given ample opportunity for the Over-the-top platforms to release newer shows, which are interesting, concept-based and also catered various age-groups. Having individual mobile phone sets with high-speed internet and getting more free time to spend alone have worked as push factors among the viewers of Delhi NCR. The lockdown period started in the month of March and gradually unlocking phases are going on till the paper being written in the month of December of 2020. Schools, colleges, universities along with some other educational institutions are yet to be opened. Some others fields have not opened for the employees to go to their workplaces physically and all the woks are being done on online basis. And this has enabled people to have more time to spend in watching their kinds of programmes on these platforms.

### **Review of Literature**

The internet is reaching a common man today, and social media played an incredible role in the media as narrated in Impact of advancements in technological aids in communication media in bringing about social reformation, by Patel K.,2018. Pattern of media intake behaviour of the handlers that higher percentage of Audience watched content in night and at a two-hour daily basis (Paramveer Singh,2019). The latest climb was a subject to research that did the media habits and

watch time drastically altered during the lockdown times, as much time was being spent with family members. Paramveer Singh's research also shows that watching movies and web-series habits were respectively first and second preferred content and the viewers were already broadening in the previous years as reported by Kantar, a research firm. According to that research conducted in 2019, also highlights that averaging 35-44, and 45-54 age groups increase in Over-The-Top viewership consumption respectively at 18% and 63%. And the wider viewers already showed their interest in subscription-based platforms. Dr. Sabyasachi Dasgupta and Dr. Priya Grover, in another study in 2019 suspected that although viewers have started investing a lot of money and also time on Over-The-Top platforms, it is not easy to come to a conclusion that it will replace television as a primary video watching platform. It was reported in CNBCTV18, Apr 16, 2020, that as per to Google Trends report some leading Over-The-Top platforms like Disney + Hotstar and Netflix were the most-searched Over-The-Top platforms starting from March 1 2020. Daily average viewership of Amazon Prime Videos too registered an increase of whopping 83%, which meant there is an ever-growing appetite for Content-Consumption pattern since the lockdown period.

Incidentally if there is an industry which wouldn't like the lockdown periods to end, it's undeniably the OTT players. Due to epidemic "Corona Virus" that spread in almost all over the globe, and almost everyone facing the Pandemic "Lockdown" situation in which no one is allowed to go outside of home, means spending almost whole time inside homes with family and gadgets. And naturally, the more people stay at home, the more people find themselves glued to the screens. Now, with no film releases in sight because of the shutdown of cinema halls and shoot of Television shows stalled across the country, what everyone is finding solace in are the Over-the-top platforms. In fact, web shows have become the best tool for people to ward off their boredom, and these platforms, too, are ensuring that the viewers' spoilt for choice. This just not increased the OTT in the number of viewership but also changing the viewers' watching habits. According to some recent surveys by mobile marketing platform In Mobi, the viewership for movies, especially, has gone up across the platforms. Cinema streaming service MUBI has seen a 28% rise in viewership on its platform in March, as compared to February, reported Financial Express, Apr 06, 2020.

OTT media and its growth have been like a revolution. Its initial entry into the Indian entertainment scene is a fascinating topic to study. In 2012, there were only a few OTT media platforms, but now, as of Jan 2020, the number is about more than forty. In 8 years, this is an incredible growth both in terms of a business and an industry. So, now the question comes that what led to this growth? Some of the key factors are: 1) Urbanization and westernization of the population – continuation of migration to larger urban centres and this pattern of shift in culture in methods and types of usage of media people consumed. 2) Access to digital devices – prominent rise in the number of mobile and other digital device users (more or less 402 million smartphone users as of the month of February 2020). 3) Improved infrastructure – improved internet connectivity. 4) Convenience – USPs like limited promotional videos, absolutely no advertisement options and Pause-Play options have captured the population.

The OTT industry in India is populated both with local and global players with heavy competition. The next OTT revolution is all about gaining supremacy in both market share and revenues in the Indian market. The industry includes traditional media streaming companies, platforms run by Television channels and video show production houses. Some of the leading players holding the reigns of the industry are Disney+Hotstar – with approximate 300 million active users; ZEE5 – 60 million active users; Amazon Prime video – 13 million active users; Netflix – 11 million active users. All these companies over the times have estimated the preferences of viewers and have invested hugely in original, diverse, and high-quality content focusing on a mix of sports, movies and shows in different provincial languages and dialects. This has attributed to the success and steady growth in the industry.

The COVID19 pandemic wreaked havoc in businesses and industries across the globe. The media and entertainment industry, which relies heavily on advertisement spend and on groundwork, was one of the worst affected in the country, staring at losses of about twenty five thousand crore Indian Rupees. During this pandemic and harrowing experience, respite if any, was found through the OTT platforms. With the whole population confined at home due to lockdown, the demand for quality and diverse content shoot up, and a subsequent rise was seen in the number of subscription and revenue for these platforms. With movie screens and malls closed for more than six months and counting now, movie production houses are left with no options but to look to OTT platforms

for releasing their films. Some films like Gulabo Sitabo, Angrezi Medium, Penguin, Ponmagal Vandhal, etc. in which high-profile and popular actors have worked, have been releases only on these selected platforms. With the disruption brought about by Covid-19 situation, almost every business is going virtual trying to have their presence on the digital front, online video streaming is no exception. The shift towards digital and varied contents is so evident that certain job roles and profiles such as ad executives and marketing consultants have been replaced by copywriters and content strategists. With some of the state governments announcing the opening of movie screens in theatres and malls with social distancing norms, it will be interesting to see how the OTT platforms and the production houses re-strategize their distribution and content models.

Manisha Pandit, Kajal Parmar in their paper “Evolution of Mediated Youth Culture: OTT as ‘New Television’ in India” showed that people across various ages, especially the youths have revolutionized their usage of mobile phones and smartly using the internet in this cause. This is also discussed how the behavioural patterns of the youths have given opportunities to the Over-the-top platforms to design their choice of programmes which have attracted more youths to start using these platforms.

Jacob Jose R in his paper, Factors influencing the shift from traditional TV to OTT platforms in India, discussed about the factors directly involved into reshaping the interests of the viewers to shift from traditional media, like television etc. to Over-the-top platforms to feed their interests of watching videos on different subjects.

### **Objectives of Study**

This study fulfils the below written objectives –

- Understanding the utilisation of time-patterns of the residents in Delhi NCR during Covid-19 lockdown and thereafter.
- To find out viewing pattern of television and other means of getting information and entertainment before, during and after the lockdown period.
- Assessing adoption of Over-the-top platforms and the reasons.
- Contribution of Covid-19 in adoption of Over-the-top platforms among the residents of Delhi NCR.

### **Findings**

The overall studies and interpretations can be compiled as these findings

- Internet based video streaming is getting popularity everywhere and Delhi NCR is no exception.
- The advantages of online video platforms have variety of shows catering to different interests of the viewers across age-groups.
- Over-the-top platforms are getting popularity and the cliental bases are growing at a fast rate.
- Covid-19 lockdown has given opportunity to the people to explore beyond the traditional way of watching videos.
- Comparatively cheaper internet packs and advanced Wi-Fi systems, plus smartphones have contributed the increase in the total number of Over-the-top platform users.
- Covid-19 pandemic increase the scope of further growth in the semi-urban areas too, including some NCR localities, with digital payment methods too on platforms.
- At present, some areas have connectivity issues at times, and that may work against expansion of various Over-the-top platforms.
- The growth of adoption of Over-the-top platform among the users has been accelerated more because of the variety of choices of programmes.

## Conclusion

With all these interpretations, from the above written research papers and newspaper articles, it is clearly shown the acceptance and consumption of Over-the-top platforms among the people across the globe and with India as no exception. Residents of Delhi NCR sum up to a total of millions have also started shifting their interests in adopting and increasing the watch of different Over-the-top platforms. The power of these Over-the-top platforms with their varied programmes catering to many age-groups cannot be denied and traditional media are also feeling the heat, as their viewership and time-spend is decreasing. The beginning of many such platforms with their focus towards different interest groups have also initiated new users to adopt these platforms, even beyond regular YouTube watching habits. Paid subscriptions of these platforms have also cut down total time of viewing the exact programmes comparing to television watching with a lot of commercial breaks. These advantages are direct contributors in sharp increase in the Over-the-top subscriptions.

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**IMPACT OF COVID-19 ON CHILDREN'S EDUCATION**

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**ABSTRACT**

The COVID-19 pandemic is spreaded all over the world. This pandemic has resulted to the closure of all educational institutions all over the world. Governments of many countries decided to temporarily close educational institutions in an attempt to reduce the spread of [Covid-19](#). This pandemic situation is more critical for children and their families, causing online learning, compromised nutrition, children health problems, and consequent economic cost to jobless families. The COVID-19 pandemic created so many new challenges for parents to support their children for a different school experience. Now Teaching and learning is moved to online, on an untested and unprecedented scale.. Children and parents are facing so many issues and challenges during online process of learning. Schools are the main source of social interaction for children when schools are closed, many children and youth lost the face to face interaction that is essential to learning and development. This pandemic is also responsible for making the children addicted to the internet that gives a negative effect on children health. This paper will study the positive and negative impact of COVID 19 on children's education and also suggest the measures to overcome the issues and challenges facing by children for their education during this pandemic situation. This paper is based on secondary data.

**Keywords:-Covid-19, Children's Education, Positive and Negative Impacts, online learning**

**Introduction**

The COVID-19 pandemic has resulted to the closure of all educational institutions all over the world. . This pandemic is spreaded all over the world. The Corona virus has created many problems to the parents with new challenges on how best to prepare and support their children and adjust their daily routine in this year. With many schools across the country suspending in-person education, parents are providing more direct care for their children for online learning. Many families are experiencing economic crisis resulting from the pandemic. Student assessments are also done through online, with a lot of trial and error and uncertainty for everyone early in the pandemic at the start of the pandemic; many parents are educating their child at home. The government decided to temporarily close educational institutions in an attempt to reduce the spread of COVID-19 between students. This impact was not only on students, also for teachers, and

children's families of their economic and social consequences. The impact was negative for children and their families, causing interrupted learning, compromised nutrition, childcare problems, and consequent economic cost to families who could not work. Most of children were adversely affected by the COVID19 pandemic, and the greatest impact could be on those in poor socioeconomic groups, who are already vulnerable and disadvantaged. However, some positive changes could also come out of this global crisis (Sonia Gupta2020). Some major Actions should be taken to address the physical and mental health effects of the COVID-19 crisis among children.

### **OBJECTIVES OF THE STUDY:-**

1. To study the impact of COVID 19 on children's education.
2. To examine the positive and negative impact on children and suggest the measure to overcome the negative impact on children.

### **Problem Statement:-**

Although there are some positive impact on children's Education but there are some negative effects on children education and their health, which resulted in a less effective education and addiction to social media.

### **RESEARCH METHODOLOGY:-**

This paper studies the positive and negative impact of COVID 19 on children's education. This paper is based on a descriptive study. We used only secondary data in this research.

### **REVIEW OF LITERATURE:-**

- **Simon Burgess, Hans Henrik Sievertsen**( 01 April 2020)The impact of COVID-19 on education,says that all interruption related to online learning can also have long-term consequences for the affected cohorts and are likely to increase inequality.
  - **Richa Choudhary**( **April 16, 2020**), 09:45 IST,COVID-19 Pandemic: Impact and strategies for education sector in India , **says that** A multi-pronged strategy is necessary to manage the crisis and build a resilient Indian education system in the long term.
  - **Richard Blundell ,Monica Costa Dias** ,**published** :(27 June 2020) COVID19 and Inequalities, they seems likely that the current crisis will leave legacies that will impact inequalities in the long term.
  - **Sonia Gupta, Manveen Kaur Jawana** (**July 2020**) has concluded the COVID19The impacts of COVID19 on children, pandemic will have a far reaching, long term impacts on children worldwide.
  - **Ritwik Ghosh,Mahua Jana Dubey**, (**July 2020**),[Minerva Pediatrica](#) 72(3):226-235,DOI: 10.23736/S0026-4946.20.05887-9, Project Impact of COVID-19 on children: Special focus on psycho-social aspect,: [COVID-19](#) are saying that Parents, pediatricians, psychologists,
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government and all concerned group have an important roles to play to reduce the psycho social ill-effects of COVID-19 on children.

- **Ileksander Aristovnik and Lan Umek,19 August 2020** / Revised: 28 September 2020 / Accepted: 6 October 2020 / Published: 13 October 2020 Impacts of the COVID-19 Pandemic on Life of Higher Education Students: A Global Perspective, they suggested that higher education institutions around the world should formulate some policies, recommendations and strategies to support students to reduce the impact of this pandemic.
- **Abbey R. Masonbrink, MD, MPH, Emily Hurley, PhD, MPH(2020)** "Advocating for Children During the COVID-19" School Closures have concluded that we must prioritize research and careful planning to guide safe and equitable plans for school re-openings, advocate for development of a good education system, and additional supports for children with disabilities.

### **IMPACT ON CHILDREN'S EDUCATION**

The COVID-19 pandemic presented parents with new challenges on how best to prepare and support their children for a different school experience due to learning moved to online. Most of the parents felt overwhelmed by their responsibilities to educate their children at home and some felt they did not have the resources they needed for at-home education. Families also faced the cost of broadband services because of the downturn in the financial condition and economy.

Due to closure of the schools and institutions that results in negative impact on children's education here are some negative effect on children's education.

#### **Negative Impact**

- Children are addicted to the internet and social media due to school closures, many children will be actively encouraged to go online to continue their education.
- Anxiety and Nervousness:-Children feel anxiety, nervousness, high strung or tensed because they are socially disconnected from the school environment.
- Insecurity about future:-Examinations have been postponed or cancelled as a result of the pandemic, and some children could be anxious about their future. These issues could also delay further education or the start to their working life.
- Many school-age children faced hunger as the pandemic continued because they were provided meals from the schools.

- Health issues are also occurring due to online learning platforms. Children are not engaged in outdoor activities and mostly children have increased their weight and eyesight disorders. Vitamin D deficiency could make children more vulnerable.
- Children are bound to miss interacting with their own peer groups, and we fear that being deprived of their company for any length of time will lead to their behavioural changes.
- Schools also provide the social and competitive and extra-curricular activities to the children so that many children play, enjoy and interacting with children from different area, help them to adapt to diverse environments and develop social connections so it creates a lack of competitive environment.

### **Positive Impact**

- Increased childhood development:- children who have access to the internet getting the opportunity to learn educational methods that will benefit them later in life. They could also get involved in different physical, learning and creative activities during school closures that will help them to develop new technical skills.
- Developed closer relationships with family:- Spending time with their family could help some children to develop closer relationships with them and being aware of the impact of the pandemic could also help children to develop more humanity and empathy, as they realize the value of human life.
- Less Polluted Environment:- children are now living in less polluted environment which will help them not to face any breathing issues.
- COVID 19 also provides opportunity to the children to enter in the new world of education to make them expertise in different areas.

### **Ministry of Education has taken several initiatives to ensure easy online learning for children during COVID-19 pandemic**

1. Diksha (Digital Infrastructure for Knowledge Sharing) a national digital platform for children's education has been launched by government.
2. VidyaDaan was launched in April 2020 as a national contribution program that allows contribution/donation of e-learning resources for school children's education by educational bodies, private bodies, and individual experts.

3. Swayam Prabha DTH channels are made to support and reach those students who do not have access to the internet. 32 channels are devoted to telecast high quality educational programme better online education.

4. E-textbooks are also available for using e-Pathshala web portal and mobile app (Android, iOS, Windows). More than 600 digital books including 377 e-textbooks (grades 1 to 12) and 3,500 pieces of audio and video content of NCERT are available in the public domain in various languages (Hindi, English, Sanskrit and Urdu).

5. MANODARPAN' is presented to provide psychosocial support to students, teachers and families to protect the mental health of children.

6 .PRAGYATA guidelines have been developed with a focus on online/blended/digital education for students who are presently at home due to the closure of schools. The guidelines recommend screen time for different categories of students.

Government has taken many initiatives for better online learning of children's education but still there are some problems facing by children and their families.

### **Conclusion**

There is a great need for more research for developing the best policies, procedures and should implement the effective strategies which can leads the best children's education worldwide and also protect their physical and mental health of the vulnerable children in this pandemic situation. COVID19 pandemic will have long time impacts on children's education worldwide. Although some impacts are positive, but we believe that the negative impacts will be devastating and could affect millions of children in some way. International health-care organizations, children's welfare organizations and governments need to take some effective steps to minimize the negative impact on children's education and create positive environment in this pandemic situation.

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# **POSITIVE AND NEGATIVE IMPACT OF COVID-19 ON HIGHER EDUCATION INSTITUTIONS**

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## **ABSTRACT:**

COVID-19 was originated in Wuhan, China and affected the whole economy of the world. This study explains the effect on higher education which not only happens in Wuhan, China but affects all around the globe. Total 188 countries' higher education institutions were affected worldwide. Due to COVID-19 world faces most negative effects but there are some positive effects also which help towards favourable outcomes. There was an estimate that the world will grow digitally after 2023 but after this pandemic four corners of the world will get this digital success in 2020 only. In this research we analyse positive and negative impacts which are faced by higher education institutions.

Previously students were used to think that online education is not producing results/ incompetent but now with the help of digital learning platforms, the situation has changed. Earlier, students didn't get much time for study but now due to online classes they have plenty of time and they can study on a routine basis which results in efficiency in education.

**Keywords:** Teaching learning process, COVID 19, positive and negative effect on higher education institutions.

### **INTRODUCTION:**

COVID-19 has positive and negative impacts on higher education such as serious impact on mental health of students and online interaction of teacher and student helpful in this pandemic. Homogeneity in academic year timing is suffered, sessions dates get suffered. Face-to-face personal classes are banned around the world from march/april. The paper is based on secondary data. Literature review has been done for this purpose.

### **LITERATURE REVIEW:**

After COVID 19, teaching learning is avoided in physical mode all over the world. Let's discuss some positives and negatives which affect higher education institutions. (1) Teachers are taking classes through digital mediums such as social media, national television, zoom, G meets, Microsoft teams, youtube etc. (2) Holidays are also reduced which results in regular online classes. (3) Teachers and students both are upgraded themselves in this digital era. (4) Now students' study from home so they have plenty of time for self-study which results in them being able to study continuously and get more efficiency in assessment tests. (5) Although in this new era male and female get equal opportunity in every field but due to restrictions in some areas females are not able to study in colleges because of

security reasons. After COVID-19 digital platform helps in female empowerment now females can study after schools and continue their study on digital platforms. (6) Digital platforms save the travelling time of students, now students can study with their favourite faculty member at their home safely. (7) Previously students have gone far from their families to study in good institutes but now they can study at their homes without going anywhere which results in savings in accommodation expenses which students have to pay when they go away for further studies.

As you all know with some assets there are liabilities also which affect higher education after COVID-19. (1) Homogeneity gets suffered due to COVID 19 as session dates got disturbed and timing of the

academic year and holidays at education institutes got suffered. (2) Autonomous learning also increases which affects grades of students. (3) In online assessment tests students start cheating with their peer students and discuss the test on conference calls. (4) Previously students got comfortable with face-to-face teaching process but after COVID-19 face to face is banned by education institutions which leads to demotivating introverted students, they feel shy in asking doubts in online classes. (5) Covid-19 effects the mental health of the college students because they are conscious about their future, concern about health of their own families which leads to difficulty in concentration on studies, disruption in sleeping pattern, social isolation results in depression, face financial difficulties, due to all this any students having lots of depressive and suicidal thoughts.

**OBJECTIVES OF STUDY:**

1. To analyse the positive and negative impact of COVID-19 on higher education institutions.
2. To analyse the impact of COVID 19 on learning strategies of students.
3. To compare the learning strategies of students before COVID 19 and after COVID 19.

**FINDINGS:**

1. Digital learning gives a hike to the IT sector.
2. E-learning helps teacher and student interaction without any distance barrier.
3. Online content is available on MOOC.
4. Online teaching tools are helpful in learning and improve teaching standards.
5. COVID 19 pandemic increases the scope of e-learning with digital platforms.
6. With some benefits there are disadvantages also such as poor network.

**CONCLUSION:**

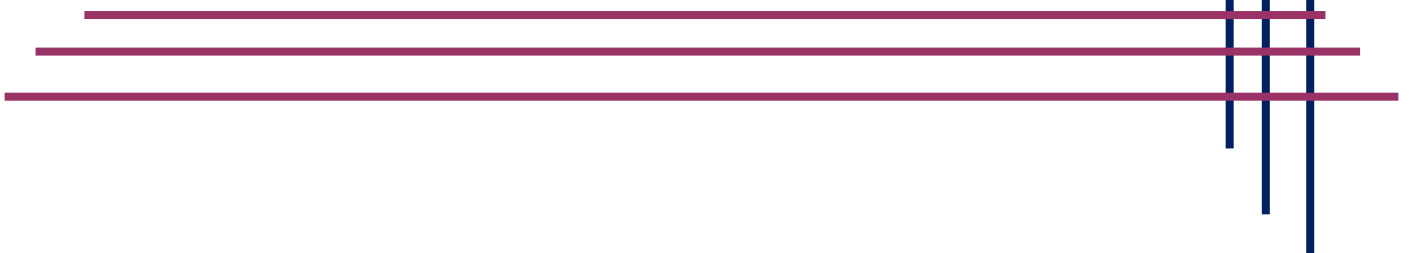
Although there are many positive effects in online learning, there are some drawbacks too. If students scored less it will lead to autonomous learning and if scored more it will lead to cheating, which resulted in less effective teaching. Covid-19 is a long lasting pandemic and the measures we are taking such as lockdown and stay at home bring stress and anxiety among college students which results in a negative Impact on higher education. To improve this situation higher institutions should change in curriculum and make it more interesting which results in improvement in mental health of students, more efficiency in students work and dedication towards students.

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THEME-VII

ADVANCES IN  
COMPUTATIONAL TECHNIQUES  
AND ARTIFICIAL INTELLIGENCE





## Quantile Based Shannon's Entropy

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**Abstract:** – In this paper, Introduce Quantile function which gives us alternate method to find measurement of uncertainty of probability distributions. There are some distribution function which is in closed form means cannot solve directly but with the help of quantile function can be solved. We also introduce residual entropy function in the quantile setup and its properties.

**Keywords:** Shannon entropy Residual lifetime Quantile function Reliability measures Characterizations

### INTRODUCTION

In 1948 Shanon defined entropy. By the help of entropy we find measurement of uncertainty of probability distributions. In recent years, there has been a great interest in the measurement of uncertainty of probability distributions. . Let  $X$  be a nonnegative absolutely continuous random variable (rv) representing the lifetime of a component with cumulative distribution function (CDF)  $F(t) = P(X \leq t)$  and survival function  $(SF)^-(t) = P(X > t) = 1 - F(t)$ . The measure of uncertainty defined by Shannon (1948) was

$$\xi(x) = \xi(f) = -\int_0^{\infty} \log(f(x))f(x)dx = -E(\log(f(x))) \quad (1)$$

where  $f(t)$  is the probability density function (PDF) of  $X$ . Eq. (1) gives the expected uncertainty contained in  $f(t)$  about the predictability of an outcome of  $X$ , which is known as Shannon entropy measure. Length of time during a study period has been considered as a prime variable of interest in many fields such as reliability, survival analysis, economics, business, etc. In such cases, the information measures are functions of time, thus they are dynamic. Based on this idea, Ebrahimi (1996) defined the residual Shannon entropy of  $X$  at time  $t$  as

$$\begin{aligned} \xi(X; t) &= \xi(f; t) = -\int_t^{\infty} \left(\frac{f(x)}{\bar{F}(t)}\right) \log\left(\frac{f(x)}{\bar{F}(t)}\right) dx, \\ &= \log(\bar{F}(t)) - \frac{1}{\bar{F}(t) \int_t^{\infty} f(x) \log f(x) dx} \end{aligned} \quad (2)$$

Note that  $\xi(X; t) = \xi(X_t)$ , where  $\xi(X_t) = (X - t | X > t)$  is the residual time associated to  $X$ . By writing  $h(t) = f(t)/\bar{F}(t)$  the failure rate function of  $X$ , can be written as

$$\xi(X; t) = 1 - f(x)/\bar{F}(t) \int_t^{\infty} (\log h(x))f(x)dx \quad (3)$$

A similar function can be obtained in terms of the inactivity time  $(t - X | X \leq t)$  given in Di Crescenzo and Longobardi (2002). Interesting extensions and multivariate forms are also

available in the literature. For additional information on these measures, we refer to Belzunce et al. (2004), Ebrahimi (1996), Ebrahimi and Kirmani (1996), Ebrahimi and Pellerey (1995), Nanda and Paul (2006) and Sunoj et al. (2009). All these theoretical results and applications thereof are based on the distribution function. A probability distribution can be specified either in terms of the distribution function or by the quantile functions (QFs). Recently, it has been showed by many authors that QFs

$$Q(u) = F^{-1}(x) = \inf\{t|F(t) \geq u\}, \quad 0 \leq u \leq 1 \quad (4)$$

are efficient and equivalent alternatives to the distribution function in modeling and analysis of statistical data (see Gilchrist, 2000; Nair and Sankaran, 2009). In many cases, QFs are more convenient as they are less influenced by extreme observations and thus provide a straightforward analysis with a limited amount of information. For a detailed and recent study on QF, its properties and its usefulness in the identification of models we refer to Lai and Xie (2006), Nair and Sankaran (2009), Nair et al. (2011), Sankaran and Nair (2009), Sankaran et al. (2010) and the references therein. Although variety of research is available for various measures of uncertainty, a study of the same using QF does not appear to have been taken up. Also, many QFs used in applied works such as various forms of lambda distributions (Ramberg and Schmeiser, 1974; Freimer et al., 1998; Gilchrist, 2000; van Staden and Loots, 2009), the power-Pareto distribution (Gilchrist, 2000; Hankin and Lee, 2006), Govindarajulu distribution (Nair et al., 2011) etc. do not have tractable distribution functions. This makes the statistical study of the properties of  $\xi(X)$  for these distributions by means of (1) difficult. Thus a formulation of the definition and properties of entropy function in terms of QFs is called for. Such a discussion has several advantages. Analytical properties of the entropy function obtained in this approach can be used as an alternative tool in modeling statistical data. Sometimes the quantile based approach is better in terms of tractability. New models and characterizations that are unresolvable in the distribution function approach can be resolved with the aid of quantile approach. Further, an explicit relationship between quantile entropy function and quantile density function in residual time can be derived. The paper is organized as follows. In Section 2, we discuss some useful reliability measures in terms of quantile function. We introduce Shannon entropy function and residual entropy function in quantile setup and study their properties. Section 3 presents characterization results for certain lifetime quantile models based on the residual quantile entropy function.

### Quantile based Shannon entropy

When  $F$  is continuous, we have from (4),  $FQ(u) = u$ , where  $FQ(u)$  represents the composite function  $F(Q(u))$ . Defining the density quantile function by  $fQ(u) = f(Q(u))$  (see Parzen, 1979) and quantile density function by  $q(u) = Q'(u)$ , where the prime denotes the differentiation, we have

$$q(u)fQ(u) = 1.$$

(5)

The hazard rate quantile function is defined by,

$$H(u) = hQ(u) = h(Q(u)) = (1 - u)^{-1}fQ(u) = [(1 - u)q(u)]^{-1} \quad (6)$$

Following Nair and Sankaran (2009),  $H(u)$  explains the conditional probability of failure in the next small interval of time given survival until  $100(1 - u)\%$  point of distribution. Like  $h(t)$  that determines the CDF or SF uniquely,  $H(u)$  also uniquely determines the QF by

$$Q(u) = \int_0^u \frac{dt}{1-t} H(t)$$

From (5), the Shannon entropy defined in (1) can be written in terms of QF as

$$\xi(x) = \xi = \int_0^1 (\log(q(p)) dp \quad (7)$$

Clearly, by knowing either  $Q(u)$  or  $q(u)$ , the expression for  $\xi(X)$  is quite simple to compute. An equivalent definition for the residual entropy (2) in terms of QF is given by

$$\xi Q(u) = \xi(X; Q(u)) = \log(1 - u) + (1 - u)^{-1} \int_u^1 (\log q(p)) dp \quad (8)$$

From (3), we can also write (8) as

$$\xi Q(u) = 1 - (1 - u)^{-1} \int_{u1}^1 \log H(p) dp . \quad (9)$$

$\xi Q(u)$  measures the expected uncertainty contained in the conditional density about the predictability of an outcome of  $X$  until  $100(1 - u)\%$  point of distribution. Further, differentiating Eq. (8) with respect to  $u$ , we get

$$\xi' Q(u) = -\frac{1}{1-u} + \frac{1}{(1-u)^2} \int_u^1 \log q(p) dp - \frac{1}{1-u} (\log q(u))$$

Equivalently,

$$(1 - u)\xi' Q(u) = -1 + \xi Q(u) - \log(1 - u) - \log q(u)$$

Thus

$$q(u) = \exp \{ \xi Q(u) - (1 - u)\xi' Q(u) - \log(1 - u) - 1 \} \quad (10)$$

The relationship (10) determines the quantile density function from the quantile residual entropy  $\xi_Q(u)$ . The relationship (10) is a unique characteristic of  $\xi_Q(u)$  unlike the residual entropy  $\xi(X;t)$  in (3), where no such explicit relationship exists between  $\xi(X;t)$  and  $f(t)$ . Table 1 provides the QFs and corresponding  $\xi_Q(u)$ . Now on the basis of residual quantile entropy (RQE)  $\xi_Q(u)$ , we define the following nonparametric classes of life distributions.

**Definition:-** X is said to have decreasing (increasing) residual quantile entropy (DRQE (IRQE)) if  $\xi_Q(u)$  is decreasing (increasing) in  $u \geq 0$ . Now it is easy to show from the relationship (8) that if X is DRQE (IRQE), then  $\xi_Q(u) \leq (\geq) 1 + \log(q(u)(1-u))$ . From the relationship (9) it follows that if X is DRQE (IRQE), then  $\xi_Q(u) \leq (\geq) 1 - \log H(u)$ . Note that for the exponential distribution,  $q(u) = 1 - \lambda(1-u)$  and  $H(u) = \lambda$  so that  $\xi_Q(u) = 1 + \log(q(u)(1-u))$  and  $\xi_Q(u) = 1 - \log H(u) = 1 - \log \lambda$ . Thus exponential distribution is the boundary of IRQE and DRQE classes.

### Characterizations

Since  $\xi_Q(u)$  uniquely determines the quantile density function  $q(u)$  using (10), the characterizations of  $\xi_Q(u)$  for various distributions can be easily obtained from Table 1. For instance, generalized Pareto family is characterized by the relationship  $\xi_Q(u) = \xi + c \log(1-u)$ , where  $c$  is a constant, for which  $c = 0$  gives an exponential distribution and  $c < (>) 0$  results Pareto II (rescaled beta) distributions, respectively. Characterizations of  $\xi_Q(u)$  for other distributions can be constructed in a similar fashion. Among various QFs given in Table 1, an important one is the Davies distribution proposed by Hankin and Lee (2006). It is a flexible family for right-skewed nonnegative data that provides good approximation to the exponential, gamma, lognormal and Weibull distributions and when  $\lambda_1 = \lambda_2 = \lambda$ , it becomes the log logistic distribution. Table 1 provides  $\xi_Q(u)$ s for QFs that has closed form expressions, however, in some cases only  $q(u)$  that has closed form expression. Accordingly, we prove a characterization theorem using  $\xi_Q(u)$ , for a family of distributions represented by  $q(u)$ .

### CONCLUSION

Through quantile function we can easily find out the solution also we can solve that distributions which is impossible by Shannon formula. Also we get some more properties of quantile function which can be used on different stages and on different distributions.

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## An overview and survey of Agritech start-ups and AI – powered cognitive solutions in Agriculture

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**Abstract-** From pest control to fertilizer and nutrients recommendation, artificial intelligence has been a boon to humanity to confront the biggest challenge of the century i.e., providing food to additional 2 billion people by 2050[1]. With the climate changes disrupting growing season artificial intelligence can help transform agriculture and help farmers to get the maximum from every acre. Technologies like image processing, computer vision and data analytics artificial intelligence (AI) algorithms are efficient to predict how long it would take for the flower to blossom and become a fruit ready for harvesting and packaging. This example shows how AI can transform agriculture. This Paper discusses many such technologies and the start-up spur leading to agricultural revolution. This survey covers more than 40 important contributions which discuss solutions of artificial intelligence framed to encounter problems in the agriculture field. This paper also discusses the work of various start-ups in different subdomains of agriculture that readers are able to capture a multi- dimensional development of various Artificial Intelligence powered solutions during last 2-3 decades.

**Keywords:** Cognitive solutions, Artificial Intelligence, Predictive analysis, Sustainable farming

### 1. INTRODUCTION

Primary source of livelihood in India is Agriculture. According to IBEF (India Brand Equity Foundation) report whooping 58% of Indian population depends on agriculture as their primary source of income. On an estimate 18.53 trillion (US\$ 271.00 billion) is the gross value which was added by agriculture, forestry and fishing in FY18. Market size also looks very promising and growing every consecutive year. During 2017-18\* harvest year, food grain creation is assessed at record 284.83 million tons. In 2018-19, Government of India



is focusing on food grain creation of 285.2 million tonnes. Total area sown with kharif crops in India reached 105.78 million hectares by September 2018.

According to third propel, creation of plant crops is assessed at 314.7 million tons (mt) in 2018-19. Thus sacking second spot in world's biggest natural product makers list. All out horticultural fares from India developed at a CAGR (Compound Annual Growth Rate) of 16.45 percent over FY10-18 to reach US\$ 38.21 billion in FY18. In FY2019 agribusiness sends out were US\$ 38.54 billion. With regards to flavors, India stands apart being one among the biggest maker, shopper and exporter of flavors and zest items. In 2017-18 flavor sends out from India came to US\$ 3.1 billion. In 2017-18 tea sends out from India was recorded as multi year high of 240.68 million kgs in CY 2017 while espresso trades arrived at record 395,000 tons.

As per UN Food and Agriculture organization, world population would increase by 2 billion by 2050 and only the 4% of additional land would be available for cultivation. In this context, current challenge in agriculture has to do more with the assumption that less farming is possible with the help of AI. Lot of computational explorations are happening to build cognitive solutions which can minimize human intervention [2]. AI powered solution gives more accurate and controlled way of farming which replaces repetitive and labor-intensive part of farming. Apart from this cognitive solution also provide guidance about harvesting time, water management, crop rotation, fertilizer recommendations and pest control and so on [3,6]. Sustainable agriculture is the need of the hour with our depleting resources. Precision algorithms help us to build better, faster and cheaper farming solutions by which efficient use of resources is possible.

## **2. Scope of AI in agriculture – Insights upfront**

Below are few key areas where cognitive solutions can benefit agriculture

### **2.1 Robotics**

Recently there is sharp reduction in number of agricultural workers all over world. Despite delays in the harvesting due to shortage of labor, hefty amount of agricultural income is spent on labor charges by farmers. Drones and agricultural robots have lot of significance in precision farming, yield management, farm management, and weed control and so on [3]. Many self-navigating robots have been developed which can help farmers in the fields and reduce human interventions [5]. These intelligent solutions can replace workers for repetitive jobs in plenty of areas. Few are discussed below:

#### **2.1.1 Weed Control**

Many companies are making use of automation and robotics to protect crops from weeds in much efficient way with less human intervention in the weeding process. When herbicides are sprayed on entire field, herbicide resistance increases [7]. Using intelligent robots uses computer vision and ML which can handle this issue efficiently by identifying weeds and spray only on weeds [7]. Blue River Technology has developed robot with precision spraying ability in cotton plantation.

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### **2.1.2 Crop Harvesting**

Farmers are losing revenue because of labor shortage during harvesting period. In strawberry harvesting process, robots are introduced to ease the process by a company called Harvest CROO Robotics. Company claims that their robots can harvest nearly 8 acres in a single day saving hundreds of human hours. Similarly, GRoboMac Company in India has developed robot to work in cotton plantation to pick fully bloomed cotton. Robots equipped with computerized vision and robotic arm locates the precise 3D coordinates of the bloomed cotton from the images of plant and uses vacuum for precision picking [8, 5, 9,10].

### **2.1.3 Seeding and Irrigation**

Plant watering robots and seeding robots are also available in market. Companies like Maker Hour, Sprinkly and Nevon are making seeding and watering robots which detects soil moisture [11] intelligently and does seeding, watering etc. accordingly [1, 13, 12].

## **2.2 Precision Farming Solutions**

Precision agriculture as the name says is application of right amount or precise measure of water, fertilizers, pesticides etc. at the right time to the crop to increase the productivity and yield. It is also the site-specific management system which uses inputs like chemical fertilizers, pesticides, watering system based on the right quantity at right time in right place. By intelligently managing the input resources productivity can be increased without any diverse effects. In near future, there will be shortage of labor for agricultural activities. So, this is the best time to incorporate available information technology and agricultural science together for environmentally sustainable and economic crop production. This gave rise to Precision Agriculture or Precision Farming.

### **2.2.1 Soil and crop health monitoring**

To optimize the potential for healthy crop production and to prevent defective crops, soil analysis is very much essential. Farmers when empowered with in depth knowledge of soil health [14] [15] and its contents find precision farming to be easier [16]. Precision farming solution in particular to crop type is becoming popular [17]. Various expert systems have been developed recently for different crop types. Trace Genomics Company is providing services like soil analysis to farmers. Packages which include a pathogen screening services on bacteria and fungi include a comprehensive microbial evaluation. Based on Madhya Pradesh Gramophone company leverages, AI and ML analyze the soil health and empower the farmers.

### **2.2.2 Crop and fertilizer recommendations**

In accuracy cultivating pointless and extreme utilization of composts can be kept away from if farmers have information to examine, with the goal that one can anticipate continuous significant bits of knowledge on standing yield and ventures [18]. Lack of knowledge about micro fertilizers among farmers is a big challenge in precision farming. Bangalore based Crop

in company uses agri-business intelligence solution to recommend. FarmShots a North Carolina based start-up has built software which uses captured image data and analyses poor nutrition on farms [19] [20] and provide recommendations on where exactly fertilizers are needed and helps to reduce the amount by nearly 40 percent.

### **2.2.3 Pest control**

Extensive research has happened in pest control field with different crop types which has resulted in development of various expert systems [21, 22, 23, 24, 25, 26, 27, 28, 29]. Most of the advancements have been done in pest control field than any other sub domain in agriculture. SkySquirrel Technologies Inc is using drones and computer vision to monitor crop health and pest control particularly in vineyards. It uses AI algorithms to analyze the captured images of vineyard leaves [30] and provides detailed report about crop health and possible pest attacks and control [31]. Company called Intello Labs based in Bangalore is using image processing models and deep learning algorithms to identify pest infestation and build solutions for cure and prevention. Berlin based start-up PEAT has built deep learning application called PLANTIX. This application correlates foliage patterns with known soil defects, plant pests and diseases. Company provides soil restoration techniques and other possible solutions. FarmShots also uses satellite captured images and provide data on pest attack, poor crop health and also detects diseases [30]. Their solutions are available for the use across mobile devices.

### **2.3 Predictive Analysis**

AI prediction algorithms play vital role in agriculture for various reasons. Due to the unpredictable weather changes like drought and excess rainfall, it is hard for farmers to predict the right time to sow seeds and right window for harvesting. A week delay in sowing might result in crop yield reduction and bad harvest.

In collaboration with ICRISAT (International Crops Research Institute for the Semi-Arid Tropics) Microsoft India has developed an app called sowing app with the help of AI which uses business intelligence and machine learning from the Microsoft Cortana Intelligence Suite. Neither farmers have to install any sensors in their field nor have a smart phone to use the facility. The only simple and affordable requirement for the same is that farmers in the group should have phone which can receive text message to take advantage of the facility.

### **2.4 Demand Prediction**

Crop demand prediction is another big challenge for farmers at various times even with good crop yield. Companies like Aibono are one among the very few companies operating in seed – to –fork segment. Aibono is Bangalore based start-up which focuses on demand side. Yield without a price is half the problem solved. And doing supply chain without controlling the product, which perishes every two days, is like a gamble one can hardly win. Company software-based assisted platform for the farmers achieves the twin targets of improving farm yield and farmer's income realization. For this Aibono's platform requires visibility of data from the supply as well as demand-side to achieve the right ratio in real-time. According to

CEO Rajkumar, even a simple study of consumption from a single retail store shelf on a day-to-day basis allows the observer to collect a deep amount of data and understand which products are being consumed and at what speed. A weekly household purchase of food is based on the kind of recipes and patterns of eating we have at home. Likewise, businesses in the hotel and restaurant industry buy produce based on their menus. So, once the process of data capture starts, prediction becomes easy.

## **2.5 Crop yield prediction**

With lot of weather changes like drought, excess rainfall and late monsoons apart from demand prediction yield prediction is also vital. Various techniques of yield prediction have been developed [32, 33, 34, 35]. Companies combine state of the art machine learning algorithms with satellite imagery to create field-scale predictions across millions of parcels for crop type, yield forecast and risk management.

FruitSpec Company provides yield estimation as service particularly for orchards. Company provides two types of reports. First report provides insight on number of fruits and size distribution in given orchard. Second report gives distribution of fruit quantities in that orchard using heat-map technology. Technology uses various feature like colour, population, texture etc. for decision making purpose [36, 29].

Motorleaf Company specializes in AI tools for greenhouse production. Due to recent advancements in technology, greenhouse production has been increased and various expert systems are developed for particular crops. Extensive work has been occurred in climate estimation, data monitoring and control for different crops in greenhouse [37][38][39][40][41][42]. Company claims to have built technology which can reduce error in harvest forecasting by 50% to 70% from the start there by increasing accuracy with time.

### **2.5.1 Weather prediction and crop sustainability**

Where, a Colorado based company is using machine learning algorithms in connection with satellites for prediction of weather and analyze crop sustainability. Based on needs of the client, daily weather predictions are customized ranging from hyperlocal to global. On daily basis company is providing access to its users to nearly billion point's agronomic related data. It has considered various data sources like solar radiation, temperature, precipitation, wind speed etc. It also provides data in comparisons to historic values.

## **2.6 Agriculture Product Grading**

There is need for standards for reliable trading of agricultural commodities across different countries. Agricultural product grading plays important role in this regard. Grading and sorting powered by computer vision and AI based algorithms [10, 43] is used as solution in food industries to overcome labour shortages and to increase accuracy, speed of operation [44, 45, 46].

Gobasco, a company based in north India does real-time data analytics on various data-streams taken from multiple sources across countrywide aided with AI-optimized automated pipelines to dramatically increase the efficiency of the current agri supply chain. Quality maintenance is one among them. Gobasco provides agri produce grading using AI as service to clients along with other agri- supply chain services.

## 2.7 Agri Supply Chain Solutions

In India roughly 70% of the population resides in rural area and more than half of the population farms for living. Despite this huge number, country's productivity is unable to keep pace with global competition and growing demand. One of the main reasons for this major productivity gap is inefficiencies in country's supply chain in agriculture sector. Farmers try to push what they produce into market without the knowledge of demand. This is due to mere absence of demand forecasting in yield and each stake holder like farmer, wholesaler, retailers, and manufacturers are connected weakly and work in silos. In any economic sector logistics play a very important role and in agriculture sector where goods are perishable supply chain becomes much more vital for farmers to fetch optimum price [47].

Gobasco company claims to use various AI and related technologies in different levels of agri supply chain like Transition discovery, credit risk management, Agri- mapping and quality maintenance. Their transaction discovery algorithm does real-time data analysis which works on data from multiple sources from producer/buyer marketplaces and transporters to obtain high-margin transactions. One of the most challenging problems of the current supply chain management is credit default problem. With the help of crowd sourced data, algorithms and analytics help to overcome this critical issue to ensure low risk operations. Combination of satellite image analysis and crowd sourced data using deep learning algorithms produce real-time agri map of commodities with a resolution of 1 sq-km.

Farmers are finding it difficult to fetch fair price for their produce and wide access to markets, meanwhile consumers are compromising on safe and affordable food. Jivabhumii Company has developed solution called 'FoodPrint' which is a produce aggregation and traceability solution which aggregates farm produce, provides e-marketplace services to clients and implements traceability. It captures comprehensive data about commodities which will be pushed through block chain which generates digital identity for agriculture products/commodities and eventually build traceability. This also helps in demand driven circulation of commodities from farm to table.

### ✓ CONCLUSION

With the huge amount of data available from satellites and drones on regular basis, potential of AI and ML algorithms to predict weather changes and explore vast opportunities is growing. Farmers are turning into entrepreneurs who make satellite machine vision applications very common for industrial farms in upcoming years. Usage of drones in Indian agriculture is

increasing which has resulted in roughly 35 drone-based start-ups. With AI powered solutions finding space in Indian agriculture, it is also important that farmers are empowered with good training on up to date technologies and easy access. Agriculture which is heavily dependent on unpredictable weather changes and many unassessed risks, technologies like computer vision, AI and data science analytics come as boon. With the immense value, it can add to agriculture, it is evident that more of AI powered solutions will be in the market in upcoming years.

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# REAL TIME MONITORING SYSTEM IN MANUFACTURING USING IOT & MACHINE LEARNING: A REVIEW

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**Abstract:** During the manufacturing process the quantity of sensor data will be increased and to satisfy the demand for high-quality products and decision-making monitoring systems play an important role. In this paper, real-time monitoring utilizes IOT-Based sensors, Big Data Processing, and Machine Learning. The IOT-Based sensor is that which collects the data related to humidity, temperature, and gyroscope. The data collected by sensors are large amount, unstructured, and real-time. The suggested Big Data processing stores the data collected from sensors or manufacturing processes. Then the results of these processes are efficient to monitor the manufacturing process. Thus Prediction model has better accuracy than other models.

**Index Terms-** Monitoring System, IOT-Based Sensors, Big Data Processing, Machine Learning

## 1. INTRODUCTION

Economic Development has been done by manufacturing processes. For the growth of developing and developed countries manufacturing process has its impact [1, 2]. The monitoring system has an important role in reducing cost, predicting diseases, and providing a warning system. As the availability of IoT-Sensor devices increases, data collected from the manufacturing process increases. This data is called Big-Data [3]. Big data technologies and techniques are applied to process and store a large amount of data. For decision making the data generated needs to be analysed.

Machine learning algorithms are very useful in detecting abnormal measures in a process and it can avoid the loss of productivity [4–5]. The algorithm of machine learning will encounter problems with outlier data, which will create the problem or reduce the accuracy. The result of this study gives the advantages of IoT- Sensors, Big Data Processing, and predictive model of the machine learning algorithm.

## 2. LITERATURE REVIEW

Mora et al. proposed a framework based on IoT-based for monitoring human essential signs [6]. A case study was conducted on monitoring footballers' heart rates for the period of a football match.

The projected system was capable to predict and monitor the players' crucial signs, possible injuries, and worst conditions also. Manes et al. proposed a system for the gas level and leakage detection in the environment [7]. Sensor data gathers by the wireless sensor networks. The data collected from the sensor will broadcast to a remote sensor and then it moves via a user interface. The system triggered an alarm if an abnormal condition was detected [8]. The current study on IoT-Based will gather real time data and it will help in finding the solution for many research findings, including healthcare and smart building. For improving the system performance IoT-Based result plays a significant role.

The IoT-Based sensors are increasing significantly. As we adopt IoT in manufacturing it will help in the transition from older to modern digitalized manufacturing. As the device that collects the sensor data in manufacturing increases, the new application that can handle a large amount of sensor data

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i.e., Big data processing also increases. Ge et al. proposed a framework by integrating big data in IoT [13]. Investigational results established the possibility of the developed system.

In the manufacturing industry, several studies have been conducted. The data will help in improving the erroneous designs, quality prediction, and help managers with better decision making [9]. Moon et al. develop a sensor based on a measure of air quality. Zhang et al. proposed a Big Data processor for reducing emission and energy consumption [10, 12]. Lee et al. proposed evaluation analysis on four machine learning algorithms (i.e., Random Forest, Decision Tree, Support vector machine, and artificial neural network) for predicting the worth of metal casting product [14]. The developed result shows that all the four machine learning algorithms be efficiently used to predict the quality. Machine learning algorithms are utilized to detect a certain pattern that has been successfully implemented in various areas.

### 3. OBSERVATION

The real-time monitoring system has been developed to monitor automotive manufacturing and help to detect fault. The prediction model consists of outlier detection and classification model based on Machine learning.

As in Figure 1.1 IoT-Based sensors consists of humidity, temperature, accelerometer, and gyroscope. The data generated is transmitted to the cloud server and then Big Data processing will be done. In addition to that, a data analytics algorithm (machine learning) is applied. Finally, web-based monitoring systems provide fault prediction results.

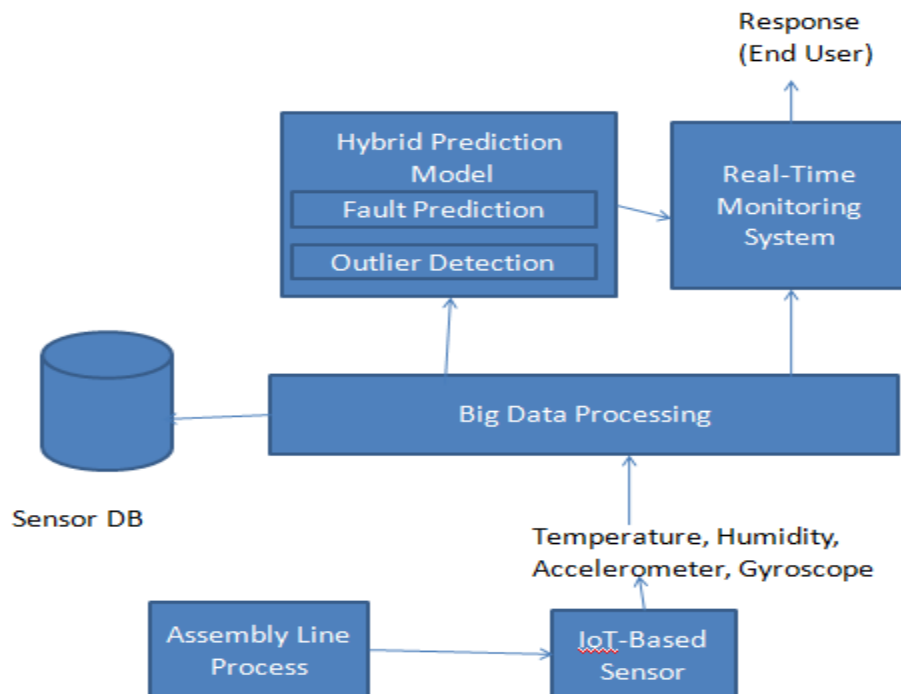


Figure 1.1 Architecture of Real-Time monitoring system [11]

It is important to analyze under various conditions of IoT-Based sensor performance. In this study performance metrics like network delay, CPU, and memory usage were utilized.

### 4. CHALLENGES

Generally, in the accepted approach certain problems as follow:

First, How it is described (unlabeled, labeled, expert knowledge, etc.) to choose unsupervised, supervised, or RL approach.

Secondly, the applicability of available algorithms to research problem requirements has to be analyzed. The focus on the structure, amount of data available, and the data types, which can be used for training and evaluation.

Thirdly, previous algorithms on similar problems are to be investigated to identify suitable algorithms. The term ‘Similar’ means, the problem with comparable requirements in other disciplines or domains.

## 5. CONCLUSION

In this case study, a real-time monitoring system which utilizes IoT-Based sensor, big data processing, and machine learning. The proposed model help manages to identify a fault in the process. It shows that the system is scalable and processes a large amount of sensor data efficiently than traditional models.

Fault detection is important in the manufacturing process as it can identify if the process is functionally normal or not. The results of this study to support management and improve decision making during manufacturing and help to prevent unexpected losses that can be caused by faults. A variety of abnormal conditions should be further identified to learn from complex data sets near future.

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# **IMPACT OF CORPORATE SOCIAL RESPONSIBILITY ON FINANCIAL PERFORMANCE**

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## **ABSTRACT**

This study attempts to examine the impacts of Corporate Social Responsibility (CSR) on the financial performance of the Indian companies in terms of profitability and growth after controlling for the effect of some variables. The study used secondary data extracted from Prowess database, for 82 BSE (Bombay Stock Exchange) listed companies for the period of 5 years from 2014 to 2018. In this study Pearson's coefficient correlation and multiple regression models have been used to find out whether Corporate Social Responsibility is associated with financial performance and also to show the impact of CSR on the financial performance of the business. The empirical results of this study show that that there is a neutral relationship between CSR and the financial performance of the firm in terms of profitability and a significantly negative association between CSR and financial performance in terms of growth. This study will provide great insights to the managers about the performance management through understanding the association between CSR and the firm performance especially in emerging or developing countries, which will help them in strategy formulation.

Key words: CSR, Financial Performance, Profitability, Growth

## **INTRODUCTION**

Corporate Social Responsibility (CSR) is comparatively a new term but the concept is certainly not. Earlier CSR considered as philanthropic actions but now, CSR is the part of strategic decisions and management of the business to avail competitive advantages and to make themselves different from others to operate in such a complex global environment. Corporate Social Responsibility (CSR) and its impact on corporate financial performances like profitability, growth, firm's reputation and cost of capital etc. has received considerable

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attention over the last few decades and is still a point of contention and debate among researchers. There are very less studies/researches conducted related to CSR in Indian context, but after implementation of the amendment made under the Section 135 of Schedule VII of the Companies Act, 2013, the number of researches/studies on CSR and its impacts on different aspects of businesses, has been rising in academic literature and organizational researches too.

To protect and care for the interest of society, an organization should offer safe and reasonably priced quality products or services, satisfactory return to the stockholders, a healthy environment for the society, and so on, because, Safe products attract customers while good working conditions may lower the costs of accidents and raise productivity and reduce employee turnover.

Nowadays, every business is searching for competitive advantage as it is the priority for firms to operate in a complex global environment. The businesses which do not concerned about the stakeholders and the society in which it operates, will find their success to be illusory and ultimately temporary. Most of the thinkers believe that socially responsible activities towards stakeholders provides competitive advantages while some believe it is add on to the cost and squeeze the profitability and decline the growth rate of the firm. Many researches have been done on this topic in other developed countries, but the number of such research is very less in Indian context. The motive is to find out the nature of the association between CSR and CFP, in terms of profitability and growth of Indian Companies.

## OBJECTIVES OF THE STUDY

- To examine the nature of association between CSR and Financial performance of the company.
- To investigate the impacts of CSR on profitability (in terms of ROA and ROE) and on Growth (in term of GSALES) after controlling for several variables such as firm size (SIZE), leverage (LEV) and research and development intensity (R&D INT) of the firm.

## LITERATURE REVIEW

(Lin, Chang, & Dang, 2015), examined how the efforts made by firms on CSR, impact the financial performance of firms keeping the intellectual capital as mediator. CSR had a positive impact on the intellectual capital first which consequently impacted the financial

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performance. (Aras, Aybars, & Kutlu, 2010), results show that there is an insignificant relationship between corporate social responsibility and financial and economic performance. They were not able to find any significant relationship between CSR and financial performance and between profitability and corporate social responsibility. (Maqbooln & Zameern, 2018), study found that CSR has a positive impact on the profitability and stock returns of the firm. Their results suggest that, it is beneficial for the firms to be socially responsible. (Wang & Sarkis, 2017), Investigated the mediation effect of CSR outcomes, on the relationship between CSR governance and financial performance their results show that there is a significant association between CSR governance and superior performance. (Jain, Vyas, & Chalasani, 2016), depicted a positive but weak relationship of CSR activities towards stakeholders with financial indicators in respect of small and medium enterprises of Rajasthan. Intangible benefits like improved brand image, goodwill are the consequence of being social responsible, hence helps in availing the improved financial performance in the long run. (Nair & Sodhi, 2012), described how an organization earns prestige, support from the stakeholders brand image, loyal customers, strong network building with internal and external stakeholders in the long run by spending on CSR and hence positively impact the financial performance of the company.

## RESEARCH METHODOLOGY

- **SAMPLE COLLECTION AND DATA SOURCE**

This study has used secondary data for collecting information required for measurement of CSR, financial performance and control variables. The data is collected from the Prowess. This database is used because required data to measure all the variables are readily available on this database and also the reliability of available data is high. Panel data for 410 (BSE) firm-year observations for 5 years from 2014 to 2018 has been used in this study.

- **MEASURMENT OF VARIABLES**

1. Independent variable in our study is CSR
2. Dependent variables in our study are Return of Asset (ROA), Sales Growth (GSALES), and Return on Equity (ROE).
3. Control variables are Firm Size, Leverage and R&D intensity.

## DATA ANALYSIS & EMPIRICAL RESULTS

### CORRELATION MATRIX

(Table I)

	CSR	ROA	ROE	GSALES	LEV_	R_D_INT_	SIZE
CSR	1.0000						
ROA	0.1100	1.0000					
ROE	-0.0024	0.8469	1.0000				
GSALES	-0.1041	0.0673	0.0799	1.0000			
LEV_	0.0102	-0.4245	-0.2316	0.0020	1.0000		
R_D_INT	0.2291	-0.0259	-0.0835	-0.0074	-0.1729	1.0000	
SIZE	0.2845	-0.2345	-0.2826	-0.0398	0.2573	0.0292	1.0000

- The results in sighted the negative association between the CSR and the growth in
- Firm's spending on the CSR are negatively impacting its returns on equity (by small amount) or slightly reducing the profit making capacity of the firm.
- Firm's CSR expenditures correlate positively with its return on assets. It is implied that increase in CSR results into Increase in return on assets

### REGRESSION ANALYSIS

#### 1. Impact of Corporate Social Responsibility (CSR) and Return on Assets (ROA)

$$\text{Model 1 } ROA_{i,t} = \alpha + \beta_1 CSR_{i,t} + \beta_2 LEV_{i,t} + \beta_3 R\_D\_INT_{i,t} + \beta_4 SIZE_{i,t} + \epsilon_{i,t}$$

In model1 we will find out the impact of CSR on ROA of the firm.

**Dependent Variable: ROA**

**(Table II)**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	23.7900	4.7090	5.0520	0.0000
CSR	0.0847	2.0233	0.0418	0.9666
LEV_	-0.0852	0.0133	-6.4087	0.0000
R_D_INT_	-0.4259	0.1888	-2.2558	0.0246
SIZE	-0.9018	0.4244	-2.1248	0.0342
<b>R-squared</b>	<b>0.113386</b>	<b>Adjusted R-squared</b>	<b>0.104629</b>	

This table indicates that there is no relationship/association between corporate social responsibility (CSR) and return on assets (ROA). The relationship between the two is neutral or there is no impact of CSR on ROA.

## 2. Corporate Social responsibility (CSR) and Return on Equity (ROE)

$$\text{Model 2 } ROE_{i,t} = \alpha + \beta_1 CSR_{i,t} + \beta_2 LEV_{i,t} + \beta_3 R\_D\_INT_{i,t} + \beta_4 SIZE_{i,t} + \epsilon_{i,t}$$

Dependent Variable: ROE

(Table III)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	73.53382	14.31131	5.138163	0.0000
CSR	-4.425185	3.519370	-1.257380	0.2095
LEV_	-0.078025	0.024713	-3.157286	0.0017
R_D_INT_	-1.019841	0.401190	-2.542038	0.0115
SIZE	-4.894726	1.289229	-3.796629	0.0002
<b>R-squared</b>	<b>0.763982</b>	<b>Adjusted R-squared</b>	<b>0.702064</b>	

This implies that there is no relationship between corporate social responsibility (CSR) and return on equity (ROE). Hence, the association between CSR and ROE is neutral.

### 3. Corporate Social Responsibility (CSR) and Growth in Sales (GSALES)

$$\text{Model 3; GSALES}_{i,t} = \alpha + \beta_1 \text{CSR}_{i,t} + \beta_2 \text{LEV}_{i,t} + \beta_3 \text{R\_D\_INT}_{i,t} + \beta_4 \text{SIZE}_{i,t} + \epsilon_{i,t}$$

Dependent Variable: GSALES

(Table IV)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-203.2781	44.42910	-4.575336	0.0000
CSR	-33.75997	10.92580	-3.089932	0.0022
LEV_	-0.047551	0.076720	-0.619799	0.5358
R_D_INT_	-2.265061	1.245485	-1.818617	0.0699
SIZE	20.16646	4.002381	5.038615	0.0000
<b>R-squared</b>	<b>0.258680</b>	<b>Adjusted R-squared</b>	<b>0.064198</b>	

Above table indicates a statically significant negative relationship between corporate social responsibility and growth in sales (GSALES) of the BSE listed Company.

## SUMMARY OF THE STUDY & DISCUSSION OF THE RESULTS

### SUMMARY OF THE FINDINGS

The ultimate findings of the study are indicating that CSR has no impacts on Profitability or there is a neutral relationship between CSR and Performance of the firm.

### DISCUSSION OF THE RESULTS

The results show that CSR has statically insignificant relationship with return on assets (ROA) and return on equity (ROE) which indicates a neutral relationship between them.

**Hence, CSR has no impact on Return on Assets (ROA) and Return on Equity (ROE) which is an indicator of profitability.**

The result also shows negative relationship between CSR and Growth. This can be relate with the stakeholder theory which states that firms creates more value for itself when it fulfills its obligation towards its stakeholders through CSR.



## Conclusions, implications, limitations and suggestion for future research

### CONCLUSIONS

The study attempt to find the nature of impacts that CSR depicted on the different indicators of profitability and growth, the research depicted that ultimately CSR has no impact on the indicators of profitability. However the current study found a significant negative relationship between CSR and Growth in sales. This study suggests that CSR is perhaps not significantly associated with the financial performance yet in developing countries like India.

### IMPLICATIONS

This study suggested that the managers should not only pay attention to the direct effects of CSR dimensions on the indicators of financial performance but also consider the possible indirect effects of CSR on the firms' reputation and goodwill creation especially in long run. This study will provide a better understanding about the relationship between CSR and the financial performance of the firm which will help the managers to formulate better and effective strategic corporate decisions.

### LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

The study has some limitations. So, results should be interpreted with these limitations.

- The CSR score, the study consider only the amount spending on CSR in respect to the total sales but ignore other aspects of CSR.
- Use of financial performance indicators. The current study used accounting-based measures of financial performance (ROA, ROE AND GSALES), however the use of market-based measures like consist of stock return and Tobin's Q ratio may produce different or more reliable results.

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# Applications of Artificial Intelligence for Climate Change Adaptation

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## **Abstract**

The adverse effect of climate change is gradually increasing all across the globe. Developing countries are more vulnerable due to global climate change. It is feared that the situation will become worse if serious proactive actions are not taken as soon as possible. Technological advancement and innovation have created new opportunities for climate change adaptation, enhancing disaster resiliency, and risk reduction. The potential of Artificial Intelligence can be an effective tool to make an appropriate adaptation strategy and enhance the resilience of the people. Artificial Intelligence can have applications in reducing greenhouse gas emissions and helping society adapt to a changing climate. This study aims to explore the potential of Artificial Intelligence for taking proper strategies against climate change effects as well as enhance people's resilience in the face of the adverse effect of climate change. The study has been done based on the systematic literature review of existing relevant literature on this important issue. This study may be helpful to policymakers and related stakeholders to take appropriate adaptation strategies for climate change by implementing Artificial Intelligence solutions.

## **Keywords:**

Artificial Intelligence, Climate Change, Climate Change Adaptation, Disaster Resilience.

## **Introduction:**

The term climate refers to the general weather conditions of a place over a very long period of time. Climate change is a significant variation of average weather conditions—say, conditions becoming warmer, wetter, or drier including precipitation, temperature, and wind patterns—over several decades or more. Article 1 of the United Nations Framework Convention on Climate Change (UNFCCC) defines "climate change" as: "a change of climate which is attributed directly or indirectly to act that alters the composition of the worldwide atmosphere and which is additionally to natural ~~climate variability observed over comparable time periods~~"[1]. Natural weather variability looks at

changes that occur within smaller timeframes, sort of a month, a season, or a year, while global climate change considers changes that occur over a longer period of your time, typically over decades or longer. And while “climate change” and “global warming” are often used interchangeably, global warming—the recent rise within the worldwide average temperature near the earth’s surface—is just one aspect of climate change [2].

The Earth’s climate has always changed and evolved. Just within the last 650,000 years, there are seven cycles of glacial advance and retreat, with the abrupt end of the last glacial period about 7,000 years ago, marking the beginning of the modern climate era. Most of these climate changes have been due to natural causes. But the present global climate change trend is of particular significance because most of it's extremely likely (greater than 95 per cent probability) to be the results of the act since the second part of the 20th century [3]. The effects of climate change are increasingly visible. Storms, droughts, fires, and flooding became stronger and more frequent. Global ecosystems are changing, including the natural resources and agriculture on which humanity depends [4]. The 2018 Inter-governmental report on climate change estimated that the world will face catastrophic consequences unless global greenhouse gas emissions are eliminated within thirty years. Yet year after year, these emissions rise. Addressing global climate change involves mitigation (reducing emissions) and adaptation (preparing for unavoidable consequences). Both are multifaceted issues. Mitigation of greenhouse gases (GHG) emissions requires changes to electrical systems, transportation, buildings, industry, and land use. Adaptation requires planning for resilience and disaster management, given an understanding of climate and extreme events. Such a diversity of problems can be seen as an opportunity: there are many ways to have an impact, including the efficient utilization of new disruptive technologies. Artificial Intelligence is one such disruptive technology that has the potential of contributing to climate change adaptation and disaster resilience in a significant way.

Artificial Intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions. The term also can be applied to any machine that exhibits traits associated with an individual's mind like learning and problem-solving. The ideal characteristic of AI is its ability to rationalize and take actions that have the simplest chance of achieving a selected goal. Artificial Intelligence promises to be a game-changer for climate change and environmental issues. AI is often applied with high impact within the fight against global climate

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change, through either effective engineering or innovative research. Its major potential applications include: Energy Management, making cities more liveable and sustainable, Smart agriculture, Protecting the oceans, More sustainable transport on land, Better climate predictions, and many more. AI can help to watch ecosystems and wildlife and their interactions. Its fast processing speeds offer almost real-time satellite data to trace illegal logging in forests. AI can monitor beverage quality, manage residential water use, detect underground leaks in beverage supply systems, and predict when water plants need maintenance. It also can simulate weather events and natural disasters to seek out vulnerabilities in disaster planning, determine which strategies for disaster response are best, and supply real-time disaster response coordination. Natural and human-made disasters upend lives and livelihoods around the world on a recurring basis. In a disaster, smart, timely decisions are needed to avert, mitigate, and manage all types of risks. In this respect, the use of AI in the decision-making process has shown both tremendous promises as well as scope for improvement [5].

**Research Elaborations:**

The present study has been done following the approach of desk literature review of the research work done in recent past on potential applications of Artificial Intelligence to save the climate and for disaster resilience also. A number of Research Papers/Articles/Technical Papers/Reports from various sources were searched and the most relevant were selected for the study. It has been attempted to remove the limitations of present researches and to present a comprehensive and integrated view on the issue. The systematic review of the relevant research papers/articles/technical papers/reports as referred in Reference section from [3] to [11] has been done with the aim to explore the potential of Artificial Intelligence for enhancing Climate Change Adaptation and Disaster Resilience.

**Discussion:**

Presently, the whole world is witnessing the most serious pandemic of the recent past i.e. COVID-19. Millions of people are suffering due to this disease. The pandemic has shocked the entire planet, resulting in thousands of deaths, economic hardship, and profound social disruption. However, the lockdown made it clear that staying at home and slowing down the economy is far from enough to solve the climate crisis. We're still emitting more than 80 per cent as much CO<sub>2</sub> as normal, despite having 17 percent fewer emissions compared to 2019 — which is one of the most significant drops in recent years. In the absence of serious efforts, the economic damage caused by climate change in the next two decades will likely be as bad as a COVID-sized pandemic every ten years. To tackle the

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issue of Climate Change, a comprehensive portfolio approach to technology development and deployment needs to be followed, which can be dimensionalized across time, risk, and maturity of the technology. To address climate change, there are primarily five focus areas where development and applications of the technology are critical viz. Power and Electricity Generation, Transportation, Manufacturing, Building and Cities, Food, and its supply chain [6]. There is a need for a system/technology which can provide Clean power, Smart transport options, Sustainable production and consumption, Sustainable land-use, Smart cities and homes, and similar other options to save our globe from adverse climate changes. AI has the potential and capabilities to make the provisions of all such requirements [7].

In the article published on the website [www.theverge.com](http://www.theverge.com) [8], James Vincent has reviewed the research paper published by Rolnick et al. [4] and notes that AI could be “invaluable” in mitigating and preventing the worse effects of climate change, but it is not a “silver bullet” and that political action is desperately needed, too. In fact, its most promising applications may come, not from uses affecting civil liberties and the social fabric of our society, but from those particularly complex technical problems lying beyond our ready human capacity. Climate change is one such complex problem, requiring fundamental changes to our transportation, agricultural, building, and energy sectors [9]. There is a need to integrate AI and associated technologies with the climate change adaptation strategies and policies being made for the purpose by the policymakers [10]. AI offers a variety of use cases that positively affect the climate, both in preventive measures like reducing GHG emissions and remedial measures like handling the effects of climate change more effectively. The use cases include both AI systems that are designed to specifically address climate challenges (such as the fight against methane leakages) as well as those that can contribute to positive climate outcomes (such as AI for general energy efficiency) [11].

**Results:**

For a sustainable environment, AI Technology has to be integrated with climate change technologies. The use cases of application of Artificial Intelligence technology to predict, mitigate, and adapt climate change are working or being worked out to fulfil this requirement. Potential major fields for AI deployment include Power and energy systems Management, Transportation, Manufacturing, Production, Food and Supply chains, Agriculture, making cities more liveable and sustainable by Smart cities and homes, Weather and Disaster Resilience, Protecting the oceans, More

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sustainable transport on land, Better climate predictions, Reduction of Green House Gases (GHG) Emission and Decarbonisation and many more. AI is often applied with high impact within the fight against global climate change, through either effective engineering or innovative research. AI can help to monitor ecosystems and wildlife and their interactions. Its fast processing speeds offer almost real-time satellite data to trace illegal logging in forests. AI can monitor drinking water quality, manage residential water use, detect underground leaks in drinking water supply systems, and predict when water plants need maintenance. It can also simulate weather events and natural disasters to find vulnerabilities in disaster planning, determine which strategies for disaster response are most effective, and provide real-time disaster response coordination [6]. The major fields where the AI Technology can be deployed along with action areas for climate change adaptation are as per Table below. The list is not exhaustive, and many more fields and action areas are finding the applications of AI for the sustainable environment.

**Table:****Major Fields of AI Applications and Action Areas for Climate Change Adaptation**

<b>Major Fields</b>	<b>Action Areas</b>	<b>References</b>
Clean Power and Energy Systems	<ul style="list-style-type: none"> <li>• Optimised energy system forecasting</li> <li>• Smart grids for electricity use</li> <li>• Predict solar flares for protecting power grids</li> <li>• Renewable energy plant assessments</li> <li>• Optimised decentralised &amp; peer-to-peer renewable energy systems</li> <li>• Optimised virtual power plants</li> <li>• Forecasting Supply and Demand of Power</li> </ul>	UNEP [3] Rolnick D. et al. [4] Malliarak E. [5] Greenman S. [6] PWC [7] Vincent J. [8] Stein Amy L. [9] Capegemini [11]
Smart Transport System	<ul style="list-style-type: none"> <li>• On-demand shared transport mobility</li> <li>• AI-enabled electric cars</li> <li>• Autonomous vehicles for efficient transport</li> </ul>	UNEP [3] Rolnick D. et al. [4] Greenman S. [6] PWC [7] Vincent J. [8]

	<ul style="list-style-type: none"> <li>• Vehicle to infrastructure communication and optimisation</li> <li>• Optimised traffic flows</li> <li>• Integrated cost-efficient transport systems</li> <li>• Demand-response charging infrastructure</li> </ul>	Capegemini [11]
Smart Cities and Homes	<ul style="list-style-type: none"> <li>• Smart traffic light &amp; parking systems for urban mobility management</li> <li>• Optimised sustainable building design</li> <li>• Energy-efficient building management systems</li> <li>• Auditory responsive lighting &amp; heating</li> <li>• Optimised urban-level energy generation and use</li> <li>• Analytics &amp; automation for smart urban planning</li> <li>• Low Emissions Infrastructure</li> </ul>	UNEP [3] Rolnick D. et al. [4] Greenman S. [6] PWC [7] Vincent J. [8] Capegemini [11]
Sustainable Land Use	<ul style="list-style-type: none"> <li>• Early crop yield prediction</li> <li>• Precision agriculture &amp; nutrition</li> <li>• Hyper-local weather forecasting for crop management</li> <li>• Early detection of crop issues</li> <li>• Automated &amp; enhanced land-use change detection for avoided deforestation</li> <li>• Monitoring health &amp; well-being in livestock farming</li> <li>• Managing forests and forest fires</li> <li>• Monitoring Deforestation</li> </ul>	UNEP [3] Rolnick D. et al. [4] Malliarak E. [5] Greenman S. [6] PWC [7] Vincent J. [8] Capegemini [11]

Sustainable Production and Consumption	<ul style="list-style-type: none"> <li>• Create New Low Carbon Materials</li> <li>• Climate friendly construction</li> <li>• Supply chain monitoring and transparency</li> <li>• Active optimization of industrial machinery &amp; manufacturing</li> <li>• Digital twins for lifespan performance optimisation</li> <li>• Smarter fresh-food replenishment</li> <li>• Smart recycling systems</li> <li>• Integrated municipal &amp; industrial waste management</li> <li>• Waste management and segregation</li> </ul>	UNEP [3] Rolnick D. et al. [4] Malliarak E. [5] Greenman S. [6] PWC [7] Vincent J. [8] Capegemini [11]
Reduction of Green House Gases (GHG) Emission and Decarbonisation	<ul style="list-style-type: none"> <li>• Increased monitoring, measuring and accountability of pollutants</li> <li>• Help consumers reduce their carbon footprint</li> <li>• Providing assistance to adopt Green policies and initiatives</li> </ul>	UNEP [3] Rolnick D. et al. [4] Malliarak E. [5] Greenman S. [6] PWC [7] Vincent J. [8] Biesbroek, R et al. [10] Capegemini [11]

In general, the introduction and expansion of artificial intelligence (AI) are having a significant impact on society, changing the way we work, live and interact. As the technology evolves, its direct and indirect applications for the environment will get to be better understood so as to harness the opportunities, while assessing the potential risks and developing approaches for mitigating them. As with any technology, AI also has some limitations and the tradeoffs between AI and climate change have to be understood clearly and be optimised before implementing AI Technology. As with all emerging technologies, AI may face suspicion, high upfront costs, and close scrutiny by regulators. Further, the impact on the environment due to the introduction of AI in the respective action area has to be taken care of. Data privacy and data security is also a big challenge. Accountability, safety, and

certification are other areas of concern. There is a need for close coordination among all the stakeholders for the successful implementation of AI Technology. It is also a fact that only technology is not enough to bring the change. The various sections of the society have also to contribute to this movement. First, we have to change our consumption pattern. The world's population is predicted to increase from seven to 10 billion by 2050. It is critical that awareness is raised of our own individual carbon footprint through our daily choices around what we eat, how we travel and the way we live. Further, the world's governments and organizations need to work together to set clear goals and policies such as the 2015 Paris climate accord. We will need much further legislation around pollution, consumption and energy usage that little questions are going to be viewed as impinging on personal choices, liberties and free markets. Furthermore, the cost of dealing with climate change by implementing AI solutions, which is in trillions, has to be financially incentivised. To tackle all these issues, the cooperation among governments, technology developers, investors and civil society will be essential. Harnessing the potential of AI could help to make sustainable, beneficial outcomes for humanity and therefore the planet we inhabit.

**Conclusions:**

AI may prove a game-changer for the sustainable planet. It is an enabling technology that has a critical role to play in reducing the carbon footprint of energy generation and management, transportation, food production and supply chains, industrial manufacturing and production, and our homes, offices and cities. Other than providing the working solutions for climate change adaptation and disaster resilience, it is beneficial for other related fields of the environment also like biodiversity and conservation, clean air, water security, healthy oceans etc. AI systems, and their ability to regulate machines automatically and remotely, have caught the public's imagination. The opportunity for AI to be harnessed to profit humankind and its environment is substantial. However, AI technology also has the potential to increase many of the risks we face today. For all the enormous potential, AI offers for building a sustainable planet for future generations, it also poses short and long-term risks including performance risk, security risk, control risk, ethical risk, economic risk and societal risk. To make certain that AI is developed and governed wisely, government and industry leaders must confirm the security, explainability, transparency and validity of AI applications. It is obligatory that authorities, AI researchers, technology pioneers and AI adopters in the industry alike to encourage deployments that earn trust and avoid abuse of the agreement. Achieving this needs a collaborative effort to make sure that as AI progresses, its idea of an honest future is aligned to human

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values and encapsulates a future that's safe for humanity altogether respects – its people and their planet.

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# DRONES AS THE NEW “FLYING IOT” IN AGRICULTURAL AND CONSTRUCTION SECTOR

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**Abstract-** This review paper focuses on application of IoT in drones. Advancements in smart phone technology have shot the drones out of the military and into our homes. Investments by technology giants of our era that created ARM core processors, GPS sensors and batteries are being used in drones today. Also with the Internet of things, drones do not need a separate device to control them; that can be done through a smart phone or through the cloud. The IoT enabled drone in agricultural and construction applications will be discussed in the present paper.

**Keywords:** Drones, IoT, phone, consumer application, etc.

## 1.Introduction

Leveraging the ongoing IoT revolution, drones have experienced accelerated transformation in their use from being hobbyist toys to complex IoT devices. Furthermore, the rollout of 5G technology is expected to enhance the ability of drones to react to commands in real time enabling instant feedback. This is expected to increase their capabilities and performance. Drones increase efficiency and productivity while reducing workload and costs. This factor makes them an invaluable addition to various sectors.



**Fig.1:** IoT based Drone( ANASIA D'MELLO AUGUST 2, 2019)

## 2.Applications

### 2.1 Applications in Agriculture

Traditional farming practices rely on intuition and experience. Using smart drone tech will enable the application of precision agriculture techniques by farmers.

Drones will be able to carry out comprehensive monitoring of crops resulting in high yields. Using drone sensors, farmers will be able to collect data on the state of a crop, water amount and soil type in a farm. Through deep learning, they will also be able to identify pests, weeds, diseases, and nutritional deficiencies early on. After analysis, the drones will provide recommendations to the farmer on optimal productivity conditions and interventions that need to be made. This will lead to increased productivity in farming and consequently increased yields.

The population of the India is increasing and it is second largest populated country in the world. Given the scale of this challenge, the obvious question is - how will it be possible to feed so many? One approach is to take the “grow more” route. It has worked in the past. However, this approach requires more pasture clearing and more land converted to farmland. This has had an enormous impact on the environment, with agriculture contributing significantly to climate change through greenhouse gas emissions and deforestation. And in a vicious circle, climate change in turn negatively impacts agriculture by diminishing crop yields.

Another route is the “grow more by growing better” route, or, the sustainable route. This is where drones come in. Drones can contribute to a [more sustainable world](#). They can collect the aerial data that farmers need to better understand and predict crop yield, assess crop health and weed cover, and perhaps most importantly when it comes to environmental sustainability, monitor and target water and fertilizer distribution and application. These farming techniques are popularly called precision agriculture, which can save farmers’ money and time, as well as help them enhance their crop quality, yields, and profits on those yields, and optimize the usage and output of farmland. Further, because drones are fully automated, farmers and agronomists can save flight paths in the mission planning software and fly identical missions at different times of year, or even from one year to the next, allowing them to overlay and compare data and development across time.

## 2.2 Application in Construction

Using drones, construction owners are able to see what is happening on the site from the comfort of their offices. Drones will also be helpful in giving the first-hand view of an upcoming structure as well as monitoring its progress. This will reduce the time and effort used in making regular site visits, especially when with clients. Inspection of roofs, mining operations, and utilities will also be enhanced with the use of drones which in turn reduce accidents and thus increase safety in any construction site.

Drones are able to access places that are ordinarily inaccessible and in the process record and relay real-time data. With technological advances, drone users will continue to discover new uses. Challenges such as battery power life and flight time, notwithstanding. Drones are also expected to change responses to emergencies. Apart from performing visual searches and sending feedback, drones will also be able to work together and build temporary shelters for the survivors. This will be enabled by advancements in technologies such as 3D printing using additive building manufacturing technology.

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## 3. Conclusions

Drones find wide range of applications in agricultural and construction sector. IoT based drones performing visual searches and sending feedback along with additive building manufacturing technology will be useful for building temporary shelters. Use of drone in agricultural sector will provide increase yield of crops with lesser efforts. Commercial and consumer applications of drones are being realized and it will expand further with the wide spread of technology.

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# PROLONGING NETWORK LIFETIME OF WSN USING EAMMH PROTOCOL

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***Abstract-*** In the recent years, Wireless Sensor Networks (WSN) have gained a substantial attention from the research community as well as from the actual users. A sensor node in WSN performs multiple tasks like sensing, communication, storing and processing. All these tasks consume energy which is a limited resource in WSN. Therefore, energy management is required to increase the lifetime of WSN and is a very challenging task to perform. The work proposes an energy efficient protocol which can be an optimal solution to the problem of limited energy in WSN.

***Keywords-*** Wireless Sensor Networks(WSN), Network Lifetime, Aggregation Techniques, Energy Efficiency, Clustering, Cluster Head(CH), Energy Aware Multi- hop Multi-path Hierarchical routing protocol (EAMMH), Data Aggregation Tree(DAT).

## 1. INTRODUCTION

A wireless sensor network (WSN) is a network, consisting of randomly deployed sensor devices used to observe the physical and environmental conditions such as sound, temperature, pressure etc. Each sensor device (sometimes called as sensor node) in the network have several parts: sensing unit, processing unit, memory, communication module and an energy source. A sensing unit senses the environment, a processing unit will process the sensed data, a memory to store the processed and sensed data, a communication module to send and receive the data and an energy source, usually a battery used to perform all the operations discussed above. The sensor nodes in the WSN will continuously observe the environment and then depending on their application transfer the data by single-hop or multi- hop data transmission to the sink node. The nodes in a network will route the data packets to the destination using a routing protocol.

Routing protocol is a standard which decides the route to transmit data to the destination. There are two types of routing protocols in WSN:

*1.1 Flat Routing Protocol:* The first category of routing protocols is the multi-hop flat routing protocols. In flat networks, each node typically plays the same role and sensor nodes collaborate together to perform the sensing task. Due to the large number of nodes in the network, it is not feasible to assign a global identifier to each node. This problem results data centric routing, where the BS sends the queries to certain regions and waits for data from the sensors located in those regions. Multiple protocols based on data centric routing were developed but they did not result in the sufficient amount of energy conservation by the sensor nodes in the network. Protocols that are based on this routing scheme are SPIN and Directed Diffusion.

*1.2 Hierarchal Routing Protocol:* This protocol divides the network into groups of sensors. Each group of sensors in geographic proximity is clustered together as a zone and each zone is treated as an entity. Each zone routes the data to the BS by making a hierarchy such that the BS will receive the necessary data and an efficient amount of energy will be used by the sensor nodes. To eliminate the redundant data, data aggregation technique has been introduced in hierarchal routing protocol which helps in saving the energy as well as maintains the integrity of the data. In data aggregation technique, data is processed at various nodes called as aggregator nodes before transferring it to the sink node. Various approaches of data aggregation have been introduced for the efficient utilization of resources which results increase in the network lifetime.

### 1.2.1 Techniques of Data Aggregation

*Centralized Approach:* In this method, each sensor node selects the most powerful node among its neighbors and transfers the sensed data to it. This powerful node is commonly known as header node which is capable of performing data aggregation of received data with its own sensed data. After performing aggregation header node transfers the aggregated data to the destination. Intermediate nodes can be there between primary sensor and header node.

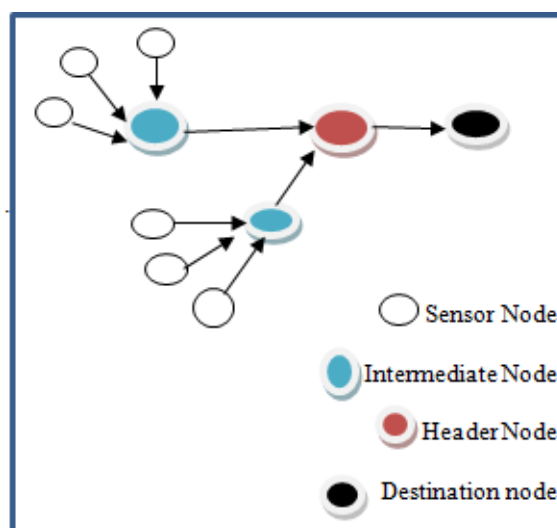


Fig. 1.1: Centralized Approach

*In- Network Approach:-* It is of two types



- *With Size Reduction*:- Data received or combined from various nodes is compressed using various methods and algorithms to reduce the power consumption. Data compression involves encoding the information using fewer bits than the original representation of information.
- *Without Size Reduction*:- It only includes aggregating the data from neighbors and converting it into a single packet for further transmission.

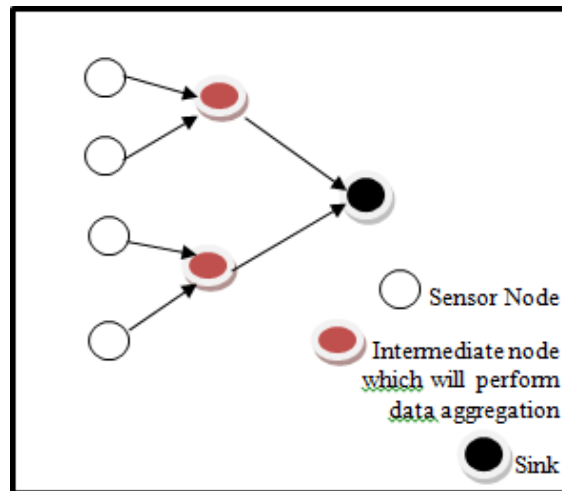


Fig.1.2: In-Network Approach

*Tree Based Approach*: In this method of data aggregation, a data aggregation tree (DAT) is formed first. And for each transmission, minimum spanning tree (which includes a path without any cycles and with the minimum possible total edge weight to destination) is created. Each node acts as leaf node and sends its sensed data to parent node, which acts as branch node, and data in this way flows from leaf node to sink and the final parent node does the processing.

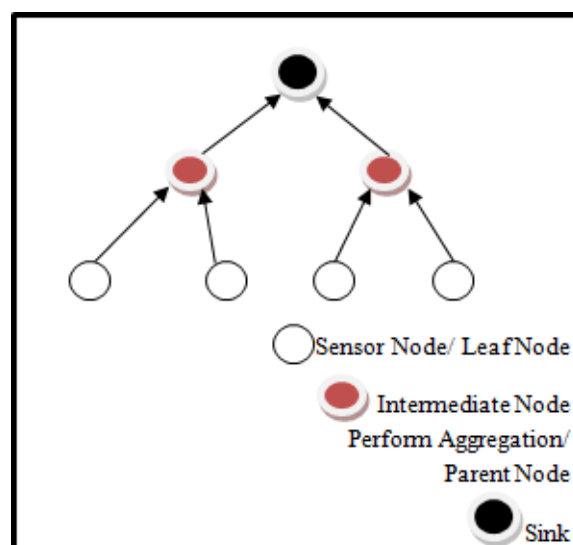


Fig. 1.3: Tree Based Approach

*Cluster Based Approach:* Most efficient approach in which network is divided into clusters containing various nodes. In each cluster, one node is selected as CH and after one process CH changes so that optimization can be achieved. These CHs perform the data aggregation, reducing the packet size as well as redundancy and then transmit the packet to the required location. In cluster based approach, communication between Sink and CH is single-hop communication.

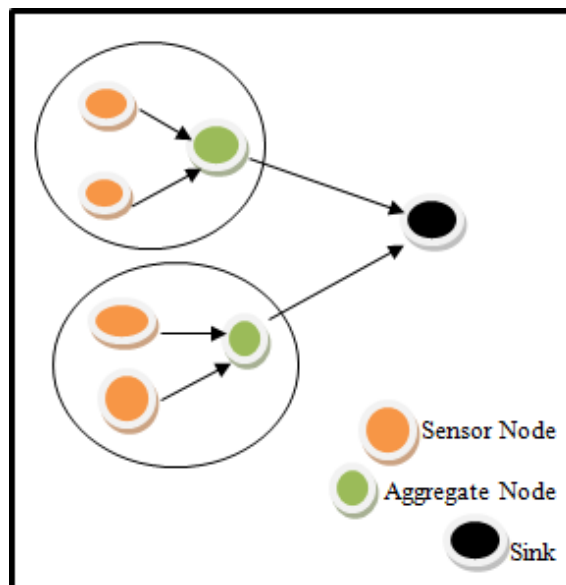


Fig. 1.4: Cluster Based Approach

Based on the architecture of cluster based routing protocol, several cluster based routing protocols have been residential to deal with the scalability and energy consumption challenges of WSNs. Several of cluster based protocols are classified as Low-Energy Adaptive Clustering Hierarchy (LEACH), Power- Efficient Gathering in Sensor Information Systems (PEGASIS), Threshold-Sensitive Energy-Efficient Sensor Network (TEEN), and Hierarchal Cluster Routing (HCR), Energy Aware Multi-hop Multi-path Hierarchical (EAMMH).

## 2. LITERATURE REVIEW

Desai et al. [1], have reviewed various data aggregation techniques which includes In-network approach, Centralized approach, Tree based approach, Cluster based approach. In the survey the authors found Cluster based approach as the best way for data aggregation and have implemented LEACH (Low Energy Adaptive Clustering Hierarchy) protocol to prove that. The aim of the LEACH protocol is to provide the scalability for cluster formation and good balancing of energy utilization. The problem with the LEACH protocol is that the CH transmits data to the sink with single hop transmission.

Fahad et al. [2], has surveyed various clustering algorithms which are partitioning based, hierarchical based, density based, grid based and model based. In the partitioning algorithms, data objects are divided into a number of partitions, where each partition represents a cluster. K-means

algorithm is the example of this algorithm. In Hierarchical-based algorithm, data is organized in a hierarchical manner. The initial cluster is gradually divided into several clusters as the hierarchy continues. BIRCH, CURE, ROCK and Chameleon are some of the well-known algorithms of this category. In Density-based algorithm data objects are separated based on their regions of density, connectivity and boundary. DBSCAN, OPTICS, DBCLASD and DENCLUE are algorithms that use this method. In Grid-based algorithm the data objects are divided into grids. Wave-Cluster and STING are the examples of this category. Model-based algorithm optimizes the fit between the given data. COBWEB is the example of such algorithm.

Datta et al. [3], have studied various routing protocols in WSN. The routing protocols are Flooding-based, Query-driven, Data-driven, Geographic based, Hierarchical and cluster-based routing protocols. In flooding based routing protocol sensed data is flooded by the sensor node which leads to the data implosion problem. In query driven approach the sink sends the query to the sensor nodes and then sensor nodes send the data to the sink in response and regarding that query. SPIN protocol is the example of Data-driven approach which reduces the data implosion problem or overlap problem. In Geographic Based routing algorithm, queries are route towards a certain geographically defined region. Hierarchical routing protocols organize the network into groups called clusters. Each cluster selects a node that works as the CH. The CH is responsible for collecting the sensed data from all the cluster member nodes, aggregating the received data and transferring the aggregated data to the base station. This results in eliminating a large number of redundant data from the sensor nodes, thereby reducing the overall energy consumption in the wireless sensor network.

Qiankun et al. [4], have proposed the improved AODV protocol to find the shortest path in the network to transmit data from source to destination. In the proposed work the author assign tasks according to the amount of path delay and improve the overall performance of the network, especially in Higher network load and real-time circumstances. Since AODV routing protocol is the On-Demand routing protocol hence it require less amount of memory and the path discovery process takes large amount of time to find shortest path to the destination.

Mundada et al. [5], have compared the performance of LEACH and EAMMH protocol. The major difference between LEACH and EAMMH protocol is that LEACH supports single-hop data transmission to the sink whereas EAMMH protocol supports multi-hop data transmission. In the simulation EAMMH protocol proved as a better protocol then LEACH protocol because the number of dead nodes in EAMMH protocol is less than the number of dead nodes in LEACH protocol which will lead to increase the network lifetime by a significant amount.

Rai et al. [6], have proposed E-LEACH protocol which is the improved version of LEACH protocol. In this protocol, initially all nodes are randomly deployed then the whole network is divided into clusters and the CH is then selected on the basis of residual energy of the sensor nodes. Node having highest residual energy will be selected as the CH. Since initially all nodes have same residual energy CH will be selected on random basis. In the simulation E-LEACH performs better than LEACHS-MAC, CAL-MAC, PD-MAC. Energy consumption in the network by the use of E-LEACH protocol is less in comparison of other protocols.

Kumar et al. [7], have proposed Energy Efficient (EECP) Clustered Protocol. EECP is divided into two phases. First phase is Set-up phase and Second phase is steady phase. In Set-up phase cluster formation takes place, CH is selected and determines cluster communication schedule. In Steady phase data is transmitted to the base station. For the election of CH sensor nodes choose a random number between 0 and 1. If the number is less than a particular threshold value then that node becomes a CH for the current round. If the elected CH is a gateway node then in Steady State phase data collected from non CHs is transmitted to the base station directly. If the elected CH is not a gateway node then it will calculate its distance from the sink and also from all the gateway nodes which are not elected as the CH in this round. If the distance of the elected CH from any of the gateway node (which is not selected as a CH in this round) is less than its distance from the sink then the elected CH after collecting the data from its members, aggregates the data and then send it to the nearest gateway node which further sends it to the base station. With the Use of EECP protocol number of alive nodes increases hence network lifetime is also increased.

Tian et al. [8], have introduced various anomaly detection methods for link traffic and for global traffic and compare their performances. Anomaly detection plays a key role in network security. Whole network traffic monitoring is more meaningful in comparison to single-link traffic monitoring, but at the same time monitoring whole network is more difficult than a single link. Among all the methods introduced by the authors for global traffic, DW- based and PCA-based methods are proved as the most promising methods in term of their performances.

Cao et al. [9], have provided a scheme by which multiple concurrent user requests for data transfers between different source-destination pairs with various performance requirements can be satisfied. Author have constructed analytical network models to minimize the turnaround time under various constraints and also have designed a cooperative routing and scheduling scheme that dispatches multiple user requests along concurrent compatible paths without interferences. The implementation of the schemes provided by the author computes maximum link patterns and show a stable performance in case of multiple concurrent user requests for data transfers between different source-destination pairs with various performance requirements.

Han et al.[10], have designed a dynamic sampling K- Means parallelization algorithm to detect the distributed Denial of Service attack. The core idea of this algorithm is initially to select k objects at a random time and every initial object shows the center or average value of the cluster. After successive traversal, distances from the remaining objects to centers of all clusters will be calculated. And then by the comparison of the distances, they will be distributed to center with the smallest distance and calculations of all centers will be performed again. Next repeat the process until the convergence of clustering criterion function. Using this approach time required to detect the DDoS attack is reduced and also accuracy of detection is also improved.

Chen et al.[11], have introduced a hybrid architecture based on Power-Efficient Gathering in Sensor Information System (PEGASIS) and Low-Energy Adaptive Clustering Hierarchy (LEACH) to reduce the energy consumption by the sensors in data transmission. Author then combined this hybrid architecture with Intersection-Based Coverage Algorithm (IBCA) to prolong the WSN lifetime that makes sensor nodes to enter sleep mode when inactive. Simulation of introduced

architecture by the author gave better result(in terms if network lifetime) than original LEACH protocol.

Lee et al. [12], have proposed a constant-rate broadcast for ensuring source and destination privacy. The proposed scheme divides the network traffic equally among all the sensor nodes to deal with eavesdropping and also minimizes the routing information of each sensor node to deal with node compromising. This scheme also allows forwarder- driven broadcast (FdB) that allows efficient multiple broadcasts in order to reduce the overhead. The use of proposed approach results in maintaining source and destination private.

Jia et al.[13], propose a cloud reasoning-based link quality prediction algorithm for the link quality prediction of WSNs. Cloud reasoning-based link quality prediction algorithm is divided into three parts: division of link quality parameters, determination of association rules and establishment of a prediction model. The proposed algorithm more accurately captures the link changes which leads to more stable predictions of the link quality. Xia et al.[14], have proposed Energy-Efficient Opportunistic Localization (EEOL ) scheme for indoor localization. EEOL makes only appropriate number of sensor nodes to enter the WAKE UP state. This method of energy conservation of each sensor nodes results in prolonging WSN lifetime because according to this algorithm instead of making all sensor nodes to enter WAKE UP state periodically only appropriate sensor nodes are made to enter WAKE UP state periodically.

Wang et al. [15], wireless sensor network coverage optimization model based on improved whale algorithm to monitor the specific region and obtain the valid data. Implementation of this model results in the larger coverage of sensor node but due to larger coverage of nodes energy consumption by the nodes also increases which lead to short lifetime of WSN.

Lan et al. [16], have proposed a novel cluster head selection algorithm to maximize the lifetime of a Body Sensor Network(BSN) for motion detection. For motion detection KNN algorithm is used by the author of this paper. For energy conservation the proposed work have made use of remaining energy of each sensor node along with cluster based approach. Cluster-based algorithm is implemented on a test bed using the KNN algorithm and show that it can achieve high accuracy (above 90%).

Wang et al. [17], have proposed the Ring-based Energy Aware Routing (REAR) algorithm for wireless sensor networks to achieve both energy balancing and energy efficiency for all sensor nodes. The proposed work use the hop count method and also the concept of residual energy of next hop to find optimum path to destination. For finding optimum path hop count is primary factor and residual energy is secondary factor and because of this reason the implementation of proposed work does not lead to the efficient utilization of energy.

Sandhu, Kumar[18], have developed an energy efficient HEED( Hybrid Energy Efficient Distributed Protocol). In LEACH protocol, every node can become the cluster head regardless of its energy level. HEED overcome this problem where cluster head is selected with the comparisons of residual energy level and the node with highest energy level is selected as the cluster head. The

objective is to reduce the energy consumption by the sensor nodes to increase network lifetime which is achieved with Energy Efficient HEED.

Perillo, Heinzelman[19], have used TAG protocol (Tiny AGgregation) for performing data aggregation. In TAG, user sends the queries for data aggregation from the base station. Operators implement the query through network and sensors sends the data back to the user through the same path traversed by the query base station. Advantages of TAGs are reducing communication bandwidth.

### 3. PROBLEM IDENTIFICATION

Energy Aware Multi-hop Multi-path Hierarchical routing protocol (Basic-EAMMH), protocol is a cluster based hierarchical routing protocol. In cluster based approach all the sensor nodes sense the environment and then send their sensed data to their respective CH which will after receiving sensed data performs data aggregation and then sends the aggregated data to the destination/sink. EAMMH protocol consists of two phases:

*Setup Phase:* Once the nodes are randomly deployed, neighbor discovery takes place. Various methods like: k-of-n approach, ping, beacon messaging can be used for neighbor discovery. After the neighbor discovery process, clusters are created and each node decides whether or not to become the CH for current round. The method used for deciding the CH is similar to the one used in LEACH protocol.

$$T(n) = \frac{P}{1 - p * (r \bmod \frac{1}{p})}, \quad \text{where } n \text{ belong to } G$$

$$T(n) = 0, \quad \text{where } n \text{ not belongs to } G$$

Where  $n$  is random number between 0 and 1

$P$  is the CH probability

$G$  is the set of nodes that were not CH in previous rounds

The setup phase takes place in the following sequence:

- Cluster member selection
- CH selection
- Cluster formation

*Data Transmission Phase:* Once the clusters are created, the sensor nodes are allotted timeslots to send their sensed data to the respective CH. Nodes always transfer sensed data at their allotted time intervals. When the CH receives data from its cluster member nodes, it aggregates it with its own data and transfers the aggregated data to the sink. While transmitting the aggregated data, CH has to choose the optimal path from its routing table entries. CH uses a heuristic function ( $h$ ) to make this decision and the heuristic function is given by,



$$h = K ( E_{avg} / h * t )$$

where K is a constant,

$E_{avg}$  is the average energy of the current path,

$h_{min}$  is the minimum hop count in the current path,

$t$  = traffic in the current path.

The path with highest heuristic value is chosen. The heuristic values are calculated on the basis of information available at each node about the paths and the routing table entries which are need to be updated periodically to provide updated view of the network. If the information about the paths and the routing table entries at each node is not updated periodically then each node will have stale information which will lead to wrong routing decisions. Information update process will increase the accuracy of the heuristic function. The interval of periodic updates is chosen wisely such that the nodes do not make its decisions on the basis of stale information and at the same time, the periodic updates do not overload the network. The problem with this protocol is that the CH of each cluster is selected on random basis. Deciding the CH randomly makes a node with very small amount of energy ( energy which is not sufficient to perform the responsibilities of a CH but sufficient to perform the responsibilities of a cluster member node) as the CH for current round of the cluster. Thus the decision of making the CH randomly leads to the faster energy exhaustion of a sensor node which results shorter lifetime of the network.

#### 4. PROPOSED WORK

In the proposed work, the wireless sensor network lifetime is improved by improving the Basic-EAMMH routing protocol. The proposed work provides an approach to elect the CH on the basis of remaining energy of a sensor node as well as the distance with the cluster member nodes instead of by generating a random number between 0 and 1 for each node as done in basic-EAMMH protocol. The proposed protocol is divided into two phases, Set-up Phase and Data Transmission phase

*Set-Up phase:* Initially all the nodes are randomly deployed and using beacon messaging methods all nodes will identify their neighbors. After neighbor discovery, cluster members are selected on the basis of connectivity and distance. After cluster member selection, cluster head (CH) selection process continues. CH selection will depend upon the distance with cluster member nodes and residual energy of the sensor nodes. Node that have smaller distance with other cluster member nodes and have smaller residual energy will be selected as the CH. Since initially all nodes have same amount of energy CH will be selected on the basis of distance only but for the next rounds CH will be selected on the basis of the residual energy of each sensor node as well as the distance with other cluster member nodes. After CH selection, the CH sends an advertising message to its cluster members to inform them about being selected as the CH of their cluster then other sensor nodes will send a ACK message to their CH and then the cluster is formed. After cluster formation CH will allocate the time slots to each of its cluster members using TDMA (Time Division Multiple Access) scheduling. Now all the cluster member nodes will send their sensed data to their CH only

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in their allocated time slots. CH will also find the optimal path between itself and the sink node. CH uses a heuristic function (h) to find the optimal path. The selection of optimal path is same as that of basic-EAMMH protocol.

*Steady Phase*, all sensor nodes will send their data to their CH in their allocated time slots. CH will receive the sensed data from all its cluster member nodes then perform data aggregation along with its own data. After performing data aggregation, CH will transmit the aggregated data to the sink node through the optimal path selected by it.

For calculating the Residual energy of each sensor Node, improved-EAMMH protocol uses both free space model (d<sup>2</sup> power loss) and multi- path fading model (d<sup>4</sup> power loss) depending on the distance between transmitter and receiver. Energy required to transmit a k-bit message over a distance d is

$$E_{Tx}(k, d) = \begin{cases} (E_{elec} \times k) + (\epsilon_{mp} \times k \times d^4), & d \geq d_0 \\ (E_{elec} \times k) + (\epsilon_{fs} \times k \times d^2), & d < d_0 \end{cases} \quad (1)$$

Where the threshold distance d<sub>0</sub> is

$$d_0 = \sqrt{\frac{\epsilon_{fs}}{\epsilon_{mp}}} \quad (2)$$

Where E<sub>elec</sub> is the energy needed to run the radio, E<sub>mp</sub> and E<sub>fs</sub> is the energy required to run the transmitter amplifier depending on the distance d. To receive a k-bit message, energy consumed is

$$E_{Rx}(k) = (E_{elec} \times k) \quad (3)$$

Data gathered from neighboring nodes are redundant and highly correlated. Hence data is aggregated at the CHs. Energy dissipated for aggregating m messages of k bits each is

$$E_{DA}(k) = (E_{agg} \times k \times m) \quad (4)$$

## 5. PERFORMANCE EVALUATION

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## 5.1 Simulation Environment

For the implementation process and performance evaluation of Improved-EAMMH protocol, ns-2(Network Simulator) is used as a simulator. Performance attributes used in our ns-2 are as follows:

1. Delivery Ratio with respect to time.
2. Throughput with respect to time.
3. Energy consumption with respect to time.
4. End-To-End delay.

A network consisting of 20 nodes, placed randomly in a region of  $M \times M$  and a BS located in the center is considered.

Table 1 is representing the initial parameters of the implementation.

Parameters	Value
Ant	Omni Antenna
Nn	Number Of Nodes
Initialenergy	100
Stop	12
Mac	MAC/TDMA
Netif	Physical/WirelessPHY
Channel	WirelessChannel

Table 1: Initial Parameters

After implementing both protocols i.e. Basic- EAMMH and Improved-EAMMH following results are obtained:

### 5.2 Results

Fig 5 is representing the throughput where the RED line is representing Improved-EAMMH and Green line is representing Basic-EAMMH. The graph is clearly showing that with the use of Improved- EAMMH throughput is increased.

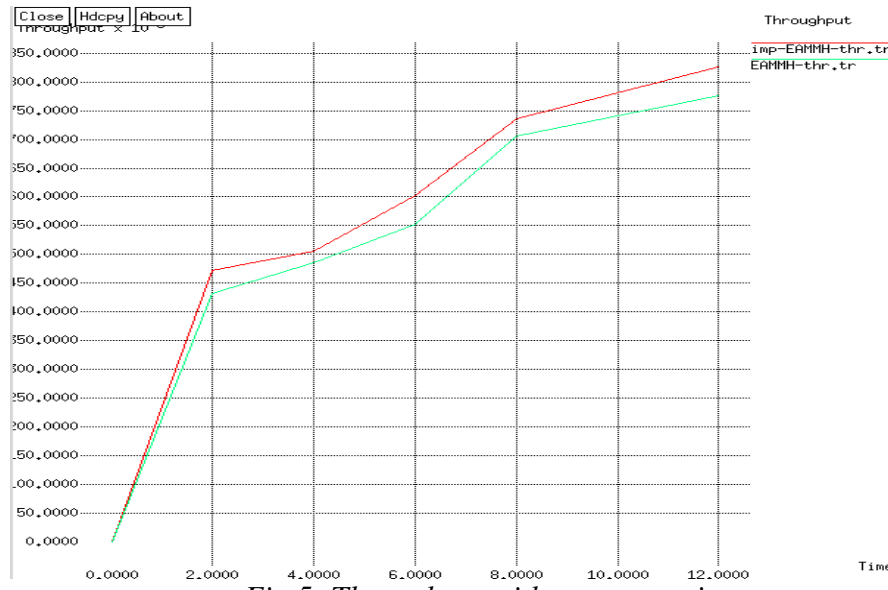


Fig.5: Throughput with respect to time

Fig 6 is the Delivery-Ratio where the RED line is representing Improved-EAMMH and Green line is representing Basic-EAMMH. The graph is clearly showing that with the use of Improved-EAMMH Delivery ratio is increased

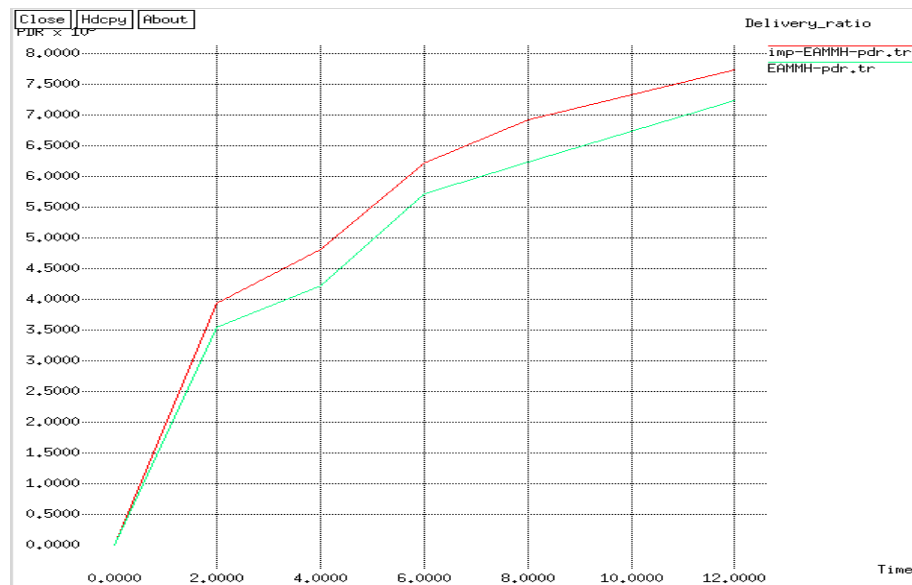


Fig 6: Delivery-Ratio with respect to time

Fig 7 is representing the energy consumption in the network in case of Improved-EAMMH and Basic- EAMMH. In this figure the RED line is representing Improved-EAMMH and Green line is representing Basic-EAMMH. The graph is clearly showing that with the use of Improved-EAMMH energy consumption in the network is reduced by a significant amount.

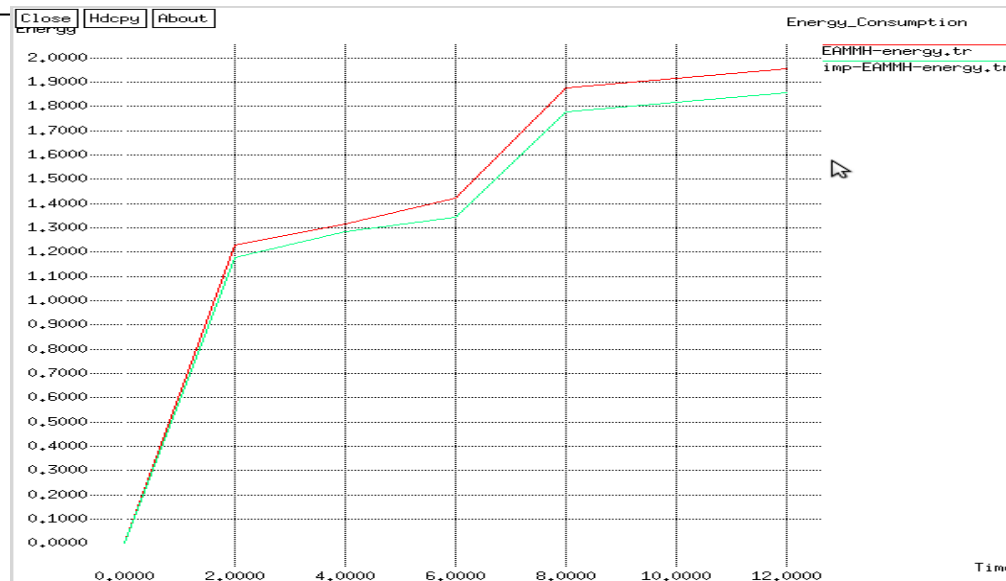


Fig 7: Energy Consumption with respect to time

## 6. CONCLUSION AND FUTURE WORK

In this paper, Improved-EAMMH protocol decides the CH on the basis of density as well as residual energy of the sensor nodes which lead to minimize the utilization of energy in the WSN and hence increase the network lifetime. Improved-EAMMH Basic-EAMMH protocol in the simulation result.

The future work may include the development of a more energy efficient algorithm which will result very less battery power consumption by the network. Another area of future work can include an algorithm which will compress the data even further without compromising the security and integrity of the data. The future work can be done in the development of an approach which should handle the difficulties of topology construction, loss tolerance, data routing. Security and energy of a sensor node are two big issues in WSN. The possibilities are endless in this field of study.

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# Artificial Intelligence in Construction

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## Abstract:

Construction is one of the oldest professions as people have been building homes and other working structures since decades. For all these decades, technology is being used to make jobs efficient and structures safe.

This paper shows how the construction industry is changing in current times, adapting the new technologies & increasing the productivity. Usage of Artificial Intelligence (AI) in construction industry will help not only to increase the productivity but also for safe structures, faster execution & better project management. The paper briefs how AI can be beneficial in different areas of whole construction value chain. Although there are challenges in implementing the AI in construction industry, but usage of AI in the industry will bring in more benefit not only to construction firms but also to other associated manufacturers, suppliers & users.

## Introduction

Construction Industry is associated with almost every other industry e.g. The industry contributes 55% share in the Steel industry, 15% in the Paint industry and 30% in the Glass industry. According to Invest India, by 2025,

- Construction market in India is expected to emerge as the third largest globally
- Construction output is expected to grow on average by 7.1% each year
- Construction equipment industry's revenue is estimated to reach \$ 5 bn

While advancement in technologies have been progressed very fast in other sectors to increase the production and better quality, it has been at a quite lower pace in construction industry. But the scenario is changed a lot in recent years. Construction industry is no more untouched of the advancements and are more open to spend on adapting new technologies, even Artificial Intelligence and machine learning, in different areas of overall construction process. It has allowed us to increase productivity, improve collaboration, and tackle more complex projects.

Companies that are researching and implementing construction technology are reaping the rewards with increased productivity, reducing risks, better collaboration, and completing projects on time and under budget—resulting in higher profit margins. Today, new technologies in construction are being developed at a breakneck pace. while construction firms continue to underinvest in technology, venture capitalists are betting big on the future of construction tech.

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### Artificial Intelligence & Machine learning:

**Machine Learning (ML)** is a field of science that uses statistical techniques to give computer systems the ability to "learn" from available data, without being explicitly programmed.

**Artificial intelligence (AI)** is the ability of a digital computer to perform tasks commonly associated with intellectual characteristic of humans, like pattern recognition, generalization, ability to reason, learn from past, problem solving & executing the corrective action.

A machine becomes better at understanding and providing insights as it is exposed to more data.

### Artificial Intelligence in Construction:

Artificial intelligence in construction is one of the several major innovations in construction industry in last few years. AI can benefit construction projects through increased safety, improving workflows, and getting jobs done faster and better. *“AI can replicate the judgments, decisions, and actions of humans without getting fatigued,”* said Dan Kara of ABI Research.

With artificial intelligence (AI) and machine learning systems, firms can turn the mountains of data they have collected over the years on projects to predict future outcomes on projects and gain a competitive advantage when estimating and bidding on construction projects.

### Use cases of Artificial Intelligence in Construction Industry

Artificial intelligence is expected to increase efficiency throughout the entire value chain – from the production of building materials to the design, planning and construction phase itself, and facility management as well.



## **Building Materials**

AI can be an enabler for the next big step in the digitalization of construction material producers and/or distributors. It would increase efficiency along the value chain in functions such as procurement, manufacturing & logistics of building material producers, merchants as well as building companies.

In procurement, AI can help companies forecast prices for raw materials (sand, gravel, iron, etc.) and other input factors. AI can then forecast the price and determine the optimal point in time to buy. AI can identify the need for a product and then order said product. It automatically chooses the best supplier based on previous data (quality, punctuality, price, etc.).

The manufacturers can improve & maintain the quality of their product. Variations in quality are eliminated by AI as it identifies the best combination of all parameters and adjusts them accordingly, and in doing so, AI realizes the best quality of product. As such, AI also improves the use of production capacities and reduces production downtimes by detecting problems in production at a very early stage. Furthermore, AI has the potential to lower energy usage and therefore energy costs.

AI also helps further optimize logistics with regard to routes. Artificial intelligence identifies the best means of transportation and also the best routes based on information on times and dates, addresses, traffic, costs, speed, etc. In addition, it improves its recommendations with every delivery executed. In the future, these routes will be used by autonomous transportation modes like cars, trucks, ships and planes.

### ***B. Design & Planning***

One of AI's greatest strengths is its ability to explore many different variations of a model to find the best option – this is known as 'generative design'. For a human to explore all these possibilities would require months – an AI engineering programme could do so in hours.

Generative design could be useful for designers using Building Information Modelling (BIM) technology. AI would take a BIM model and explore tens of thousands of minor and major design changes to make a design safer, more stable, or simply cheaper and faster to build.

### ***C. Construction & Execution***

Construction projects frequently become delayed or experience cost overruns – even with skilled project managers overseeing them. Project managers could use AI-enhanced PPM software that identifies how likely their plans are to be delayed. This could help them revise projects and find ways to manage time and resources better.

AI can improve worker productivity by reducing the amount of time wasted moving about the construction site to retrieve tools, materials, and equipment to perform certain tasks. AI can support to check the availability of required machines & tools and based on that workers/engineers can plan their work without wasting time. A message can automatically be conveyed to shift the desired equipment to next required location.

Artificial intelligence (AI) are also being used to monitor jobsite progress with real-time, actionable data to improve jobsite productivity. Autonomous drones and rovers are equipped with high-definition cameras and scan the construction site each day with pinpoint accuracy. AI then uses those scans to compare against your BIM models, 3D drawings, construction schedule, and estimates to inspect the quality of the work performed and to determine how much progress has been made each day.

Workers can also be tracked throughout the day using smartphones or wearables. By classifying and measuring quantities installed, these systems can tell you how much work was done each day, which it can then compare against your construction schedule and alerts you if your project is falling behind. The AI also detects deviations between installed components and onsite work with models so you can quickly identify errors and avoid costly rework.

#### *D. Safety & Training*

A major driver of construction delays and cost overruns are accidents. The use of AI in the form of computer vision in combination with cameras at the construction site might mitigate risks and reduce the number of accidents greatly. Deep-learning algorithms are used to identify and report errors in work performed. This can be anything from the excavation and site work to the mechanical, electrical and plumbing systems. The AI can recognize a building component based on its shape, size and location even if only a portion of the component is visible.

AI is very effective at analysing historical data and using this to create likely forecasts of future events. A picture taken by drones or safety cameras can be sent to AI system. AI system based on historical data and other available information of material, can plausibly begin to predict when certain surfaces, fittings or materials will become damaged or worn and alert maintenance teams to this

VR/AR based systems can be used to train the engineers & workers for any kind of situation. These system can simulate the instances for better learning of workers at different levels.

#### **Facility Management**

Facility managers have to dedicate a lot of time to making these decisions, which are based on huge amounts of data collected during the project's lifecycle. This is costly and prone to error.

AI-supported software can analyze data to help facility managers take proactive action. For example, AI can detect parts of buildings that are currently not being used and automatically deactivate the heating, ventilation and air conditioning in these parts, drastically reducing energy consumption. Similarly, service & repairing job can be tracked automatically and be informed well in advance to facility team. In case any part is required to be ordered, that can also be checked and ordered by AI system. manager also learns from AI whether it is really better to repair or replace the air conditioner. Moreover, The cleaning and unnecessary maintenance for unused parts of the building can be cancelled.

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AI enables facility managers to reduce costs by ensuring more efficient facility management. Thanks to AI, work is only done when it is needed or if it is needed at all. It also improves quality and reduces downtimes as it recommends the best way to react to anomalies

### ***Post Construction***

*Building managers can use AI long after the construction of a building is complete. Building information modelling, or BIM, stores information about the structure of the building. AI can be used to monitor developing problems and even offers solutions to prevent problems.*

In customer service and aftersales, AI supports and relieves the staff by answering customer inquiries automatically. Today, there are already chatbots operating in customer service that speak and answer like human beings, with the result that people often do not notice that they're talking to an AI instead of a human being. Not only does this save money, it also results in a higher quality of customer service as the staff can focus on more difficult inquiries as required.

### **Challenges for AI in Construction:**

AI construction technologies face a handful of key obstacles to wider adoption:

- AI machines require large amounts of data to 'train' algorithms to spot patterns. Without enough data, this kind of training isn't possible.
- There is a shortage of data scientists and they tend to command extremely high values. Only the biggest firms can attract top AI talent.

### **Conclusion**

While these obstacles are important, the potential benefits of AI in construction are significant and make it an opportunity worth exploring. And, as the following examples demonstrate, there are several scenarios where construction AI is already in use – or could be in the coming years.

Despite the predictions of massive job losses, AI is unlikely to replace the human workforce. Instead, it will alter business models in the construction industry, reduce expensive errors, reduce worksite injuries, and make building operations more efficient. In the coming years AI will continue to drive cost savings, time savings, and overall improvements.

Leaders at construction companies should prioritize investment based on areas where AI can have the most impact on their company's unique needs. Early movers will set the direction of the industry and benefit in the short and long term.

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## Easy Alternatives of Complicated Surveying Techniques

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**ABSTRACT:** *Whenever we think of performing an engineering project, the first thing that strikes our mind is the need to know about the various features of our location, including its dimensions, topography, elevation, soil quality, etcetera, this systematic study is termed as surveying. It is even termed as the backbone of civil engineering. However, as important it is, in many cases, it gets equally complicated and very expensive as well. Thus, not everyone can afford to do it. The presence of technical equipment like Theodolite, prism-light, Scanners have made our work time friendly and easy, but equally complicated and pocket shocking at the same time. Thus, to find some easy alternatives to carry out our operations have become a requirement. So, following it, we have therefore proposed two such physical ways of determination. In the first one, through a Trigonometric-pole shadow technique, we can find the dimension of a landmass. For this, we can either extend the pole height or alter the angle that the pole makes with the ground. On the other hand, we can analyze the depth of a shallow water body via a simple rope and an easily available weight (preferably some stone/ light-rock) and submerging the apparatus in the waterbody. Thus, using natural resources and a little innovation, we can make our surveying work pretty much less complicated. It is to be mentioned that there is a lot of space for renovations in the proposed theory.*

**Index Terms-** Depth, Scanners, Shallow, Theodolite, Topography

### **INTRODUCTION**

As complicated surveying is, it is equally necessary. We have technical equipments like Theodolite, Prism light, total-station, scanners. Even though they might be pretty much accurate, but the thing to see here is that the term “Pretty much” does not guarantee complete accuracy. So, if the machines that are costing us humongous investments (An average total station set can cost us to nearly 2 lakh rupees), still cannot guarantee us perfection, it will automatically be a win-win condition if the same work can be done by doing a much smaller investment, guaranteeing us a fair to almost-perfect measurement. This will not only put an end to the complications, the money invested on a total station, the time taken, the huge margin of error that is caused while using a measuring tape, but at the same time, it will be so easy that an average human shall be able to use it. The basic idea of the first act is to measure the dimension of a clear plot of land and in the second one, is to easily measure the depth of any waterbody we have. The best part is that these things will make use of pretty much available natural resources/tools like an extendable rod, a protractor (under a very sunny and clear sky) to measure a landmass’s or a plot’s length and a simple rope (with colored paints over it or a measuring scale) along with just a heavy stone to figure out the depth of a shallow water body (a pond or lake). Of course, the margin of errors and depending conditions are existing, however, so are in the technical equipment.

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**1) Height Measurement using Shadow-Trigonometry technique:** In this technique, we can find the shortest distance between any two points located on a given plain ground (suppose one point is the base of the apparatus and the other one is the desired point of our plot, then either the height of a scaled (measurement units can be in feet and inches) pole can be adjusted or the angle it makes with the ground can be taken into consideration for usage. In the system where we have the alternating length, we can use very basic trigonometric identities, our only concern will be to find a suitable position and timing of the sun to work upon, thus making it a lengthy and slow process. And, in the alternating angle method, we can alter the pole length as well. So, what happens here is that the equation to find the dimensional length gets way trickier in calculations, but it will not depend on the sun's position as much as it did back in the length technique.

**2) Depth Measurement Using Rope-weight technique:** This technique is a way to find the depth of a waterbody without getting into the water. Just with a rope (colored/scaled/striped/waterproof etc.) and a weight, we can find a pond's or any waterbody's depth. Even though the concept has already been introduced, and while doing operations through it, we face problems like the transfer of water to surrounding rope particles and a huge margin of errors, however, we can still improve it via easy and accurate measurements.

### **OBJECTIVE:**

1. To make use of the natural resources around us and easily available cheap materials to make our surveying process lesser complicated (dimensional analysis)
2. To suggest changes in already existing surveying methods in the field of Depth measurements of various Waterbodies.

### **LITERATURE REVIEW:**

1. **N.A.S.A.'s the angles of the sun's rays:** On the 30<sup>th</sup> of march in 2015, N.A.S.A. published an article that deals with the angle of the sunlight. It mentioned that through devices like solar plate and sensors, we can not only measure the intensity of the sunlight in an area but also the angle that is made between the light and the ground. This technique has many other applications, including designing of window (to allow entry of light and to guide ventilation) and installation of solar panels. However, to get the full amount of the intensity, it was tilted at an angle of 45<sup>0</sup>.
  2. **PV Education's The sun's Position:** It suggested that using following formulae, we can find the position of the sun.  

$$LSTM = 15^0 (\Delta) T_{GMT}; (LSTM = \text{local Time} - \text{Green Meridian Time})$$

$$E_oT = 9.87 \sin(2B) - 7.53 \cos(B) - 1.5 \sin(B); \text{ where } B = 360/365 (d-81)^0 (D \text{ is the number of days since the start of the year})$$

$$\text{Time Correction Factor (TC)} = 4(\text{Longitude} - LSTM) + E_oT$$

$$\text{Local Solar Time (LST)} = LT + TC/60$$

$$\text{Hour Angle (HRA)} = 15^0 (LST - 12)$$

$$\Delta = 23.45 \sin [360/365 (d-81)]$$

$$\text{Alpha} = \sin^{-1} [\sin(\Delta) \sin(\phi) + \cos(\Delta) \cos(\phi) \cos(\text{HRA})]$$

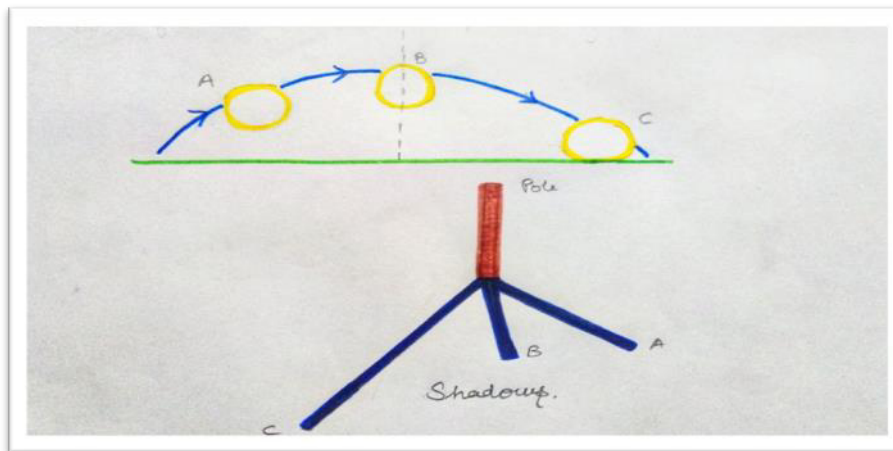
$$\text{Azimuth} = [\cos^{-1} \{ \sin(\Delta) \cos(\phi) - \cos(\Delta) \sin(\phi) \cos(\text{HRA}) \} / \cos(\alpha)]$$
 where phi is the latitude. This way through elevation and azimuth, we can find the position of the sun.
-

3. **Scientific American's Change the Size of a Shadow:** The article dealt with the ways we can vary shadows from being extremely huge to insanely small just by changing the position of Light source. It mentioned that when the source of light was taken away from the object, the object's shadow's size will decrease, and the exact opposite was also clearly observed. The authors mentioned that the tricks can spook out anyone on Halloween nights.
4. **Discovery of Sound in the sea:** The article DOSITS fulfilled the drawback of our proposed theory by being able to find the depth of an extremely deep waterbody (oceans included). By using a Transmitter, a receiver, and a tracker. They decided to measure the time taken for the sound to return to the receiver, then used the formula of  $\text{speed} = \text{distance}/\text{time}$ . This way, the authors were able to track the depth of the oceans.

### METHODOLOGY:

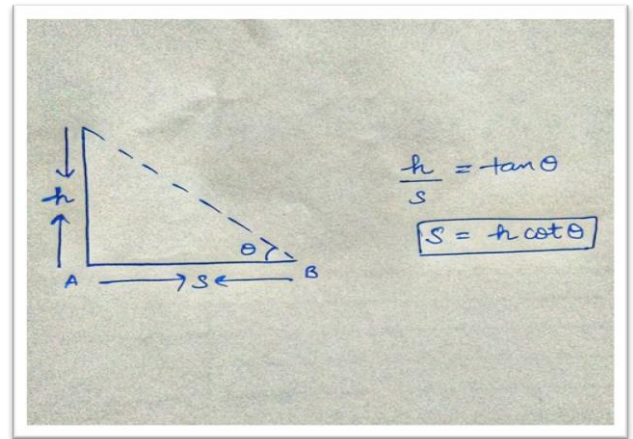
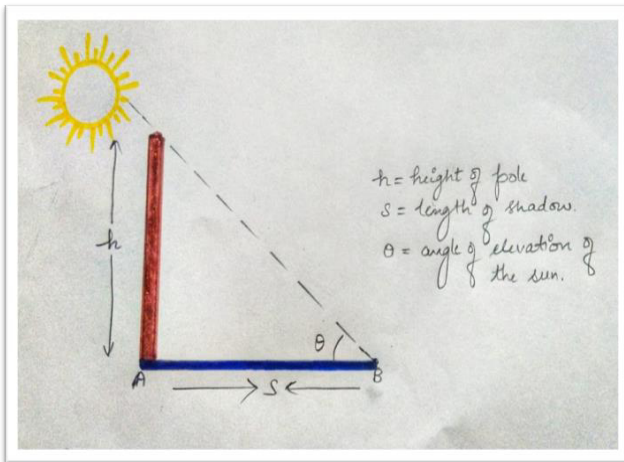
**Pole- Shadow technique:** Through Trigonometric Pole Shadow Technique, we will be able to find the dimension of the landmass. In this, we will have a pole of adjustable height and angle (concerning the ground) and its shadow will tell us the dimension. Suppose we want to calculate the distance between two points A and B. We will simply place the pole at point A and then we will adjust the height or angle (with the vertical plane) so that its shadow ends at point B. All the mathematical work and calculations will be done via trigonometric functions.

Before moving ahead, it was important for us to study the effect on shadow due to the location of the sun. (Given below is the pictorial view of the changing lengths of shadows of a single pole.)



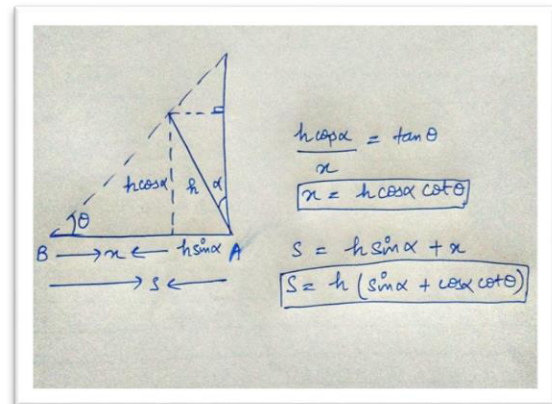
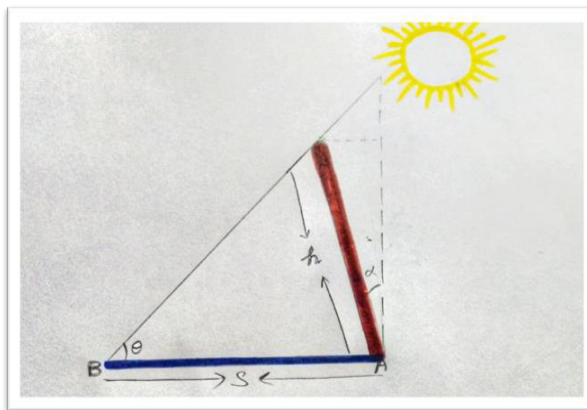
**Now, let us see how this technique is supposed to work**

1. To begin with, we placed our pole at point A to measure the distance between two points A and B and at height  $h$  of the pole, the shadow ends at point B. We will find the angle of elevation of the sun and can simply use a trigonometric function to calculate the length of the shadow.



[So, considering has pole height and theta as the angle that the sunrays are making with the ground, we can calculate the dimension or the shadow's length by formula  $S = h \cot \theta$ ].

- In a second way, we placed the pole at point A to measure the distance between two points A and B at height h and tilted angle of alpha the shadow is ending at point B. We will find the angle of elevation of the sun and can simply use the trigonometric function to calculate the length of the shadow.



[This way, considering the pole length h, angle apparatus makes with the ground as Beta and  $\alpha = (90^\circ - \text{Beta})$  and  $\theta$  is the angle the shadow, then at any given instant, the length of shadow or the dimension can be calculated by formula  $X = h(\sin \alpha + \cos \alpha \cot \theta)$ ].

**Depth Measurement by Rope-Stone technique:** To determine the depth of a water body, all we need is a rope and a weight (rock). This method is very simple and intuitive. Simply, tie the rope to the weight. Now to measure the depth at different points in a water body, we will be requiring our rope to fall straight down at that point. For example, if we want to measure the depth at the center of the water body, it is required for our rope to fall perpendicularly down at the center.

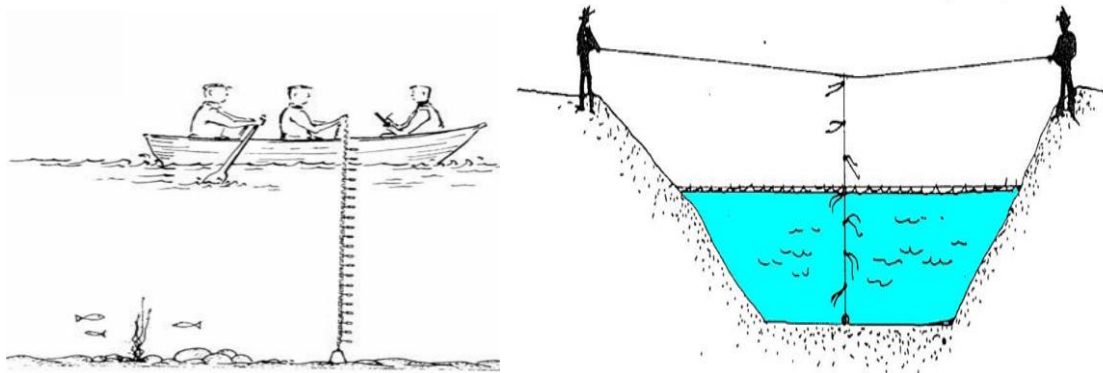


### Let us analyze how this trick is supposed to work

This can be achieved using a boat to reach these points (like shown in the diagram), or by tying our apparatus to another rope, and using that rope taking it to desired positions (as shown in the diagram). Just a rope and a rock, depth of a water body can be measured, up to a satisfactory limit. So, after reaching the desired position let the weight fall in the water, till it reaches it is the floor.

Now to measure depth, either we can mark the rope till the point it is wet and measure it later by a tape or we can have a rope which is marked with several indicators (scales) on our rope with a certain length gap between two successive indicators, which can tell us there only about depth. For sake of precision, weight shall be dropped in several nearby locations. To check where it is deepest, If the deepest mark is underwater, mark the new deepest point. Continue until you feel satisfied with the accuracy of the depth point. And this shall be the depth of our water body. Now, move back to the lab and measure the rope with a tape measure.

On the other hand, we can use pre-scaled ropes, paint indicators or the best can be to use a waterproof tube that does not allow the water to move from layer to layer and thus our readings are not hindered.



Figure(s) (1 and 2 from left to right respectively) depicting the rope-weight techniques.

### DISCUSSION:

**Impact of Sunlight/ Any source of light on the formation of shadow:** When the light rays travelling at a speed of  $3 \times 10^8$  m/s hits the opaque object a shadow is formed. Shadow can be easily seen on a white wall or at outdoors on a clear, bright, and sunny day, means when there is the contrast between shadow and surface. Although the shape of the object determines the shape of the shadow, it can alter due to the position of the light source. The sun's position in the sky affects the length of the shadow when the sun is low on the horizon the shadow is long and vice - versa. Shadow also alter with seasons it is short in summer whereas long in winters.

**Impact of the wave speed on the things below the waterbodies:** Generally, the stability of the objects beneath the surface of the water are hindered by the flow of water waves, this is the exact reason why the fishes and other sea creatures are gifted with streamlined bodies. The higher the speed of the current is, the tougher it will be for us to submerge our equipment in the waterbodies.



**Applications:**

- a. The pole shadow method can be used in the areas of intense sunlight where we know the angle the shadow makes with the ground.
- b. The Rope technique can be used to not only find the dimension of the given waterbody, but if installed with a waterproof camera/sensor, can help wildlife researchers do the study and the analysis of the aquatic life in the region.
- c. The extendable pole can also be used in the elevation analysis of the location.
- d. Basically, the major aim to perform our task in less expenditure is being carried out, which is a win-win condition.

**4) Limitations:**

- (a) The Rope-stone technique has already been introduced, though our work suggested a few improvements.
- (b) The Pole-shadow technique being sunlight dependent can not be done under dark conditions till an artificial light source is used.
- (c) In areas of muddy water/swamp, we can not use the rope-stone technique. Also, the pollution particles may cause hinderance in the path of the stone to the depth of the waterbody, thus creating error in the readings.
- (d) In areas of forest with huge tree density, we can not use the pole technique. It can only be performed on plain levelled grounds.

**CONCLUSION:**

As per our studies and experiments, we deduced two basic conclusions:

For calculation of dimensions of a piece of land (its length and breadth), we can use a pole and a smart digital protractor, in cases where either the height of the pole or the angle it makes with the ground can be altered. For depth calculation, in a shallow water body, if a stone tied to a rope is dropped perpendicularly, the length of the rope submerged can give us the idea of the depth of the pool and there are many smart ways to avoid hinders or scope of errors (or to minimize it, to say the least). This way, huge investments for basic requirements are now not much troublesome.

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# Picard Type Iterative Scheme with Initial Iterate in Reverse Order for a Class of Nonlinear Three Point BVPs

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## Abstract

I investigate the BVPs which is

$$y'(t) = f(t, y) \quad 0 < t < 1,$$

(a)

$$\alpha y'(0) = \beta y(\eta) \quad \gamma y'(1) = \delta y(1)$$

(b)

where  $0 < \eta < 1$ ,  $\alpha, \beta, \gamma$  and  $\delta$  is positive.  $f(t, y)$  is continuous in  $t$  and one sided lipschitz in  $y$ . By the monotone iterative scheme show that on some sufficient condition sequences is generated which is uniformly converge to a solution of nonlinear multipoint BVP.

## 1 Introduction

BVPs are uses in many branches of science and technology and the monotone iterative scheme is uses for the study of the existence and uniqueness of non linear BVPs. In 2013, Singh et.al. uses this technique for the BVPs which is

$$-y''(t) = f(t, y) \quad 0 < t < 1$$

(c)

$$y'(0) = 0 \quad y(1) = \delta y(\eta)$$

(d)

where  $\delta$  is greater than zero and  $f(x, y)$  is continuous and lipschitz in  $y$ . I observe the BVPs which is

$$-y''(t) = f(t, y) \quad 0 < t < 1$$

$$\alpha y'(0) = \beta y(\eta) \quad \gamma y'(1) = \delta y(1)$$

where  $f(t, y)$  is continuous on  $U$ , where  $U = [0, 1]$

## 2 Derivation of Green's Function

To evaluate equations (a) and (b) I detect the BVPs

$$(e) \quad -y''(t) - \mu y(t) = 0 \quad 0 < t < 1$$

$$(f) \quad \alpha y'(0) - \beta y(\eta) \quad \gamma y'(1) - \delta y(1) = d$$

For the derivation of Green's function of this equation I split it into parts

### Part- (a)

For  $0 < \mu < \frac{\pi^2}{4}$  I assume,

$$(P_0): \sqrt{\mu}\gamma \cos \sqrt{\mu} - \delta \sin \sqrt{\mu} \geq 0, \quad \sqrt{\mu}\alpha - \beta \sin \sqrt{\mu}\eta \geq 0 \text{ and}$$

$$\mu\alpha\delta \cos \sqrt{\mu} - \mu\beta\gamma \cos \sqrt{\mu}(\eta - 1) + \mu\sqrt{\mu}\alpha\gamma \sin \sqrt{\mu} - \beta\delta\sqrt{\mu} \sin \sqrt{\mu}(\eta - 1) > 0.$$

**Lemma a.2.** The Green's function  $G(t, s)$  for the equations (e) and (f) for  $\mu > 0$  is

$$\frac{1}{D_\mu} P(t, s)$$

Where  $P(t, s) =$

$$\left\{ \begin{array}{ll} \sqrt{\mu}\alpha \cos \sqrt{\mu}t [\sqrt{\mu}\gamma \cos \sqrt{\mu}(s-1) + \delta \sin \sqrt{\mu}(s-1)] \\ + \beta \sin \sqrt{\mu}(t-s) [\sqrt{\mu}\gamma \cos \sqrt{\mu}(\eta-1) + \delta \sin \sqrt{\mu}(\eta-1)], & 0 \leq t \leq s \leq \eta; \\ \sqrt{\mu}\gamma \cos \sqrt{\mu}s [\sqrt{\mu}\gamma \cos \sqrt{\mu}(t-1) + \delta \sin \sqrt{\mu}(t-1)] , & 0 \leq s \leq t \leq \eta; \\ [\sqrt{\mu}\gamma \cos \sqrt{\mu}s + \beta \sin \sqrt{\mu}(s-1)] [\sqrt{\mu}\alpha \cos \sqrt{\mu}t + \beta \sin \sqrt{\mu}(t-\eta)], & \eta \leq t \leq s \leq 1; \\ [\sqrt{\mu}\alpha \cos \sqrt{\mu}s + \beta \sin \sqrt{\mu}(s-\eta)] [\sqrt{\mu}\gamma \cos \sqrt{\mu}(t-1) + \delta \sin \sqrt{\mu}(t-1)], & \eta \leq s \leq t \leq 1 \end{array} \right.$$

Where  $D_\mu = \mu\alpha \cos \sqrt{\mu} - \mu\beta\gamma \cos \sqrt{\mu}(\eta-1) + \mu\sqrt{\mu}\alpha\gamma \sin \sqrt{\mu} - \sqrt{\mu}\beta\delta \sin \sqrt{\mu}(\eta-1)$ .

*Proof.* The corresponding homogeneous equation is

$$(g) \quad -y''(t) - \mu y(t) = 0 \quad 0 < t < 1,$$

$$\alpha y'(0) - \beta y(\eta) \quad \gamma y'(1) - \delta y(1).$$

(h)

The solution of (g) is

$$y - A_1 \cos \sqrt{\mu}t - C_2 \sin \sqrt{\mu}t$$

And  $G(t, s) =$ 

$$\begin{cases} l_1 \cos \sqrt{\mu}t + l_2 \sin \sqrt{\mu}t & 0 \leq t \leq s \leq \eta \\ l_3 \cos \sqrt{\mu}t + l_4 \sin \sqrt{\mu}t & 0 \leq s \leq t \leq \eta \\ l_5 \cos \sqrt{\mu}t + l_6 \sin \sqrt{\mu}t & \eta \leq t \leq s \leq 1 \\ l_7 \cos \sqrt{\mu}t + l_8 \sin \sqrt{\mu}t & \eta \leq s \leq t \leq 1 \end{cases}$$

Use the features of Green's function for found the constants  $l_1$  to  $l_8$ .**Lemma a.2.** Let  $\mu > 0$  and  $y$  is the solution of (e) and (f) then,

$$y(t) - \frac{-d\sqrt{\mu}}{D_\mu} (\alpha\sqrt{\mu} \cos \sqrt{\mu}t + \beta \sin \sqrt{\mu}(t - \eta)) - \int_0^1 G(t, s)k(s)ds$$

**Part (b)**For  $\mu < 0$  I assume that

$$P_k; \gamma\sqrt{|\mu|} \cosh \sqrt{|\mu|} - \delta \sinh \sqrt{|\mu|} \geq 0$$

$$\delta \cosh \sqrt{|\mu|} - \gamma\sqrt{|\mu|} \sinh \sqrt{|\mu|} \leq 0, \alpha\sqrt{|\mu|} - \beta \sinh \sqrt{|\mu|}\eta \geq 0 \text{ and}$$

$$|\mu|\beta\gamma \cosh \sqrt{|\mu|}(\eta - 1) + \alpha\gamma|\mu| \sqrt{|\mu|} \sinh \sqrt{|\mu|} + \beta\delta\sqrt{|\mu|} \sinh \sqrt{|\mu|}(\eta - 1) > 0$$

**Lemma a.3.** The Green's function  $G(t, S)$  for the equation (e) and (f) ( $\mu < 0$ ) is

$$\frac{M(t, s)}{M_\mu}$$

Where  $M(t, s) =$

$$\left\{ \begin{array}{l} \sqrt{|\mu|}\alpha \cosh \sqrt{|\mu|}[\sqrt{|\mu|}\gamma \cosh \sqrt{|\mu|}(s-1) + \delta \sinh \sqrt{|\mu|}(s-1) + \\ + \beta \sinh \sqrt{|\mu|}(t-s)[\sqrt{|\mu|}\gamma \cosh \sqrt{|\mu|}(\eta-1) + \delta \sinh \sqrt{|\mu|}(\eta-1)], \quad 0 \leq t \leq s \leq \eta \\ \sqrt{|\mu|}\alpha \cosh \sqrt{|\mu|}t[\gamma \sqrt{|\mu|} \cosh \sqrt{|\mu|}(s-1) + \delta \sinh \sqrt{|\mu|}(s-1)], \quad s \leq t, s \leq \eta \\ [\gamma \sqrt{|\mu|} \cosh \sqrt{|\mu|}(s-1) + \delta \sinh \sqrt{|\mu|}(s-1)][\alpha \sqrt{|\mu|} \cosh \sqrt{|\mu|}t + \beta \sinh \sqrt{|\mu|}(t-\eta)], \quad \eta \leq t \leq s \leq 1 \\ [\gamma \sqrt{|\mu|} \cosh \sqrt{|\mu|}(t-1) + \delta \sinh \sqrt{|\mu|}(t-1)][\alpha \sqrt{|\mu|} + \beta \sinh \sqrt{|\mu|}(\eta-1)], \quad \eta \leq s \leq t \leq 1 \end{array} \right.$$

**Lemma a.4.** Let  $\mu < 0$  and  $y$  is a solution of (e) and (f) then,

$$y(t) = \frac{d\sqrt{|\mu|}}{M_\mu} \left( \alpha \sqrt{|\mu|} \cosh \sqrt{|\mu|}t + \beta \sinh \sqrt{|\mu|}(t-\eta) \right) - \int_0^1 G(t,s)k(s)ds$$

**Lemma a.5.** Assume that  $P_0$  is true, then  $G(t,s)$  is greater than or equal to zero.

**Lemma a.6.** Assume that  $P_k$  is true, then  $G(t,s)$  is less than or equal to zero.

### 3 Maximum and Minimum principle

**Proposition 1. Minimum principle:** If  $P_0$  is true,  $d > 0$  and  $k(t) > 0$ , then  $y(t)$  in Lemma a.3. is less than or equal to zero which is solution of (e) and (f).

**Proposition 2 Maximum principle:** if  $P_k$  is true,  $d > 0$  and  $k(t) > 0$ , then  $y(t)$  in Lemma a.4. is greater than or equal to zero which is solution of (e) and (f).

### 4 Conclusion

The monotonic iterative scheme is powerful for upper and lower solutions and important for finding solution of three point boundary value problem. It proves the existence of solutions analytically and helpful for solving numerical problem by the use of minimum principle and maximum principle.





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