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**BCKIC**  
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# WMSD 2021

International Conference on  
Promoting Environmental Technologies for  
**Waste Management and Sustainable  
Development**

## ABSTRACT SOUVENIR



HYBRID MODE

**12-13 December, 2021**

Auditorium, Campus-11, Kalinga Institute of  
Industrial Technology, Bhubaneswar, Odisha

In Association With



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## Message



It is a matter of great privilege that Kalinga Institute of Industrial Technology (KIIT) Deemed to be University, in association with National Environment Science Academy, New Delhi, Bhubaneswar City Knowledge Innovation Cluster, CSIR-Institute of Minerals and Materials Technology - Bhubaneswar, Environment and Social Development Association- New Delhi and CIPET-Bhubaneswar is organizing a two-day International Conference on "**Promoting Environmental Technologies for Waste Management and Sustainable Development (WMSD-2021)**"

Waste of various streams is an issue with an immense impact on the quality of life of the people in India and world over. Sustainability has to be the bottom-line when thinking of the ways of utilization and remediation from the waste problems. Improper waste handling and disposal has been one of the greatest challenges and the ongoing pandemic has exacerbated the issue. I am indeed happy to notice that the objectivity of this conference lies in setting up dialogue and discourse for sustainable development through effective waste management.

The conference in the academic institutions is an essential part of academic growth of faculty members and students. I am fully aware that the faculty members and patrons have to put extra time and their resources for this important purpose. I am confident that the deliberation of the conference will prove a milestone for the development of research and innovations related to waste management and sustainable development.

I wish conference and its deliberations all the success.

**Dr. Achyuta Samanta**  
Founder, KIIT & KISS

## Message



I feel proud that the KIIT University, Bhubaneswar, Odisha is organizing an International Conference on "**Promoting Environmental Technologies for Waste Management and Sustainable Development (WMSD-2021)**" on 12-13 December, 2021 in Hybrid mode (Auditorium, Campus-11, Kalinga Institute of Industrial Technology, Bhubaneswar, Odisha\*) in collaboration with National Environmental Science Academy (NESA), New Delhi. The theme of the International Conference is relevant to the current quest of human mind which is actively engaged not only in exploring its surroundings but also in resolving the secrets of nature. Nurturing the nature requires deep understanding of all its facets.

Environmental and economic implications have compelled proper eco-friendly disposal of modern day wastes and also made it essential to come up with alternative waste management practices that reduce the environmental burden resulting from unwise waste disposal habits. Increasingly vigilant environmental regulators are imposing austere regulations for waste treatment prior to discharge coupled with escalation in the costs for direct disposal present two interrelated problems such as traditional practice of disposing waste loaded with pollutants need to be either discontinued or upgraded and incremental improvement in the waste management technologies, which has always been a game of playing catch-up with the regulations, have inflated infrastructure requirement and treatment cost significantly. Therefore, rather than continuing slow evolution, adaptation of a leapfrogging strategy could be more effective. Although a great deal of research is carried out in various academic and research institutions, their practical applications is rather slow. Biodegradable machines should be prioritized in place of open burning of farm wastes.

Waste Management and Sustainable Development (WMSD-2021) aims to bring together leading academicians, scientists, researchers, industry experts and policy makers to exchange and share their experiences and on various aspects of Waste Management and Sustainable Development. It also provides a premier interdisciplinary platform for researchers, practitioners and educators to present and discuss the most recent innovations, trends, and concerns as well as practical challenges encountered and solutions adopted in the fields of waste management and resource recycling.

Water management will also remain the main objective among the participants.  
I extend my best wishes to the organizers and the participants for a grand success of the conference.

A handwritten signature in blue ink, appearing to read "Javed Ahmad".

**Prof. Javed Ahmad**

President, NESA &

Former Dean, Faculty of Science Jamia Hamdard, New Delhi

## Message



On the behalf of organizing committee, I would like to cordially welcome you all to the International Conference on **Promoting Environmental Technologies for Waste Management and Sustainable Development (WMSD-2021)**.

Waste management refers to the activities and actions that handle waste materials. Waste prevention, recycling, reuse, and recovery are important waste management strategies that eases the burden on landfills, conserves natural resources, and saves energy. This helps utilize resources more effectively and sustainably.

When waste is disposed of or recycled in a safe, ethical, and responsible manner, it helps reduce the negative impacts of the environment. Ensuring that waste management procedures are carried out with regularity helps ensure that fewer waste materials go to the general waste stream. Poor waste management contributes to climate change and air pollution, and directly affects many ecosystems and species. Landfills, considered the last resort in the waste hierarchy, release methane, a very powerful greenhouse gas linked to climate change. There are eight major categories of waste management, and each of them can be divided into numerous sub-categories. The categories include source reduction and reuse, animal feeding, recycling, composting, fermentation, landfills, incineration, and land application.

The success of the International Conference depends ultimately on the message we pass on to the new generation. I would like to thank the team members of WMSD-2021, Patron, Co-patron, President NESA, Advisory Committee Members, as well as the Eminent Scientist for helping me deliver the Promoting Environmental Technologies for Waste Management and Sustainable Development message to the young researchers and students for a key to the success of this conference.

*Sushil Kumar Singh*

**Sushil Kumar Singh**  
General Secretary, NESA &  
Scientist "F", Solid State Physics Lab  
Lucknow Road, Timarpur, Delhi- 110054, INDIA

## Message



It gives me immense pleasure to share. that National Environmental Science Academy, New Delhi has been organizing an International Conference on "Promoting Environmental Technologies for Waste Management and Sustainable Development (WMSD-2021)" on hybrid mode on December 12 - 13, 2021 jointly by CIPET, Bhubaneswar, KIIT, Bhubaneswar, CSIR-IMMT, Bhubaneswar & Environment & Social Development Association, in collaboration with Bhubaneswar City Knowledge Innovation Cluster (BCKIC).

The Conference shall be focusing on emerging theme on Waste Management, Extended Producers Responsibility and Circular economy, wherein Eminent Speakers from the Scientific Fraternity on varied expertise shall be delivering talks pertaining to various issues of environment and its management. I hope the Conference will have generous participation both in online & offline mode from Young Budding, Researchers, Academicians, Entrepreneurs, Industrials across the globe.

I wish the Conference a grand success and congratulate all the Scientific Members involved in the Conference, for bringing it live on varied platforms.

A handwritten signature in blue ink, appearing to read "P. K. Sahoo".

**P. K. Sahoo**  
Principal Director & Head  
CIPET, Bhubaneswar

## Message



It is indeed a great pleasure for me to know that National Environmental Science Academy (New Delhi) is organizing the International Conference on "Promoting Environmental Technologies for Waste Management and Sustainable Development (WMSD-2021)" hosted by KIIT University, in collaboration with Bhubaneswar City Knowledge Innovation Cluster and not letting the pandemic hamper the process of learning and sharing.

With the themes on causes of different Environment and Health challenges and proposed solutions in combating and mitigation of the same, I am confident that this conference will create yet another benchmark in providing a platform for expressing and sharing thoughts by the distinguished participants to contribute pertinent benefits to the world as a community. The innovations and technology in waste management are solutions to a healthy future and hygienic environment, sometimes partially or fully substituting unsustainable process and practices that have crept into our daily lives mainly after the advent of the industrial revolution.

I am sure the conference will provide a vibrant exchange of ideas between the professionals of Waste Management, Environment & Sustainability, Biology, Chemistry, Agriculture and Industries.

I welcome all the delegates, dignitaries and participants, and wish the Conference a huge success.

A handwritten signature in blue ink, appearing to read "Sudhasatwa Basu".

**Prof. Sudhasatwa Basu**  
Director, CSIR-IMMT Bhubaneswar

## Message



It gives me immense pleasure that National Environment Science Academy, New Delhi along with Bhubaneswar City Knowledge Innovation Cluster (BCKIC) and KIIT Deemed to be University, Bhubaneswar are organising International Conference on "Promoting Environmental Technologies for Waste Management and Sustainable Development (WMSD-2021)" in association with CSIR-Institute of Minerals and Materials Technology - Bhubaneswar, Environment and Social Development Association- New Delhi and CIPET -Bhubaneswar.

I wish grand success of the conference with a hope that it will be an ignitor for the much-needed discourse in the sustainable approach in the waste management. Recycle, reduce and reuse has to be the mantra for attaining sustainability in the waste management strategy and the deliberations at the conference should pave the path for a wider discourse in this ever-increasing problem. The presence of distinguished researchers, academicians, industry persons and students from all across the country and abroad at a single platform is a step forward in this direction.

The conference at our institution gives me immense pride. We are organizing such activities at a regular interval. The organizing committee deserves high appreciation and congratulation for their efforts and hard work.

I am confident that the proceedings of the conference will be of immense use to the participants and wish the conference a great success.

### **Dr. Mrutyunjay Suar**

Director General R&D, KIIT  
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# NATIONAL ENVIRONMENTAL SCIENCE ACADEMY (NESA), NEW DELHI

This ACADEMY is registered by the provisions of Societies Act XXI of 1860 under the Government of Bihar in 1988, presently has its headquarters at 206, Raj Tower-1, Alaknanda Community Centre, New Delhi. The main objective of the Academy is to bring awareness about environmental issues among the masses by arranging lectures, workshops, training programs, seminars, symposia, conferences, publishing journals, etc.

### Aims Objectives and Functions of the Academy

- To enhance and promote the study of the environmental sciences by encouraging students, scientists, researchers, academicians and members of the Academy for pursuing research on environment and allied areas.
- To set up Regional/State Chapters for dissemination of information on environment.
- To motivate and prepare young minds on environmental management.
- To hold Annual Conference of the Academy.
- To organise national/international level conferences, symposia, seminars, meetings and workshops on themes of environmental concerns.
- To publish policy papers, synthesis volumes, proceedings, journals, newsletter, transactions and other publications for the promotion of Environmental Sciences.
- To forward the recommendation of scientists / professors to govt. agencies.

Various eminent personalities have graced the Academy as President. The first President of the Academy was **Dr. K.C. Bose**, Vice-Chancellor of Ranchi University; then Dr. B.S. Attri, Advisor, Ministry of Environment and Forest. Most recently Padmabhushan Dr. S.Z. Qasim was the President of the Academy till June 2015, who is a renowned marine scientist known for his Antarctica mission in 1981-82, he also served as the Secretary at the Deptt. of Ocean Development (now Ministry of Earth Sciences); Member, Planning Commission and Vice-Chancellor, Jamia Millia Islamia, New Delhi. Currently Prof. Javed Ahmad, (Former Dean, Faculty of Science), Jamia Hamdard, New Delhi, is the President of the Academy.

### ANNUAL AWARDS

The Academy recognizes the merit and achievements of individuals who have contributed to the field of environmental science, education and societal values by conferring (1) NESA FELLOWSHIP AWARD (2) NESA EMINENT SCIENTIST AWARD (3) NESA SCIENTIST OF THE YEAR AWARD (4) NESA ENVIRONMENTALIST AWARD (5) NESA GREEN TECHNOLOGY INNOVATIVE AWARD (6) NESA DISTINGUISHED AWARD (7) WOMEN EXCELLENCE AWARD (8) NESA YOUNG SCIENTIST AWARD (9) NESA JUNIOR SCIENTIST AWARD. Any life member of the Academy can apply for the awards.

In addition, the Best Oral Presentation and Best Poster Awards are given away during the Annual Conference of the Academy.

### PUBLICATIONS

The Academy is publishing the following Journals (Biannual):

- 1) INTERNATIONAL JOURNAL ON AGRICULTURAL SCIENCES
- 2) INTERNATIONAL JOURNAL ON ENVIRONMENTAL SCIENCES
- 3) INTERNATIONAL JOURNAL ON BIOLOGICAL SCIENCES
- 4) INDIAN JOURNAL OF UNANI MEDICINE
- 5) E-NESA Newsletter (Monthly)

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## **BHUBANESWAR CITY KNOWLEDGE INNOVATION CLUSTER**

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BCKIC is an initiative by the Office of the Principal Scientific Adviser to the Government of India, set up under the direction of the Prime Minister's Science, Technology, and Innovation Advisory Council (PM-STIAC) to seamlessly connect research institutions, academia and corporate towards creation of a Hub & Spoke model, actively facilitating innovation and knowledge creation. The key objectives of BCKIC are:

- Creating a shared ecosystem and providing solution to local and regional problems
  - Harnessing the knowledge and expertise available in partnering academic, R&D institutions and industries
  - Promoting Capacity Building through exposure visits and workshops
  - Creating Innovation Pipeline and Pathways for Entrepreneurs at Institute Level
  - Channelizing Innovation for Social Impact
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## **KALINGA INSTITUTE OF INDUSTRIAL TECHNOLOGY**

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Kalinga Institute of Industrial Technology (KIIT) is the premier academic hub in India located at Bhubaneswar, and within a short span of time, it has grown to be one of the finest educational centers in India offering various programs in its 22 schools/departments. KIIT, though a very young institution has performed incredibly well in the rankings conducted by various national and international associations. Founded in 1992 and opened five years later as a centre for higher learning, its commitment to teaching excellence led to the grant of university status under Section 3 of UGC Act, 1956 by the Ministry of Human Resources Development, Govt. of India in 2004, within only seven years of its inception. It is declared as an "Institution of Eminence" by UGC. It is ranked 24th among Indian universities by NIRF in 2020. It is also accredited by NAAC with grade A.

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## **CSIR-INSTITUTE OF MINERALS AND MATERIALS TECHNOLOGY**

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CSIR-Institute of Minerals and Materials Technology (IMMT) was established on 13.04.1964 as Regional Research Laboratory, Bhubaneswar in the eastern part of India under the aegis of the Council of Scientific and Industrial Research (CSIR), New Delhi. It was renamed in 2007 with a renewed research focus and growth strategy to be a leader in the areas of mineral & material resource engineering. The institute has expertise in conducting basic research and technology oriented programs in a wide range of subjects to address the R&D problems of mining, mineral and metals industries and ensure their sustainable development. For the last one decade, the main thrust of R&D at CSIR-IMMT has been to empower Indian industries to meet the challenges of globalization by providing advanced and zero waste process know-how and consultancy services for commercial exploitation of natural resources through the public-private-partnership (PPP) approach. Today, CSIR-IMMT is the first choice for many mineral based industries. It is also carving out a niche in processing of advanced materials for greater value addition and working on resource use efficiency of critical raw materials.

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## **CENTRAL INSTITUTE OF PETROCHEMICALS ENGINEERING & TECHNOLOGY**

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Central Institute of Petrochemicals Engineering & Technology (CIPET) (formerly known as Central Institute of Plastics Engineering & Technology (CIPET)) was established in 1968 by the Government of India with the assistance of United Nations Development Program (UNDP). CIPET, Bhubaneswar Center offers an excellent curriculum in plastic, polymer & allied technologies and cutting edge laboratory space for the research and development. The Exclusive R&D Center at CIPET: Bhubaneswar - School for Advanced Research in Petrochemicals (SARP)-LARPM focuses on multidisciplinary research involving various disciplines of Polymer Science & Engineering including Structural Composites, Nanocomposites, Energy Storage and Harvesting, High Temperature Polymers for Aerospace, Recycling & Waste Management, Filtration Membranes, Polymer Coatings including Antimicrobial, Super hydrophobic corrosion resistant, Adhesives, Foams, Fuel Cells etc. CIPET also brings immense expertise on some of the key unmet needs in areas such as biodegradable Polymers.

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## **ENVIRONMENT AND SOCIAL DEVELOPMENT ASSOCIATION**

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Environment and Social Development Association (ESDA) Delhi is a non-government, non-profit national based voluntary organization, principally dedicated to enhancement of public awareness on preservation and up gradation of environment and management of all forms of air, waste, water and river conservation, plantation, tree protection, sustainable development, social upliftment, gender equality as well as providing platform for "Beti Bachao Beti Padhao" (Save Girl Child) Movement. Since its registration on 23rd July, 2004 under Societies Registration Act-XXI of 1860 in Delhi by a handful of environmentalists, the association has grown with more than 1000 life and patron members from diverse fields of specialization in more than 15 States of India. Its main aims and objectives include educating and creating awareness about environmental and social issues among young minds, students, researchers and general public; setting up regional and state chapters to organize different academic, scientific and mass awareness activities such as National/International level conferences, symposia, seminars, workshops, trainings, meetings, Street Plays etc. on the themes of environmental concerns. ESDA is an open platform of the people who want to work as an Academician, Scientist, Activist, Volunteer, Member, Office Bearer, Advisor and Sympathizer on environmental and social issues. The Society is working passionately to achieve said goals in different parts of the nation and in collaboration and support with esteemed Government and private institutions.

# ABSTRACTS

## **THE ROLE OF HYDROMETALLURGY IN MINES WASTE MANAGEMENT**

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**Dr. C. Kesava Rao**

DY. General Manager (Hydrometallurgy)  
R&D centre, NMDC Ltd, Hyderabad, India

### **ABSTRACT**

In the present world scenario of global market economy, the mining and mineral industries face the challenge of competition from within and outside. It is said that to get divorce Nowadays is easy rather than to get pollution certificate for setting up mining industry. Indeed, the menacing presentiments in the efforts of massive urbanization and the technology developments are the origin of many environmental problems. Nowadays the progressive development of policies of the environment, the problems linked to the environment play a increasing role in company's strategies. According to the present regulation in force, the industries are responsible for eliminating their own waste and have taken necessary steps to ensure that waste is taken care right up to final elimination. In India, iron ores processing industries play a vital role in the Indian economy.

During the washing and processing of iron ores, slimes less than 0.15 mm are generated and part of it is discarded into the tailing pond. These slimes need processing as they cannot be used directly in blast furnaces. Iron ore slime is which has the particle size of below 150m is being discarded as waste during the mining and processing stages iron ore and it will be stored at the tailing dam. It is estimated that 18%- 25% of tailing will be generated during the processing of iron ore. The major compositions of iron ore slime are hematite, quartz, alumina, mica and kaolin. The iron ore slime is discarded as was due to its particle size and chemical composition which are not suitable to feed the blast furnace. Hydrometallurgists are involved in the treatment of ores through low temperature refining and wet processes such as leaching. Hydrometallurgists study the nature and properties of different metals and materials and remove insoluble and toxic materials from metal using water-based solutions to find a more pure form of ore. They may use electrolytic refining and processes. NMDC has carried extensive studies for utilization of mines waste and developed indigenous process technology for production of value added products from: kimberlite tailings, Iron Ore Slime, Iron Ore overburden and Blue dust by Hydrometallurgical route.

## **RECOVERY OF NON FERROUS METALS AND ENERGY MATERIALS FROM INDUSTRIAL WASTES**

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**Prof. T. Subbaiah**

Dept of Chemical Engineering, VIGNAN'S Foundation for Science, Technology & Research  
Vadlamudi, Guntur-522213, A.P, India

### **ABSTRACT**

Processing of low grade ores, secondary materials, such as ash, scrap, flue dust, sludge, slag, spent catalyst is a practical method for bridging the gap between production and its growing demand of nonferrous metals. The nonferrous metals finds major applications in consumer goods, chemical equipment, automobile, aerospace building and power industries. Presently several Indian organizations import such materials from various industrialized nations to produce different nonferrous metals such as nickel, copper, zinc etc. India has no primary resource for many metals including nickel and cobalt. Availability of additional metals will lead to increased production of related materials, like alloy steel, and super alloys.

Recovering metal values from secondary sources is a mine above the ground, saves enormous energy and high investments. The demand for non-ferrous metals is increasing by 7-8% due to their rapid industrial growth. A viable approach to meet the demand for these metals is to recycle industrial wastes produced either in India or abroad. Some reasons for processing secondary resources in India are, the metal prices in the country are more than the International prices, India has low labor cost for unskilled, skilled, engineers, and India has ability to develop custom made processes.

The talk covers some case studies such as recovery of energy materials nickel hydroxide, electrolytic manganese dioxide and barium titanate from waste materials, recovery of nonferrous metals like cobalt from super alloy scrap/residue, nickel from spent catalyst, copper and zinc from copper based and zinc based spent catalysts available from fertilizer industries. Recovery of metal values from printed circuit boards, barite wastes, spent batteries will also be discussed.

**Keywords:** Recovery, Secondaries, Non Ferrous Metals, Extraction, Electrowinning

## **COAL FLY ASH: METALLURGICAL RESOURCE**

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**Dr. Kali Sanjay**

Chief Scientist & Head, Hydro & Electrometallurgy Department  
CSIR-Institute of Minerals and Materials Technology, Bhubaneswar, Odisha – 751013, India

### **ABSTRACT**

As per the half-yearly report by CEA, Ministry of Power, Govt. of India, for 2020-21 (April 2020 to September 2020), out of ~84 million tons of fly ash generated by the coal (having ~34% average ash content) based thermal power plants in the country, about 21% of fly ash is unutilised. Though fly ash can be used in many applications such as bricks, roads, cement industry, filling materials etc., the generation exceeds its utilization and is expected to increase with further increase in thermal power production. Alternative methods should be explored towards addressing the unutilised volumes of fly ash generated in the country. One such option for utilizing fly ash is treating it as a metallurgical resource. Indian fly ash contains copious amounts of values in the form of alumina and other strategic elements. Coal fly ash (obtained from NALCO) comprises of 25-27% Al<sub>2</sub>O<sub>3</sub>, 64-67% SiO<sub>2</sub>, 3-4% Fe<sub>2</sub>O<sub>3</sub>, 0.6-1% CaO etc. CSIR-IMMT in collaboration with NALCO has developed a process to recover alumina from fly ash (Indian Patent no: 344358). The process produces chemical grade alumina from fly ash along with by-products calcium silicate, impure quartz and REE enriched iron hydroxide.

While alumina can be utilized in chemical industries, quartz residue can be used for glass making for building applications, and calcium silicate in chemicals and ceramics industry. The iron hydroxide produced is also a suitable resource for the extraction of Rare Earth Elements (REEs) as their concentration is enhanced significantly compared to their concentration in fly ash. The recent study shows that fly ash produced in Lignite based plants have higher REE content and can be rich resource for the REEs. The talk covers the efforts made at CSIR-IMMT for extraction of value added products from Indian fly ash.

**Keywords:** Fly ash, alumina, calcium silicate, extraction, utilization

**Corresponding author:** ksanjay@immt.res.in; kalisanjay@gmail.com

## **PLASTICS RECYCLING AND CIRCULAR ECONOMY**

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**Dr. Lakshmi Raghupathy**

Former Director, Ministry of Environment Forests and Climate Change  
Visiting Faculty TERI School of Advanced Studies

### **ABSTRACT**

The benefits of plastic are undeniable, the material is cheap, lightweight, durable and easy to make. These qualities have led to a boom in the production of plastic over the past century. According to the United Nations plastics would continue to be used as it is cheap, lightweight and easy to produce and the trend will continue as global plastic production skyrockets over the next 10 to 15 years. The post-consumer plastics have been a major environmental concern because it is not degradable and remains in the environment for long and dealing with the plastics that enter the environment is one of the biggest problems of our time.

The 3Rs principle of Reduce, Reuse and Recycle is also used for plastics such that there is a minimal impact on the environment. However, when it comes to recycling there is need to adopt environmentally sound recycling technologies. The Concept of Circular Economy is though recent but has a major influence on the human beings and their activities and has relevance to the human action and its impact on the environment. Industrial economy so far has been 'linear Economy' with a 'Take, Make, Dispose' – a 'Cradle to Grave' approach resulting in depletion of natural resources resulting generation of huge amount of waste that end up in landfills. This is now changing into a 'Circular Economy' wherein the material and waste flow is designed to circulate in a 'closed loop' without being discarded into the environment and being restorative and regenerative with a 'Cradle to Cradle' approach. The concept of circular economy when applied for is known as the New Plastics Economy. Thereby converting post-consumer plastics into resource mimicking the natural ecosystems. This paper is an attempt to develop a circular economy model for plastics for the developing nations involving all stakeholders in the value system.

## **BIOCHAR FOR WASTE MANAGEMENT AND ENVIRONMENTAL REMEDIATION: A GREEN AND SUSTAINABLE TECHNOLOGY?**

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**Santanu Mukherjee**

School of Agriculture, Shoolini University of Biotechnology and Management Sciences,  
Solan 173229, India

### **ABSTRACT**

Biochar is typically defined as a carbonaceous, stable, and recalcitrant product obtained on the thermal treatment of carbon-containing biomass in a limited supply of oxygen. The composition and properties of biochar are mainly dependent on the thermal treatment technique, the treatment temperature, and the feedstock type. Different techniques have been utilized for biochar production such as torrefaction, carbonization, combustion, gasification, and pyrolysis, with pyrolysis being most commonly used due to its simplicity and high yield of production. A wide range of feedstocks has been used previously including kitchen waste, agricultural wastes, leaf litter, wood biomass, rubber tyres, poultry litter, animal litter, sewage sludge, and algae. Biochar application could also help in climate-smart agriculture, waste management, clean energy production, contaminant removal, and climate change mitigation.

Biochar amendments have been proposed to ameliorate the adverse effects of temperature rise on soils and plants. The application of biochar improves the thermal properties of soils. Reflectance reduced in the infrared wavelength range and increased in blue-light and near-ultraviolet range. Amendment of soil with biochar reduces the bulk density and thermal diffusivity of soil and improves its moisture content. These changes affect the thermal conductivity and reflectance of soil which ultimately moderates the soil temperatures. These changes could also influence plant growth and biochemical processes in soil. Further, soil depth, soil moisture content, and biochar application rates affect soil temperature and volumetric heat capacity. The reduction in organic matter and clay fraction with a rise in soil temperature decreases the cation exchange capacity of the soil. Biochar has a high surface area, which coupled with an abundance of carboxyl and hydroxyl groups, helps in improving its cation exchange capacity. Consequently, the addition of biochar to soils helps in enhancing its cation exchange capacity. With regards to microbial activity, an increase in soil temperature affects the soil microbes. However, the addition of biochar to soil supports microbial proliferation and the community structure. The high surface area, enhanced porosity, escalated pH, increased electrical conductivity, surplus moisture retention, and abundant organic matter support the microbial activity in the soil. The present invited talk will focus on how biochar is becoming popular in environmental remediation and playing an important role in the sustainable decontamination of toxicants.

**Corresponding author:** santanu\_mukherjee86@yahoo.co.in; santanu@shooliniuniversity.com

## **BACTERIAL DEGRADATION AND DETOXIFICATION OF RECALCITRANT ORGANIC CONTAMINANTS IN TANNERY WASTEWATER FOR ENVIRONMENTAL SAFETY**

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**Gaurav Saxena**

EMBL-Environmental Microbiology and Biotechnology Laboratory, EERG-Ecotoxicology and Environmental Remediation Group, School of Biotechnology, Shoolini University of Biotechnology and Management Sciences, Kasauli Hills, Solan, Himachal Pradesh, India 173 229.

### **ABSTRACT**

Industrial effluents are considered to be the major sources of water pollution because these contains a variety of toxic organic and inorganic metal pollutants that causes serious environmental pollution and severe health hazards in living beings. The untreated/partially treated wastewater discharged by the leather tanning industry is considerably polluting our water and land resources. As a result, tannery effluent (TE) must be sufficiently treated/detoxified before it can be safely discharged into the environment. In this study, a newly developed bacterial consortium called GS-TE1310 was able to effectively degrade real TE in just 120 hours, resulting in reductions of 76.12, 85.32, 71.89, 48.59, 78.81, 69.53, 71.22, and 88.70 percent in pollution parameters like COD, BOD, TDS, phosphate, sulfate, nitrate, Cr, and phenol, respectively. According to the high-performance liquid chromatography (HP-LC), Fourier transform infrared spectroscopy (FT-IR), and gas chromatography and mass spectrometry (GC-MS) study, the newly developed bacterial consortium GS-TE1310 mineralized/degraded most of the organic contaminants identified in the untreated TE into new degradation products in the treated TE at 7 pH, 0.5 percent glucose and ammonium chloride, 120 rpm, and 20 ml inoculum volume. The bacterially treated TE was also employed to investigate phytotoxicity using *Phaseolus aureus* L as a terrestrial model organism. The toxicity of bacterially treated TE was considerably reduced, permitting 70 percent seed germination and indicating that leather TE can be detoxified and can be safely used in ferti-rrigation. Overall, the newly discovered bacterial consortia GS-TE1310 showed a lot of potential in terms of treating and detoxifying leather TE for environmental safety.

**Keywords:** Tannery effluent, Environmental pollution, Toxicity, Bioremediation, Detoxification

**Corresponding author:** gaurav10saxena@mail.com; gauravsaxena@shooliniuniversity.com

## FABRICATION AND CHARACTERIZATION OF LOW EXPANSION GLASS-CERAMICS USING INDUSTRIAL WASTE AND LOW-COST ALUMINOSILICATE MINERALS

**Sitendu Mandal<sup>1\*</sup>, Sunirmal Jana<sup>2</sup>, Kaushik Biswas<sup>3</sup>, Sourav Nag<sup>4</sup>, Srikrishna Manna<sup>5</sup>, Raktima Chatterjee<sup>6</sup>, Sirshendu Ghorui<sup>7</sup> and Balram Ambade<sup>8</sup>**

<sup>1-7</sup>CSIR-Central Glass & Ceramic Research Institute, Kolkata – 700 032, India

<sup>8</sup>National Institute of Technology, Jamshedpur – 831 014, India

### ABSTRACT

High strength low expansion glass-ceramic materials based on  $\text{Li}_2\text{O}-\text{Al}_2\text{O}_3-\text{SiO}_2$  (LAS) ternary system are desired for cook-top plate of LPG gas oven. The high cost of the glass-ceramic material mainly for the use of expensive raw materials as well as high glass melting temperature for its fabrication are found to be primary constraints for this type of application. To reduce the cost of the product without compromising the properties, an approach of utilizing an industrial waste as raw materials can be adopted to prepare the parent glass at relatively lower temperature compared to pure LAS system (glass melting temperature  $\sim 1650^\circ\text{C}$ ). Hence, in the present work, an optimization of the batch composition of parent glass using low cost aluminosilicate raw materials and blast furnace slag (BFS, an industrial waste) have been performed by melting the raw glass compositions at  $\sim 1450^\circ\text{C}$ . This glass has been further converted into glass-ceramics by adopting suitable nucleation and crystallization schedules. Based on ternary system (LAS / 1:1:3), low expansion glass-ceramic has been developed using BFS and relatively low expensive raw materials such as China clay and pyrophyllite in the presence of  $\text{TiO}_2$  as nucleating agent. In this process, a part of the precursor powder has been prepared by sol-gel route using  $\text{Li}_2\text{CO}_3$  as a source of  $\text{Li}_2\text{O}$  and  $\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$  for additional  $\text{Al}_2\text{O}_3$  for maintaining the glass compositions. DSC measurement has been carried out to determine the nucleation and crystallization temperatures towards conversion of glass to glass-ceramics. The fabricated glass-ceramics show linear thermal expansion coefficient value (CTE) of  $14 \times 10^{-7}/^\circ\text{C}$  and  $19 \times 10^{-7}/^\circ\text{C}$  in the temperature ranges of  $30 - 300^\circ\text{C}$  and  $30 - 500^\circ\text{C}$ , respectively, whereas the CTE of parent glass is found to be  $69 \times 10^{-7}/^\circ\text{C}$ . XRD and SEM studies revealed the presence of lithium aluminosilicate as a major phase in the glass-ceramics at the crystallization temperature of  $730^\circ\text{C}$ . The present work can make an avenue towards conversion of waste into wealth in the form of development of low CTE glass-ceramics for cook-top plate of LPG gas oven.

**Keywords:** Low expansion glass-ceramics,  $\text{Li}_2\text{O}-\text{Al}_2\text{O}_3-\text{SiO}_2$  system, Blast furnace slag, China clay, Pyrophyllite, Cook-top plate

# **SUSTAINABLE ENGINEERING TECHNOLOGIES FOR COMBATING EFFLUENT TREATMENT PROBLEMS, DRINKING WATER SCARCITY AND COVID-19 PANDEMIC**

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**Dr. S. Sridhar**

Senior Principal Scientist, PETT Department, CSIR-IICT, Hyderabad.

## **ABSTRACT**

Chemical engineering is a vast arena within which membrane technologies have made rapid strides towards providing sustainable solutions for environmental safety, low capital investment and minimized energy consumption. Continuous efforts are being made by CSIR-Indian Institute of Chemical Technology, Hyderabad, to provide alternative low-cost and robust technologies with lower environmental footprint for industrial effluent management, domestic wastewater treatment, chemical purification, solvent recovery and membranes for purification of drinking water. Membrane Separations Laboratory led by Dr. S. Sridhar specialized in developing membrane based hybrid processes for the treatment of various kinds of effluents generated by pharmaceutical, textile, steel and chemical industries to achieve zero liquid discharge with reclamation of water, solvents and valuable chemicals.

CSIR-IICT also ventured into defluoridation of groundwater in rural areas of Telangana, Andhra Pradesh, Karnataka and Tamil Nadu. Installation of 15 model defluoridation pilot plants of 1000–4000 L/h capacity provides safe drinking water to a population of 1 Million which has been widely appreciated by the Governor of the State. An inexpensive hollow fiber membrane technology for clarification and disinfection of surface water by ultrafiltration has been developed to bring down the cost of potable water. These membranes have been incorporated in hand pump operated systems and deployed in 7 flood affected states including Kerala, West Bengal and Bihar. Modular Nanofiltration systems of 100–1000 L/h capacity have been installed in schools, colleges, hospitals, small village hamlet clusters, industrial & science exhibitions besides free water camps in urban areas for treatment of ground water containing moderate TDS levels. Technologies for production of ultrapure medical grade water for dialysis, atmospheric water generator in arid regions and alkaline ionized water have also been developed and deployed by CSIR-IICT for societal welfare.

During the current pandemic user-friendly technologies to mitigate the COVID-19 spread were developed which include multilayered face masks 'SaanS', face shields, hand sanitizers, eco-friendly formulations of disinfectants, touch-free dispenser, UV chamber for disinfection, mechanical ventilator for emergency medical care and air purifier for closed rooms. Around 5 lakh face masks and 3000 face shields were distributed in 20 states across India through a collaborative project with employment opportunities and revenue generation for self help groups, NGOs and senior citizens. Future projects involve development of solar powered desalination of sea and brackish water by forward osmosis and membrane distillation, integrated treatment strategies for STPs and oxygen enrichment unit for pretreatment of Covid patients.

## **CURBING RICE STRAW BURNING MENACE: CHARACTERIZATION OF STRAWS OF DIFFERENT RICE VARIETIES COMMONLY CULTIVATED IN NORTHERN INDIA FOR BEST ALTERNATIVE USES**

**Namita Das Saha<sup>1\*</sup>, Rajesh Kumar<sup>2</sup>, Niveta Jain<sup>1</sup>, Bhupinder Singh<sup>1</sup>, Anita Chaudhary<sup>1</sup>, Archana Sharma<sup>1</sup>, Bappa Das<sup>3</sup> and Sadiqul Islam<sup>4</sup>**

<sup>1</sup>Division of Environment Science

ICAR-Indian Agricultural Research Institute, Pusa, New Delhi, India-110012

<sup>2</sup>Division of Agricultural Chemicals, ICAR-Indian Agricultural Research Institute, Pusa, New Delhi

<sup>3</sup>ICAR-Central Coastal Agricultural Research Institute, Goa, India

<sup>4</sup>ICAR-Indian Institute of Soil and Water Conservation, Dehradun, India

### **ABSTRACT**

Rice straws of seventeen different predominantly cultivated rice varieties of northern India were chosen for chemical characterization based on their content of silica, cellulose, Hemicellulose, Lignin for grouping them for best alternative use potentials like bioethanol production, mushroom cultivation, composting and biochar production. FTIR, SEM and biochemical properties were characterized and based on descriptive statistics, low, medium and high category values for each variable were quantified and further through Venn diagram analysis, they were grouped for best alternative uses. Based on the desirable properties the following varieties can be used for different purposes like few varieties can be used for dual purposes like PB-1121, PR-123, PR-122, P-44 can be used for both Bioethanol and composting. PS-5 can be used for both composting and mushroom cultivation. P-718, BPT-5204, PS-5 can be used both for Bioethanol, Composting and Mushroom Cultivation P-44 can be used for Bioethanol and Biochar purposes. Based on the properties, the classified varieties for most suited purposes can be encouraged to use for alternative uses.

**Keywords:** Rice Straw; Burning; Alternative uses; Bioethanol; Silica; Mushroom cultivation; composting

## **IDENTIFYING PRIORITIZED MEDICINAL PLANT RESOURCES IN A TRIBAL DOMINATED AREAS UNDER CLIMATE CHANGE IN CENTRAL INDIA**

**Dr. Vasu Choudhary<sup>1\*</sup> and Dr. Geeta Shah<sup>2</sup>**

<sup>1</sup>College of Agriculture, Rani Lakshmi Bai Central Agricultural University, Jhansi, India

<sup>2</sup>College of Horticulture and Forestry, Rani Lakshmi Bai Central Agricultural University, Jhansi, India

### **ABSTRACT**

This study examines critical provisioning ecosystem services derived from medicinal & aromatic plants (MAPs) in a culturally and biodiversity rich landscape of the tribal dominated areas of Madhya Pradesh, Central India. Result reveals remarkable ethnic and location differences on utilization pattern of MAPs by aboriginal communities (i.e. Baiga, Gond, Kol, and Oraon). These tribes are vulnerable and facing food scarcity, explicitly recognized from inadequate intake of recommended food. The scientific interventions are indispensable for refining the methods of collection, processing and value addition in MAPs which will enhance the value of products many folds than unprocessed raw products.

Training and experiential learning i.e. learning by doing improve the skills and knowledge for developing value added products and ensure higher returns to indigenous communities. Proper training in order to conserve and mass multiplicate the medicinal and aromatic plants will also provide to the tribal communities. The mass multiplication of MAP in the farmers' field and their redistribution among rest of the farmers' community for the cultivation practices as the area has great potentialities of Medicinal & Aromatic plant cultivation for the conservation of natural medicinal herbs which are in the verge of extinction. The study will support and enhance the livelihood and economy of indigenous/aboriginal communities and finally put together the research conclusion to doubling the agriculture income of the aboriginal communities. Constant while the obtainable information is limited and split, our approach provides a chance to suppose areas predicted to be appropriate for multiple species and to approximation the cultural value of a particular geographical area. Our results also indicate that to keep bio-cultural diversity, full information and active input of indigenous communities is essential. The medicinal flora of the AABR is facing improper utilization and collection, overexploitation, grazing, deforestation, conversion of forest land to non-forest, construction of concrete roads and increasing the built-up area inside the study area. Hence, appropriate conservation management strategies can be reformed to encourage the cultivation practices of medicinal plants. This study could be useful for designing suitable policy implications for conservation and improving MAPs and livelihoods of indigenous/rural communities in changing bio-cultural environment of Central India and enable the proper planning of prioritized planting areas with fully considered climatic factors.

**Keywords:** Endangered MAPs resources, RET species, Traditional knowledge, Medicinal uses, GIS mapping, GPS, Climate change

**\*Corresponding author:** aish260198@gmail.com

## **RICE PRODUCTION ESTIMATION USING MICROWAVE AND YIELD MODELS OF UTTAR PRADESH DISTRICT OF BUNDELKHAND**

**Aishwarya<sup>1\*</sup> and Pavan Kumar<sup>2</sup>**

<sup>1</sup>College of Agriculture, Rani Lakshmi Bai Central Agricultural University, Jhansi, India

<sup>2</sup>College of Horticulture and Forestry, Rani Lakshmi Bai Central Agricultural University, Jhansi, India

### **ABSTRACT**

Rice feeds more than half of the global human population with more than 90% of rice production being in Asia. Rice is the most important food crop of India and it is the second largest rice producing country (after China) of the world. Rice plays an important role in India's diet and source of livelihood for millions of households. It is having high economic importance as well as central to food security in the country. Majority of Rice is sown in kharif season in the country. The satellite sensor data were acquired throughout the rice crop growing season (May to October). A case study is presented in this paper for analysis of past years (2019-20) Uttar Pradesh District of Bundelkhand was estimated. Extensive ground truth collected by Mahalanobis National Crop Forecast Centre (MNCFC) was utilized in setting the limits of yield models and accuracy assessment. Yield was estimated using weather based and remote sensing-based models. The results showed a significant increase in overall classification when the NDVI time-series data were integrated with the various combinations of multi-temporal polarization channels (i.e. VH, VV, and VH/VV). The highest classification accuracies overall (95.2%) and for paddy rice (96.7%) were generated using the RF algorithm applied to combined multi-temporal VH polarization and NDVI data. The study showed that use of multi temporal SAR data (both HH and VV) is quite useful for paddy acreage estimation, especially during monsoon.

**Keywords:** Rice, RISAT-1, Synthetic Aperture Radar data, RMSE, Yield model

**\*Corresponding author:** aish260198@gmail.com

## ROLE OF *Spirulina* CPCC-695 ENZYMES IN BIODEGRADATION OF ESTRONE: AN ENDOCRINE DISRUPTING CHEMICAL

**Neha Sami\* and Tasneem Fatma**

Cyanobacterial Biotechnology Laboratory, Department of Biosciences,  
Jamia Millia Islamia, New Delhi-110025

### ABSTRACT

Addition of exogenous endocrine disrupting compounds like estrone, classified as a Group-1 carcinogen by the World Health Organization, in the food chain through aquatic system, disrupt the steroid biosynthesis and metabolism by altering either the genomic or non-genomic pathway that eventually result in various diseases. Thus, its bioremediation is urgently required. Enzymatic degradation has proven to be a knight in shining armour as it is safe and generate no toxic products. The present study targets to identify the cyanobacterial enzymes that help in estrone degradation and the isolation, purification, and characterization of the enzyme showing maximum activity. *Spirulina* CPCC-695 was grown in estrone (20 ppm, 50 ppm, 100 ppm and 200 ppm). The culture without estrone was considered as control. The culture supernatant was used for testing laccase, esterase and peroxidase activity. All the enzymes showed concentration-dependent activities. Maximum activity was seen in laccase enzyme at 20 ppm estrone and so it was isolated and purified. *Spirulina* CPCC-695 culture filtrate (crude laccase) was concentrated and precipitated using cold-acetone and dialyzed against tris-buffer gave four-fold partially purified form, with 45.56% yield and 204.14 U/mg as specific activity and a single peak at 250–300 nm. The partially purified laccase was approximately 80 kDa and preferred ABTS as substrate. Both crude and partially purified laccase showed maximum activity at pH 3.0, 40 °C and 4 mM ABTS. Kinetic constants ( $K_m$ ,  $V_{max}$ ) of crude and partially purified laccase was found to be as 0.83 mM; 494.31 mM/min and 0.58 mM; 480.54 mM/min respectively. Iron sulphate and sodium azide inhibited laccase maximally. Crude and partially purified laccase degradation efficiency was 87.55 % and 91.35 % respectively. *Spirulina* CPCC-695 laccase with efficient estrone degradation ability render them as promising candidates for EDCs bioremediation.

\*Corresponding author: farha.biotech@gmail.com

## **MANGLICOLOUS MARINE FUNGI FROM KERALA COAST (INDIA)-IV**

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**Ashok R. Tuwar**

Arts, Commerce & Science College Sonai, Tal. Newasa, Dist. Ahmednagar, (MS) India;  
Affiliated to Savitribai Phule Pune University Pune

### **ABSTRACT**

Twenty seven manglicolous marine fungi comprising 18 Ascomycetes, 1 Basidiomycete and 8 Mitosporic fungi were isolated from the mangrove forests of Kerala, South India. Average isolates per wood sample and percentage colonization were 1.33 and 74.92 respectively. Based on the percent frequency of occurrence, *Verruculina enalia* (Kohlm.) Kohlm. & Volkmar-Kohlm. (16.43%) and *Periconia prolifica* Anastasiou (14.15%) were the most common species, while *Zalarion maritimum* (Linder) Anastasiou (8.67), *Lulworthia grandispora* Meyers (7.99%) and *Cirrenalia pygmea* Kholmeyer (7.30%) were the most frequent species.

**Keywords:** Mangrove Marine fungi Kerala coast.

**Corresponding author:** tuwarar@gmail.com

## MAGNETIC BIOCHAR AND INDIGENOUS BACTERIA IMMOBILIZED ALGINATE BEADS FOR PAPER AND PULP MILL EFFLUENT TREATMENT

**Kavya Bisaria<sup>1</sup>, Rachana Singh<sup>1</sup>, Ashwani Dixit<sup>2</sup>**

<sup>1</sup>Amity Institute of Biotechnology, Amity University Uttar Pradesh, Noida

<sup>2</sup>Central Pulp and Paper Research Institute, Saharanpur, India

### ABSTRACT

The presence of bio refractory organic pollutants in the paper and pulp mill effluent is severely detrimental to the environment. In the present study, indigenous bacterial strains were isolated and characterized from the mill effluent. The best performing strain in terms of maximum reduction in COD, BOD and color of the sterilized effluent was identified by a series of batch treatment. The magnetic bio char (MBC) was prepared from pyrolysis of coconut coir at 300°C for 1h in an oxygen-deficit environment and modified by Fe<sub>3</sub>O<sub>4</sub> nanoparticles through ultra sonication. Finally, MBC and the identified strain were encapsulated in alginate beads and tested for decontamination of paper and pulp mill effluent. The prepared material was characterized by Scanning Electron Microscopy (SEM) and Fourier Transform Infrared (FTIR) spectroscopy. Under the optimized conditions pH 7, temperature 37°C and 150 rpm, 68.8% and 77% and 74% reduction in COD, BOD and color was observed. Moreover, bacteria growth was enhanced in the encapsulated composite as compared to the free cell growth due to presence of porous structures in the bio char and alginate which provided shelter as well as necessary nutrients to support growth of the bacterial mass. To conclude, the long-term production of bacterial biomass was improved in the presence of bio char and alginate beads which resulted in greater remediation efficiency of the effluent.

## **SMART & RESILIENT CITIES: CHALLENGES AND OPPORTUNITIES**

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**Rashid Aziz Faridi<sup>1</sup> and Rakshanda F Fazli<sup>2</sup>**

<sup>1</sup>Professor, department of Geography, AMU, Aligarh.

<sup>2</sup>Professor, Department of West Asian and North African Studies, AMU, Aligarh.

### **ABSTRACT**

The rapid pace of urbanization today, coupled with the adoption of technology by individuals, businesses, and governments, are driving the social and economic transformation of cities around the world. Rapid urbanization has mandated the need for these cities to be both resilient and smart. Experts' worldwide point out those smart, resilient cities will be the future enablers in accelerating economic growth and improving the quality of citizens' lifestyle.

Almost all big cities are trying to develop on the smart lines of urban development. The concept of smart cities for sustainable urbanization is not a very old concept, but city resilience is relatively a new concept first given by Rockefeller Foundation. Defines urban resilience as "the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience."

To test whether cities are resilient on above mentioned four aspects requires a big canvas, for in-depth analyses one dimension that is Infrastructure & Environment discussing regarding man-made and natural systems that provide critical services, protect, and connect urban assets enabling the flow of goods, services, and knowledge; ensure continuity of critical services; provide reliable communication and mobility is selected.

Source material for the present work is twofold: a review of the available literature on smart and resilient cities, challenges and opportunities whereas the second source, is an in-depth analysis of secondary data regarding the testing resilience of Aligarh.

While taking the above as the context, the paper shall look at new dynamics of smart and resilient city solutions. Following are major research questions, which shall be explored and analyzed:

- What is the reason of resilience of cities?
- What distinguishes a resilient city from one that collapses in the face of disruption and adversity?

## **SUSTAINABLE WASTE MANAGEMENT**

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**Dr. Sanjeeb Kumar Das**

Department of Botany, Regional Institute of Education (NCERT)  
Sachivalaya Marg, Bhubaneswar- 751022

### **ABSTRACT**

Waste is generated any time anywhere. As the human life goes on, it is not possible to avoid the generation of the waste. The aim, in this situation is not to avoid the generation of the waste –minimize, maybe-but separate according to the types and avoid from paying unnecessary costs for useless treatment and (just the opposite) get advantage of gaining income from the waste. Waste reduction can be supplied in the individual level by consuming less, organizing the shopping & daily life consciously, encouraging re-use and recycle. In the industrial level; newer techniques which are supported by green technologies such as co-generation in order to regain the energy, zero-waste manufacturing processes, the processes that require less material in the end products, not depending on raw materials. Sustainability can only be executed only if the waste allows getting beneficial revenue. By separating and processing the wastes accordingly, will give great advantage in solving the waste problem and also derive profit.

**Keywords:** Solid waste management, treatment methods, sustainable waste management, municipal solid waste, recycling, energy recovery, integrated waste management

**Corresponding author:** sanjeebdas75@yahoo.com

## **RECENT TRENDS IN SOLID WASTE MANAGEMENT STATUS, CHALLENGES, AND POTENTIAL FOR THE FUTURE INDIAN CITIES – A REVIEW**

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**Dr. Sanjeeb Kumar Das**

Department of Botany, Regional Institute of Education (NCERT)  
Sachivalaya Marg, Bhubaneswar- 751022

### **ABSTRACT**

In recent years, the exponential population growth, high density of urban areas, diverse culture, changing food habits, and lifestyles have seen an unresolved problem in terms of Municipal Solid Waste Management (MSWM) in India. Consequently, the municipalities have been facing many other issues related to the collection, treatment, and management of solid waste. The present study is a comprehensive review summarising the present SWM status identifying the associated challenges and deriving potential solutions for the MSWM in the Indian context. The unsorted solid waste at source, social taboo, citizen's attitude, poor assessment, inadequate potential strategies unorganised informal sector of waste, unplanned fiscal, and poor implementation government policies. The discussion in this review article concludes, there is an urgent need for adequate treatment and recycling strategies required to be adopted as per the Indian solid waste composition. The appropriate implications of the potential solutions for MSW at the centralised and decentralised level need to be emphasised through various available of scientific treatment processes. Hence municipalities, along with the involvement of informal sectors, private agencies required to focus on creating potential opportunities and achieve the long term goal of the MSWM sustainability for Indian cities.

**Keywords:** Municipal solid waste management, Recycling, Waste to energy, Composting, Biogas, Sustainable cities

**Corresponding author:** sanjeebdas75@yahoo.com

## **USE OF BIOFILMS IN FOOD SECTOR: A SUSTAINABLE APPROACH TO REDUCE FOOD WASTE**

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**Arjun Sharma<sup>1</sup>, Sumedha Mohan<sup>1</sup>, Praveen Dahiya<sup>1</sup>**

<sup>1</sup>Amity Institute of Biotechnology, Amity University, Noida, Uttar Pradesh, India.

### **ABSTRACT**

Approximately 1.3 billion tonnes of the food which is produced in the world for human consumption is lost or wasted. Food wastage acts as a crucial problem affecting public health, environment, and economy in the conditions where population is on a high rise along with degradation of natural resources. On an average nearly 470 million small scale farmers lose 15 percent of their gross income due to food spoilage across developing countries. Wastage of food can arise at each of the food production stage from harvesting till it reaches to the consumer. Degradation of food is largely dependent upon the existence of moisture and microorganisms. Conventional techniques such as use of synthetic additives which are being followed by the industries for preservation purposes of the food products are not only expensive, but they also have potential adverse side effects on environment and human health. Therefore, there is a demand to explore an eco-friendly alternative way by which we can inhibit the microorganisms and prevent food wastage. Bio-films produced using plant extracts do have possibility for this purpose. Previously the interest in biofilms was specific to the research related to the water distribution system but in the modern era this has become more prominent for various industrial applications. Plants extracts show antimicrobial properties that act as a boon in food sector. Phytoconstituents from a large number of plants species can be used for the production of these biofilm coatings. This needs to be further explored as it can serve as an opportunity to reduce the agricultural food waste issues globally which can help to conserve the food resources with a sustainable approach.

**Keywords:** Food waste, Microorganisms, Plant extracts, Food spoilage, Biofilms

## **RECYCLING AND REUSE OF HUMAN EXCRETA FOR ENERGY GENERATION: AN INNOVATIVE APPROACH TO RESOLVE ENERGY CRISES**

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**Anil K. Shrivastava**

Formerly with Naval Materials Research Laboratory, DRDO,  
Mumbai, India

### **ABSTRACT**

Almost a billion people in developing world have no access to toilet and practice open defecation. But that waste should not go waste. Rather than tainting the environment and transmitting diseases, it could actually be harnessed to heat or power for millions of homes. The review paper will discuss about utilization of human excreta to produce biogas/energy as an alternative renewable energy. Utilization of human waste is considered beneficial in terms of the process because it does not require additional starter (micro organisms seeds) and a supply of micro organisms occurs continuously during the feeding of raw materials. Product gas resulting from typical dry human feces have LHV and energy values of 17.2 MJ/kg and 24 MJ/kg, respectively, at optimum equivalence ratio of 0.31 values that are comparable to wood biomass.

Non-sewered Sanitary Systems (NSS) are emerging as one of the solutions to poor sanitation because of the limitations of the conventional flush toilets. The new sanitary systems are expected to safely treat fecal waste and operate without any external connections to sewer, water supply or energy source. The Nano Membrane Toilets (NMT) is unique domestic -scale sanitary solution to treat human waste on site. The Reinvent The Toilet Challenge (RTTC) is one of the pioneering schemes initiated in 2011 under the Water, Sanitation And Hygiene (WASH) programme of the Bill and Melinda Gates Foundation to increase access to safe, sustainable and affordable sanitation.

In the present communication merits, demerits, advantages, limitations of various engineered technologies employed will be critically reviewed on the basis of their innovations, user friendliness, cost effectiveness, maintenance etc. Also, health aspects of biogas generated, design and R &D aspects of biogas plant fed by human excreta with or without supplementary feed stocks, treatment of slurry and its use, strategy for promotion and integration with other programmes will be thoroughly discussed.

**Corresponding author:** akshrivastavaa@yahoo.in

## **EXPLOITATION OF *Dictyosphaerium ehrenbergianum* NAGELI FOR BIODIESEL PRODUCTION USING SEWAGE RICH POND WATER: ISOLATION, CHARACTERIZATION AND BIODIESEL PROPERTY ANALYSIS**

**Devihalli Chikkaiah Mohana\*, Akbar Basha Roshan and Borah Nayana**

Department of Microbiology and Biotechnology, Bangalore University,  
Jnana Bharathi, Bengaluru-560 056, India

### **ABSTRACT**

Biodiesel is one of the renewable, completely burning, non-toxic and eco-friendly fuels commonly produced from microalgae and plants. Biodiesel production from microalgae has gained extensive interest in recent years due to its rapid and vigorous growth rate, high efficiency for lipid production, and a broad range of habitats with high adaptability to heat, cold, drought, salinity, osmotic pressure, and UV radiation. The present investigation evaluates the lipid production, fatty acid profile and biodiesel properties of *Dictyosphaerium ehrenbergianum* isolated from freshwater samples. *D. ehrenbergianum* was identified using 18S rDNA sequence analysis along with morphological study. The cells of *D. ehrenbergianum* were cultivated using a laboratory-scale bioreactor (5 L capacity). The cultural condition employed for cultivation is as follows: 4 L medium (BBM broth: sterile sewage rich pond water 1:5 v/v), 2% CO<sub>2</sub>, and 2000 lx light intensity. The extracted lipids were estimated quantitatively using the gravimetric method and and fluoro-spectrophotometric analysis. The fatty acid profile of FAME of *D. ehrenbergianum* was estimated using GC-MS analysis. The total cytosolic lipid content was 46.8 %, and oleic acid, palmitic acid and linoleic acid were identified as major fatty acids. The FAME of *D. ehrenbergianum* showed kinematic viscosity, flashpoint, density at 15°C, ash contents, and acid numbers were 3.561cSt at 40°C, 103°C, 0.86kg/m<sup>3</sup>, 0.015% with zero acid number. The percentage of biodiesel was found to be 58.45%. The obtained results confirm that the lipid extracted from *D. ehrenbergianum* could be used as an alternative source for biodiesel production.

## **EXPLORATION OF NUTRACEUTICAL COMPOUNDS FROM MARINE SOURCES AND THEIR APPLICATIONS**

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**R. Lakshminarayana**

Department of Microbiology and Biotechnology, Jnana Bharathi Campus,  
Bangalore University, Bangalore-560 056.

### **ABSTRACT**

Among natural products, seaweeds/marine algae are a renewable source and remain unexploited. The importance of marine algae or seaweed as sources of functional ingredients has been recognized due to their potential health benefits. Among natural compounds, carotenoid pigments from seaweed received particular attention due to exhibit various vital functions, such as antioxidant, anticancer, anti-inflammatory, anti-obesity, and neuroprotective activities. Therefore, the development of appropriate techniques for the recovery of the novel carotenoids may help to increase the use of potentially bioactive compounds and attract food, nutraceuticals, and the pharmaceutical industry concerning various health benefits. In this context, isolation/characterization of targeted compounds and evaluation of food/nutraceuticals-based approaches to combat health problems investigated.

## **THE PERSPECTIVES OF INDIAN EDUCATION SYSTEM**

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### **Misal Nivrutti Vinayak**

Department of Marathi, Arts, Commerce & Science College  
A/p- Sonai, Tal- Newasa, Ahmednagar (Maharashtra), India

### **ABSTRACT**

Ancient Indian sages had emphatically said, "Nothing is more scared than knowledge." Even southern scholars were saying "Knowledge is power .Modern education system really needs radical changes in it. Mahatma Fule's views still proves right. It was his demand that primary education should be free and compulsory. The teachers should be encouraged to work in hilly and tribal areas. The primary education should be strengthened by providing basic life education in the primary schools. Primary classrooms should be well equipped. So that the attitude of upper classes about primary schools will be changed. The government should see that all these things are done effectively and nobody would be deprived of primary education. This is in the interest of society as well as of nation's development.

**Keywords:** Primary, Remedies, Percolation, education, Knowledge

**Corresponding author:** nivruttimisal2010@gmail.com

## A BETTER ALTERNATIVE FOR AIR QUALITY

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**Dr. ST Girisha**Dept of Biotechnology, Bangalore University,  
Bangalore -56

### ABSTRACT

Among air pollutants nitrogen oxide, sulfur dioxide, volatile organic compounds, dioxins and polycyclic aromatic hydrocarbons are all considered air pollutants that are harmful to humans. Gaseous pollutants such as carbon monoxide, unburned hydrocarbons, nitrogen oxides, particulate matter, and carbon dioxide are found to be major exhaust emissions from vehicles running on fossil fuel which is a precursor to many health issues. Carbon monoxide can even provoke direct poisoning when breathed in at high levels. Heavy metals such as lead, when absorbed into the human body, can lead to chronic intoxication. Diseases occurring from the aforementioned substances include Chronic Obstructive Pulmonary Disease, asthma, bronchiolitis etc. The only way to tackle this problem is biodiesel which is nontoxic and biodegradable compared to petroleum diesel fuel, biodiesel combustion produces fewer air pollutants such as particulates, carbon monoxide, sulfur dioxide, hydrocarbons, and air toxics. Currently, many countries use biodiesel as a fuel alternative in diesel engines to improve combustion efficiency and reduce emissions of pollutants as hydrocarbons, carbon monoxide, sulfur oxides etc.

The present study aims to estimate vehicle emissions of the pollutants from the addition of biodiesel to diesel in several blends, as well as to assess atmospheric pollutant concentrations.

In this paper, the effect of pure diesel and biodiesel-to-diesel blend (30% biodiesel, 70% diesel in volume) was studied. The combustion of biodiesel decreased total hydrocarbons, polycyclic aromatic hydrocarbons, carbon, and sulfur emissions by 65, 79, 49 and 100%, respectively. Evaluation of emission results from topical literature strongly suggests that the use of biodiesel is effective in the reduction in pollutants, which is beneficial to human and environmental sustainability.

**Corresponding author:** stgirisha@gmail.com

## **ROOFTOP FARMING IN THE CONTEXT OF PROMOTING ENVIRONMENTAL SUSTAINABILITY: A STUDY FROM THE SMART CITY OF BHUBANESWAR**

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**Kartik Chandra Sahu**

Regional Institute of Education, NCERT,  
Sachivalaya Marg, Bhubaneswar 751022

### **ABSTRACT**

Rooftop Farming rapidly growing in urban localities provides various opportunities. Rooftop farming besides providing fresh food promotes the environmental sustainability with increasing population and buildings in urban area. Environmental imbalance becomes a serious issue. So rooftop farming plays an important role in environmental sustainability. The urban citizens have realized more time that to combat air pollution in urban environment. Rooftop gardening is a possible solution of increased as the plants are known to migrate the ill-effect of air pollutants besides providing insulating effect. Thus rooftop gardens offer an opted solution to these challenging circumstances. Urban farming offers a unique opportunity to understand the scientific and operational details of rooftops garden that perform environmental sustainability. Bhubaneswar stakeholders valued the sustainability benefits (i.e., environmental, economic and social) to urban rooftop farming, particularly in the context of the development of a local green technology in qualitative reducing the environmental Problem. Rain water and dew water harvesting for supplying the water demand of the crops and reused of household water for cultivation enhance the sustainability. The domestic used water is directly link hydroponic techniques. Environmental-friendly research on the potential self-sufficiency of urban resource has mainly focused on sustainable strategies in rooftop applied to energy, water are urban planning, waste management. Studies have already demonstrated that rain water harvesting systems are environmentally and economically feasible. Roof gardens provide decorative benefits, roof planting, food security, temperature control, pollution control, carbon sequestration, hydrological benefits, and architectural enhancement recreational opportunity beside other large scale ecological benefits. Rooftop farming gives sustainable use of household garbage, domestic bio-wastes use by bio composting method to prepare bio-fertilizer. Millions tons of household garbage released day to day in urban area like Bhubaneswar. Urban agriculture promotes waste management and makes the environment clean. Nowadays Bhubaneswar is being developed in to a smart farming for food security and environmental sustainability for future citizens. It shows the vital role it can play in the development of sustainable environment in rooftop. Green plants of rooftop farm absorb storm water, reducing water runoff and Pollutants is sucked out of the air by plants in the garden, thus reducing air pollution and dust. Roof gardens are one of the most innovative and cost-effective ways, cities can use to improve the degrading urban environment. Roof gardens have been proven to reduce the effects of the urban heat, the result of sunlight reflected off concrete and other reflective materials, which can make summer air very hot. More energy has to be used to cool buildings and more air pollution is created in the form of smog. Rooftop gardens keep buildings cooler in summer and warmer in winter. Air conditioning costs are cut down and roof gardens can cool the whole city by several degrees in summer. During this period, rooftop farming spread in Bhubaneswar creates an eco-friendly environment. Environmental concerns have been since then a motivation to engage in urban agriculture experiences. Currently, urban farming is dominated by organic practices leading to organic waste (household garbage) flows and preserve biodiversity. The traceability of products is still a motivation behind urban gardens which aim to guarantee the environmental sustainability.

## **DECOLOURIZATION OF DIRECT RED 31 BY USING NEEM LEAVES-IRON OXIDE-CHITOSAN AS ADSORBENT**

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**Swati Solanki and Dr. Rachana Singh**

Amity Institute of Biotechnology, Amity University,  
Uttar Pradesh, India

### **ABSTRACT**

Azo dyes are ubiquitously used in the textile industry. Removal of these dyes is one of the major challenges due to their intense color and toxicity. In the present study dry Neem leaves- Iron oxide-Chitosan (NmL-Fe3O4-Cs) hybrid nanocomposite was synthesized by using the method of co-precipitation. The prepared NmL-Fe3O4-Cs hybrid nanocomposite was characterized by Fourier Transformation infrared spectrometer (FTIR) and X-ray Powder Diffraction (XRD). Ultraviolet/Visible (UV/Vis) spectroscopy at maximum wavelength of 526 nm was used throughout the batch experiment for dye absorbance measurement before and after adsorption. The efficiency of obtained nanocomposite for the removal of Direct red 31 (DR31) was studied and influence of various parameters like pH (2, 3, 4, 5, 6, 7, 8, 9, 10, 11), temperature ( $25 \pm 25^{\circ}\text{C}$ ,  $35^{\circ}\text{C}$ ,  $45^{\circ}\text{C}$ ,  $55^{\circ}\text{C}$  and  $65^{\circ}\text{C}$ ), Contact time (2, 4, 6, 8, 10, 20, 30, 60, 90 and 120 min), adsorbent dose (0.01, 0.03, 0.05, 0.07, 0.09, 0.1) and initial dye concentration (50, 60, 70, 80, 90 and 100 mg/L), was investigated. Herein, considering all the results, maximum adsorption of 96% was observed at pH 4 and equilibrium was attained within 10 min at  $25^{\circ}\text{C}$  for 100 mg/L of dye concentration. The investigated data concluded that NmL-Fe3O4-Cs proved to be a suitable adsorbent for azo dye de-colorization as components of the fabricated adsorbent are economical and easily available.

**Keywords:** Chitosan, Azo dye, Neem, Direct red 31, Magnetic chitosan

**Corresponding author:** rsingh2@amity.edu

## **CROP DIVERSIFICATION FOR RESTORATION OF ECOSYSTEMS AND ENVIRONMENTAL SECURITY AMIDST INCREASING RESOURCE DEGRADATIONS**

**SS Rathore and Kapila Shekhawat**

Division of Agronomy  
ICAR-IARI Pusa, New Delhi – 110012

### **ABSTRACT**

The agricultural ecosystems occupy almost 40 per cent of the terrestrial earth surface area and the farming is a leading form of land management globally (FAO 2009). India has one of the largest net arable land of 145 Mha, comprising almost 50 % of total geographical area. Agroecosystems are both providers and consumers of ecosystem services. Variety of ecosystem services are ensured by agroecosystem such as regulation of soil and water quality, carbon sequestration, support for biodiversity and cultural services and these are well maintained under diverse production scenarios including well-designed crop diversification (Polasky 2008). Half a million-plant species are existing globally but only 4 crops (rice, wheat, maize and soybean) are priding all food needs of the globe. Depending on fewer crops for our food and nutritional security is a serious ecological threat and may be the reason for increasing biotic and abiotic stresses in crop production. In spite of the fact of vast plant biodiversity across the world, the present situation has reached where only 150 crops are now commercially important, with rice, wheat and maize accounting for 60 percent of the world's food supply. The agronomic practices may also be the reasons for many disservices, including loss of fertile soils, wildlife habitat, nutrient runoff, sedimentation of waterways, greenhouse gas emissions, and pesticide poisoning of humans and non-target species. Generally, crop diversification perceived a change from the regional supremacy of one crop to regional production of many of crops, to meet ever increasing demand of cereals, pulses, vegetables, fruits, oilseeds, fibers, fodder, grasses etc. of the population. Crop diversification also guarantees higher profits of the growers. It also aims to improve soil health and to maintain dynamic equilibrium of the agro-ecosystem. Further, in India crop diversification is generally viewed as a shift from traditionally grown less remunerative crops to more remunerative crops.

Agricultural diversification can ensure more availability of food and nutritional security, minimizing environmental degradation, lessening poverty, ancillate the prudent use of land and helping to contest desertification. Since mono-cropping is a serious threat for biodiversity, but at the same time through multiple ways, the farming is often considered a curse to conservation. However, appropriate management can ameliorate many of the negative impacts of agriculture, while largely maintaining provisioning services. Hence all four types of ecosystems services. Provisioning, regulating, supporting and aesthetic are being sustained to larger extent by proper practicing crop diversification. Diversification also provides new opportunities for more environmentally sustainable agricultural systems, livelihood options for farmers and integration of community knowledge with scientific evidence and novel technologies. Crop diversification and growing of large number of crops are practiced in dry-land areas to reduce the risk factor of crop failures due to recurring droughts. For majority of farmers in different parts of the country gains from application of science tools and technologies in agriculture have yet to be realized. Crop diversification can be done in spatial and temporal dimension. And it is hugely possible in irrigated IGP regions through crop intensification, where number of computable crops are grown either in sequential or intercropping systems. There are crops which act as complementary to each other when grown together, like growing legumes with cereals, through positive allopathic effect (mustard+ wheat, mustard+ potato etc.) and in tier /multi-storeyed system. Inclusion of oilseed crop, Indian mustard with early maturing short duration varieties like PM 28 and PM 26 in maize (fodder)-mustard-late wheat system restyled n higher system productivity and also the profitability (Table1). Maximum system productivity (49.9 t/ha) and system net return (Rs 1.45 lakhs) were obtained from M-M(PM28)- late wheat (HD 3118) Maize-mustard (PM28)- late wheat (HD 3118) system. System productivity of maize (fodder)-early mustard (PM 28)-late wheat (HD 3118) was recorded maximum with higher net return and B:C ratio. Similarly higher system productivity and profitability were recorded under 5.0 kg Zn application during kharif season crop in a calendar crop year. The agri-horti system has been developed for round the year cultivation of the crops and generation of produce for regular income and employment. The data revealed that the different agri-horti systems are economically viable, productive and employment generator round the year. Therefore in present tie f increasing degradation of resource base of agricultural production systems, declining resource use efficiency and trade off, it has been widely realizer that best management practice in terms of diversification of crops, cropping, and crop/farm operations can help a lot in checking the environmentally unfriendly process and bring sustainability by ensuring better ecosystem services, environmental safety and better livelihood of the growers. The diversification of staple crops in systems mode is essential to make future agriculture resilient, sustainable, and suitable for agri-ecosystem.

## **PLASTIC & POLYMERS AND OTHER WASTE RECYCLE AND RE-USE PROJECT ATTEMPTED BY A NGO ABHINANDAN SWACHHA SEVA SANGHA IN BALANGIR**

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**Dr Manmohan Bagh**

MBBS, MD Asst. Professor

Dept. of Anaesthesia SCB Medical College Cuttack Prakruti Bandhu Award

Forest and Environment Dept, Govt. of Odisha Environmental Activist

Life member IPCA, Life member ESDA

### **ABSTRACT**

Plastics are inexpensive, Lightweight and durable materials, which can readily be moulded into a variety of products that find use in a wide range of applications. As a consequence the production of plastics markedly over the last 60yrs. The current levels of their usage and disposal generate several environmental problem. The world's oil and gas production produces a non-renewable resource is 4% used as a feedstock for plastic is and about 3-4% is expended to provide energy for their manufacture . The majored portion of plastic produce each year is used to make disposable items of packaging or other short-lived products that are discarded with in a year of manufacture . So our current use of plastics is not sustainable . Because of the durability of the polymers involved, substantial quantities of discarded plastics are accumulating as debris in landfills and in natural habitats worldwide. Recycling is one of the most important actions currently available to reduce these impacts and represents one of the most dynamic areas in the plastic industry today. Recycling provides opportunities to reduce oil usage, carbon dioxide emissions and the quantities of waste requiring disposal. So Recycling is used against other waste-reduction strategies, namely reduction in material use through down-gauging or product reuse, the use of alternative biodegradable materials and energy recovery as fuel. Plastics have been recycled since the 1970s, the quantities that are recycled vary from place to place according to plastic type and application. Recycling of packaging materials has been rapid expansion over the last decades in a number of countries. Advances in technologies and systems for the collection, sorting and reprocessing of recyclable plastics are creating new opportunities for recycling and with the combined action of the public, industry and governments it is possible to divert the majority of plastic waste from landfills and Incineration to recycling and Re-use.

## **NANOTECHNOLOGY FOR SUSTAINABLE DEVELOPMENT**

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**Ravikiran T**

Department of Microbiology and Biotechnology, Jnanabharathi campus,  
Bangalore University, Bengaluru-56

### **ABSTRACT**

The world is facing great challenges in meeting rising demands for basic commodities while reducing and minimizing the impact of human activities on Earth's global environment and climate. Nanotechnology has emerged as a versatile platform that could provide efficient, environmentally, and cost-effective acceptable solutions to the global sustainability challenges facing society. Nanomaterials exhibit key physicochemical properties that make them particularly attractive as functional materials for sustainable technologies. They can be functionalized with various chemical groups to increase their affinity toward a given compound including dissolved solutes and gases. Nanomaterials can also be functionalized with chemical groups that selectively target key biochemical constituents and metabolic/signaling networks of waterborne bacteria and viruses. They also provide extraordinary opportunities to develop functional materials with superior electronic, optical, catalytic, and magnetic properties. These novel functional materials can be processed into various form factors including water-soluble supramolecular hosts, particles, fibers, and membranes. The present paper overview the recent progress in the utilization of nanotechnology to address global challenges faced in water purification, clean energy technologies, greenhouse gases management, materials supply and utilization, and green manufacturing and chemistry.

## **PATHOGENICITY, MEDIAN LETHAL CONCENTRATION (LC50) AND TIME (LT50) OF ENTOMOPATHOGENIC FUNGAL ISOLATES AGAINST SERPENTINE LEAF MINER, *Liriomyza trifolii* IN TOMATO**

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**S. Sumaiya Parveen and C. Jayapradha**

Karunya Institute of Technology and Sciences,  
Coimbatore – 641 114, Tamil Nadu, India

### **ABSTRACT**

In Tomato, 35-50% annual yield loss is caused by insect pests and plant pathogens. Among the pests, serpentine leaf miner (*Liriomyza trifolii*) cause severe yield loss ranging from 40 to 50%. Use of chemicals and breeding for resistance lost its value against this pest due to environmental hazard and resistance development. Thus, the present study was undertaken to develop an ecofriendly management strategy against leaf miner in Tomato. Bioassay of serpentine leaf miner larvae with various concentrations ( $1\times10^2$ ,  $1\times10^4$ ,  $1\times10^6$  and  $1\times10^8$  spores/ml) of *Beauveria bassiana* KR139926 was studied. The studies revealed that the larval mortality was proportional to the concentration of conidial suspension. The least larval mortality of 25.82 % was observed with  $1\times10^2$  conidial concentration. The conidial concentration of  $1\times10^8$  recorded the highest per cent mortality (72.58%). With regard to time-mortality, *B. bassiana* KR139926 with the spore concentration of  $1\times10^8$  recorded lowest LT<sub>50</sub> value (5.26 days) followed by  $1\times10^6$  (7.00 days). The maximum LT<sub>50</sub> value was observed in  $1\times10^2$  conidial concentration (12.54 days).

## **AIR POLLUTION IMPACT FROM BURNING OF WASTE AND SOLUTION IN CUTTACK CITY**

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**Dr Manmohan Bagh**

MBBS, MD Asst. Professor

Dept. of Anaesthesia SCB Medical College Cuttack Prakruti Bandhu Award

Forest and Environment Dept, Govt. of Odisha Environmental Activist

Life member IPCA, Life member ESDA

### **ABSTRACT**

The paper examines the environmental threats associated with the burning of house hold and, community waste in open piles across urban communities with a focus on Cuttack city state of odisha country India as a case study of uncontrolled waste disposal practice. This option derived from the lack of efficient municipal waste collection schemes and Traditional practice of waste management cleaning duming and on the other hand, it is a traditional disposal route for house hold and community waste besides open dumping and burning on the surroundings. This study estimates the potential amounts of household and waste uncollected by formal waste management services to be burnt by urban communities related to regional waste management features and how such bad practice interacts with geographical conditions. The paper performs a quantitative analysis of waste indicators and makes estimations on consequent environmental impact focusing on inventorying air pollutants. The spatial analysis provides an appropriate cartographic representation of the analyzed phenomenon. The conclusions converge towards two main ideas: 1)open burning of mixed household waste could be a significant air pollution source at the local scale, and 2)better urban waste management practices are needed to be implemented in the study area to mitigate environmental and public health threats. 3)Zero waste management system to be applied Practically (a)Recycling of dry (Inorganic) plastic polythene, Paper waste and (b)Micro-compost of Wet (Organic) plant –based kitchen and yard waste Indirectly no waste no Burning no Air Pollution from Waste.

**Keywords:** Waste management, Open burning, Urban areas, Air pollution, Zero waste management, Dry and wet waste

## **ECO-FRIENDLY UTILIZATION OF FLY ASH IN AGRICULTURE FOR SUSTAINABLE DEVELOPMENT**

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**Ayushi Varshney, Sumedha Mohan and Praveen Dahiya**

Amity Institute of Biotechnology, Amity University,  
Noida, U.P., India

### **ABSTRACT**

Though, from past few decades, various alternate sources of energy have come into the spotlight, but the electricity generation from coal as a major source cannot be counterbalanced. Fly ash, a solid waste residue, produced from coal based thermal power plant every year. The increasing energy demand with increasing population causes various environmental, economic and social problems associated with fly ash disposal. Appropriate remediation of FA is important as it causes damage to the environment and human health due to the presence of heavy metals. Fly ash has great potentiality in agriculture due to its efficacy in improving soil quality and crop productivity. The high concentration of various essential elements in fly ash increases the yield of several agricultural crops. But compared to other sectors, the utilization of fly ash in agriculture is limited. Land application of fly ash is considered as an environment friendly alternative in improving soil texture, pH and improving the plant growth at lower doses. This study assessed the effect of fly ash amended soil on *Calendula officinalis* by growing it in different combination of soil and fly ash. The effect of varying concentration of fly ash on the soil physiochemical properties, growth performance, heavy metal uptake and biochemical responses of *Calendula officinalis* were observed.

**Keywords:** Fly ash, solid waste, *Calendula officinalis*, sustainable agriculture, growth performance

**Corresponding author:** ayushi.alg@gmail.com

## **CLIMATE CHANGE: PERCEPTIONS AND MITIGATION TACTICS ADOPTED BY LOCAL FARMERS**

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**Yamini Verma**

Ph. D. Forestry, Indira Gandhi Krishi Vishwavidyalaya,  
Raipur, Chhattisgarh

### **ABSTRACT**

Climate change is a significant cause of concern currently. Concern authorities and professionals have been collectively working towards identifying possible causal factors for climatic change and enlisting mitigation remedies. But most of the indigenous population and villagers are still unaware of the term climate change and the proposed mitigation policies. This study focuses on a farmer's perception of climate change's causes and impacts and their method against it. A questionnaire consisting of 230 questions and sub-questions was prepared under eight categories. The interviewees were categorized under three groups based on their age. The primary objective was to conduct an in-depth analytical study of communities at risk from climate change. The change in climatic conditions has affected their daily lives by impacting livelihoods and income-generating activities. The 325 local farmer families were selected under the random table method to interact and understand the perception and mitigation measures adopted by them to deal with climate change. Results of logit regression analysis indicated that among the respondents, about 62.63% had never heard the term climate change but have developed their understanding of it. Other than this, around 69.52% of respondents observed temperature variations like warmer rainy seasons and colder dry seasons. Also, 51.93% of respondents realized the changes in frequency and intensity of rain, whereas 27.63 % observed the same for drought. And about 0.93 % believe that there is no climate change whatsoever. The major obstacles are a lack of implementation and information dissipation on government adaptation strategies, poverty, and a lack of meteorological information. Even though the farmers are highly aware of climatic issues and are adopting mitigation measures on their individual community level.

**Keywords:** Vulnerability and impact of Climate change, Perception of farmers, Adaptation strategies

## **ENVIRONMENT DRINKING WATER AND PUBLIC HEALTH**

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**B. Sravya, S. Sowmika, M. Reshma Anjum, M.Sankari**

Department of Biotechnology  
Sri Padmavathi Mahila Visvavidyalayam Women's University,  
Tirupathi 507501, Andhra Pradesh, India.

### **ABSTRACT**

Water is one of the essential components to life. Water is crucial renewable resources, which is vital for sustaining all forms of life, food production, economic development, and for species well being etc. It is the core of life that helps us to exist and also, the most energetic that keeps us alive. The water quality depends on various anthropogenic and natural factors that cause pollution and contamination of water. Ground water in the form of wells and springs is often the only source of water supply especially in villages and small towns. The importance of underground water varieties from good quality fresh water (potable), to medium (local, industrial) or inappropriate is playing key role. The stress on water environment as a result of increased industrialization, which aids urbanization, is becoming very high thus reducing the availability of clean water. Groundwater is one of the important components in development of any area. It is the major clean, agricultural and industrial source of water. Approximately one third of the global population depends on groundwater for drinking water. Drinking water quality is important for public health. Groundwater is a particularly important resource in arid and semi-arid regions where surface water and precipitation are limited. Contaminated groundwater has harmful effects on health. The objective of this analysis is to evaluate causes of groundwater pollution and contamination as well as pollution types and the effects of groundwater contamination and pollution on public health.

**Keywords:** Ground water, Contamination, Freshwater, Public health

## **EDUCATION FOR SUSTAINABLE DEVELOPMENT: A STUDY ON THE TEACHERS' KNOWLEDGE ON CLIMATE CHANGE ISSUES.**

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**S. Mohapatra and M.K. Satapathy**

Regional Institute Of Education (NCERT),  
Bhubaneswar 751022

### **ABSTRACT**

One of the major concerns that mankind faces today is the threat from global climate change. Reckless consumption of natural resources and materialism that fueled economic growth has played havoc with the global environment. Rapid consumption of coal and fossil fuels in industry and transport has led to building of green house gases ( GHGs) such as CO<sub>2</sub> leading to fast rise in temperature. Its impacts are being reflected through increase in catastrophic extreme weather events such as excessive rain fall ,drought, flood ,cyclone, reduction in crop productivity, scarcity of water resources , melting of ice caps, loss of biodiversity, rise in sea level, social conflicts etc. Pushing millions of people round the globe into poverty and hardship. In what is known as the Paris Agreement (2015) , the Countries around the world promised to limit the rise in temperature to 2°C above the pre industrial age. Further efforts are being made to limit temperature rise to 1.5 °C by 2030 failing which could lead to irreversible destruction – may be extinction of all life forms including human being.

In order to ensure that the planet is livable and to keep the global temperature under 1.5°C by 2030, it is realized that the world must reduce global CO<sub>2</sub> emissions by 45 percent of the levels that were in 2010 and make it absolutely zero by 2050. Though scientists and technocrats are trying to address the issues through search for alternate energy sources , capture and storage of carbon for reduction of GHG emissions, common man could also play a viable role through his/her green life style that reduces stress not only on natural resources but can help to mitigate the potential damage due to GHGs production to some extent . Sustainable life style of the individual can lead to sustainable communities to sustainable nations and then to a sustainable globe.

While it is highly essential for constant monitoring, evaluation, and periodic uploading our field data by research and analysis , at the same time ,it is necessary to disseminate the information for the awareness and understanding of the people and motivate them to practise environmental friendly life style. The 2030 agenda for sustainable development goal-13 calls for (Anonymous ,2016) " climate action ".

Further sustainable development goals stress everything that we can do to save the planet (Elliot, 1994; Brown,2000) . It is observed (Atechia, 1988) that any action plan that does not involve the education of children and youth of today is doomed, for the feature belongs to them.

Teachers being the agents of change (Mangal, 2002) are responsible for growth , development and progress of societies and communities. Enlightened and emancipated teachers lead the communities and nations in their march towards better and higher quality of life ( NCTE, 1998) . They play an important role in molding the personality of the children ( future citizens of the country ) in the class room formally and people in the society informally to promote desired behavior in a changing climate. As they ( teachers ) have very important role, their quantum of knowledge and understanding of climate change and developmental issues and level of commitment and involvement determines the future society and its development.

In a study with 462 school teachers from Odisha, it was noted that Pre-service school teachers have better knowledge than in-service teachers. Teachers in general have quite good knowledge on issues such as climate and weather, causes of climate change, impact of climate change etc. but have poor knowledge on Policy issues and International developments. All teachers have a positive attitude climate concerns. Further studies are being carried out to correlate with the knowledge issues with practices.

## **MODULATING THE TOXICITY OF ENGINEERED ZNO BY CONJUGATING WITH CLAY MATERIAL**

**Susanta Kumar Behera <sup>a, b †</sup>, Swati Singh <sup>a</sup>, K. Sashank <sup>a</sup>, Md. Imran Khan <sup>a</sup>,  
Meerambika Behera <sup>a</sup>, Bhumika Jena <sup>a</sup>, Srinivas Patnaik <sup>a</sup>, Suraj K. Tripathy <sup>a, c</sup>,  
Amrita Mishra <sup>a \*</sup>**

<sup>a</sup> School of Biotechnology, Kalinga Institute of Industrial Technology, Bhubaneswar 751024, India

<sup>b</sup> IMGENEX India Pvt. Ltd., Bhubaneswar 751024, India

<sup>c</sup> School of Chemical Technology, Kalinga Institute of Industrial Technology, Bhubaneswar 751024, India

### **ABSTRACT**

ZnO based nanomaterials offer enormous potential in targeted drug delivery, antibacterial, and anticancer treatment. However, their indiscriminate toxicity to both infected and healthy cells has severely crippled their clinical applications. In this regard, we in the present study have demonstrated that conjugation with clay matrix reduces the toxicity of synthetic ZnO nanoparticles (NPs) without seriously affecting their biological function. We have investigated the toxicity impact of ZnO NPs anchored on Bentonite (clay mineral). In vitro toxic impact of Bentonite, ZnO NPs and ZnO/Bentonite have been checked against different mammalian cells (using varied concentrations) followed by MTT assay. The results obtained suggest that ZnO/Bentonite have shown less toxicity as compared to ZnO NPs. Further, to confirm the viability, uptake of propidium iodide by mammalian cells was assessed using FACS after treatment with 100µg/mL of nanomaterials. Additionally, changes in the nuclear morphology of malignant and non-malignant cells have been compared after exposure with nanomaterials. Interestingly, ZnO/Bentonite has not affected the DNA of mammalian cells at 100µg/mL concentration and expression of Cyt-c, p16 and p53 were also found to be maintained at the said concentration. Above observations suggest that toxicological impact of ZnO NPs can be reduced by altering its physico-chemical properties for future biomedical application.

**Keywords:** *In vitro*, Cytotoxicity, ZnO, Bentonite, Nanocomposites

**\*Corresponding author:** amrita.mishra@kiitbiotech.ac.in

## **MORPHOLOGICAL STUDY of NEMATODE PARASITE SUBULASCARIS (FREITAS ET.DOBBIN, 1957) FROM RANA TIGRINA**

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**Dandawate R.R.**

Department of Zoology, Arts, Commerce and Science College Sonai District Ahmednagar MS

### **ABSTRACT**

The genus subulascaris was erected by Freitas et.Dobbin,1957 to accommodate their species *Subulascaris falcaustriformis*. Since then no other species has been added to this genus. A new species is being reported here is *Subulascaris sailuensis n.sp.* The worm is transparent with uniform thickness throughout the length of the body. The anterior end is well developed inflated cuticle,mouth is surrounded by three lips, three teeth are present, buccal capsule is absent. In male caudal alae is with sucker and caudal papillae are in to posterior half of the tail.

**Keywords:** *Rana tigrina, Nematode, Parasite, Subulascaris sailuensis n.sp., Subulascaris falcaustriformis.*

**Corresponding author:** drajendra2006@gmail.com; drajendra2006@rediffmail.com

## CCS IN DECCAN BASALT: A POSSIBLE DEVICE TO MITIGATE CO<sub>2</sub> EMISSIONS VIS-A-VIS CLIMATE CHANGE

**Amit Kumar<sup>1\*</sup>, J. P. Srivastava<sup>2</sup> and Rajesh K. Srivastava<sup>1</sup>**

<sup>1</sup>Centre of Advanced Study in Geology, Institute of Science, Banaras Hindu University,  
Varanasi 221005, India

<sup>2</sup>Department of Geology, University of Delhi, Delhi 110007, India

### ABSTRACT

Geological sequestration is one of the promising preferences to immobilize increased atmospheric CO<sub>2</sub> concentration, causative for warming at the rate of 0.2°C per decade globally. A drastic annual rise of 3.1% CO<sub>2</sub> emissions is alarming for country like India. The Deccan Traps of basalt composition are important and capable to release free Ca<sup>+</sup>, Mg<sup>2+</sup> and Fe<sup>2+</sup> for Carbon Capture and Storage (CCS), thus sequestering CO<sub>2</sub> geologically and permanently, although, CCS is a slow process slow process, thus necessitates intensive research to enhance reaction rates.

Earlier, CCS experiments on Deccan basalt rocks show formation of carbonate minerals, chiefly calcite, followed by other carbonates. But for longer period of experiments, smectite acted as barrier, thus restricted mineral carbonation. As a result, CO<sub>2</sub> mineralization only up to 35% was achieved. To address this issue, thermodynamic simulations and experimental work was carried out simultaneously at elevated pH and apposite pCO<sub>2</sub>, temperature and time parameters. Obtained negative fG, H and S values suggest feasibility of plagioclase, pyroxene and magnetite dissolution and spontaneous reaction of CO<sub>2</sub> with the free Ca<sup>+</sup>, Mg<sup>2+</sup> and Fe<sup>2+</sup> in solution to form secondary carbonates. A solution with pH value > 7 is pH is conducive to carbonation and rapid precipitation rate for Cal>Ank>Ara>Sid>Mag as also evidenced by SEM-EDAX, XRD and Rietveld refinement results. The crystallographic attributes of the neo-formed carbonates are identical to that of the naturally formed crystals. Also, smectite precipitation is restricted to 1-5% and leads enhancement in mineral carbonation. Mineralization rate of 55.31% was achieved in 50 hours, but an average rate of ~40% was also achieved by performing carbonation experiments between 75-50 hours at 100°C under 5 bar CO<sub>2</sub> and 8-9 pH. Obtained results indicate that Deccan Traps possess more CCS potential that also in less time. Additionally, the neo-formed carbonates produced as by-products and find application in cement and cosmetic industries.

**Keywords:** Carbon Capture and Storage (CCS), Carbonates, Deccan basalt, Thermodynamic simulations, Gibbs free energy, Silicate mineral dissolution.

## **POTENTIAL ROLE OF PARTICULATE BOUND BENZO(A)PYRENE IN AMBIENT AIR AND PUBLIC HEALTH - A REVIEW IN INDIAN SCENARIO**

**Shreya Singh<sup>1</sup>, Akriti Ashesh<sup>1</sup>, Ningombam Linthoingambi Devi<sup>1\*</sup>**

<sup>1</sup>Department of Environmental Science, Central University of South Bihar,  
SH-7, Gaya Panchanpur, Post- Fatehpur, P.S- Tekari, District-Gaya 824236

### **ABSTRACT**

Benzo(a)pyrene (BaP) is a carcinogenic pollutant that belongs to a large family of polycyclic aromatic hydrocarbons. The primary anthropogenic sources of PAHs are from burning of carbon containing compounds. BaP are ubiquitous organic pollutants which are toxic, persistent, teratogenic and mutagenic in nature. Its fate and distribution in environment are present in all possible matrix. In ambient air it is present in gaseous phase and associated with particulate bound PAHs. Benzo(a)pyrene, which is largely bound to particulate matter in the environment, has been established as a good marker of PAH-induced ambient air pollution. These compounds can be transported over long distances and deposited in remote regions because to their physical and chemical qualities. BaP is of high concern because of its effect on human health. They have an impact on foetal development. Prenatal exposure to Benzo(a)pyrene is linked to significantly lower birth weight and is likely to have a deleterious impact on early children's cognitive development. Benzo(a) pyrene can bio accumulate, infiltrate into the food chain and cause environmental toxicity. India is a fast-growing country where pollution is a major issue so its continuous monitoring in different environmental matrix is necessary to regulate the emission level.

**Keywords:** PAHs, Benzo(a)pyrene, Air pollution, Toxic, Human health.

**Corresponding author:** nldevi@cub.ac.in

## **TEMPORAL AND SEASONAL VARIATION OF VOCs AND TRACE GASES (O<sub>3</sub>, NOX AND CO) AT A CAMPUS SITE OF AGRA: OZONE FORMING POTENTIAL AND HEALTH RISK ASSESSMENT OF VOCs**

**Neelam Baghel, Sonal Kumari, Anita Lakhani and Maharaj Kumari Kandikonda\***

Department of Chemistry, Faculty of Science, Dayalbagh Educational Institute,  
Dayalbagh, Agra 282005, India

### **ABSTRACT**

Volatile organic compounds (VOCs) are hazardous pollutants released from various anthropogenic and natural sources which affect human health and play an important role in photochemical ozone (O<sub>3</sub>) formation. The present study reports the, diurnal and seasonal variations of benzene, toluene, ethylbenzene, xylenes, formaldehyde (VOCs) and trace gases ozone (O<sub>3</sub>), nitrogen oxides (NO<sub>x</sub>) and carbon monoxide (CO), ozone formation potential and health risk assessment of VOCs at a campus site of Agra from April 2019- March 2020. Samples of BTEX were collected by activated charcoal tubes and analyzed by Gas Chromatograph coupled with Mass Spectrometer and Flame Ionization Detector (GC-MS/FID) and the collection of Formaldehyde samples were done by impinge method and analyzed by UV-Visible Spectroscopy. Surface O<sub>3</sub>, CO and NO<sub>x</sub> concentration were recorded by continuously operating online trace gas analyzer (Thermo Fischer Model 49i, Model T300 and Thermo Fischer Model 42i, respectively. The average concentration of BTEX and HCHO ranged from 79.1 to 228.4 µg/m<sup>3</sup> with a mean concentration of 146.9 ± 44.3 µg/m<sup>3</sup>. Toluene was the most abundant species in all the seasons with the average concentration of 42.2 ± 12.3 µg/m<sup>3</sup>. The diurnal pattern of BTEX and trace gases were highly influenced by vehicular traffic and photochemical oxidation. BTEX, NO<sub>x</sub> and CO showed the maximum concentration in the morning and in evening. HCHO and O<sub>3</sub> showed an opposite diurnal pattern, higher concentrations during the afternoon. Ozone Formation Potential (OFP) was determined by the Maximum Incremental Reactivity (MIR) scale and o-xylene showed the largest contribution to ozone formation, whereas benzene was the lowest contributor. The cancer risks for Benzene, Ethylbenzene and formaldehyde were higher than 1 × 10<sup>-6</sup> (more than the acceptable value). Hazard index for BTEX were within acceptable limit while for Formaldehyde health quotient was 1.

## **PHYTO-ACCUMULATORS TO MITIGATE MICRONUTRIENT DEFICIENCY IN ORGANIC FARMING**

**Adarsh S.<sup>1\*</sup>, Sithin Mathew<sup>2</sup>, Gify Thomas<sup>3</sup>, Roshni A. S.<sup>4</sup>, Gopika K. T.<sup>5</sup> and V. Nirosha<sup>6</sup>, Arya A. P.<sup>7</sup>**

<sup>1</sup>Research Scholar, Department of Agronomy, Kerala Agricultural University, Kerala.

<sup>2</sup>Junior Research Fellow, ICAR – Directorate of Floricultural Research, Pune, Maharashtra

<sup>3</sup>Assistant Professor (on Contract), Department of Agriculture, Carmel College, Mala, University of Calicut, Kerala.

<sup>4</sup>Research Scholar (KSCSTE Fellow), Department of Botany, Christian College Kattakada, University of Kerala

<sup>5,6,7</sup>UG Scholar, Kerala Agricultural University, Kerala.

### **ABSTRACT**

Subsistence farming in India was shifted to demand driven agriculture for green revolution which includes the use of high yielding varieties, synthetic chemical fertilizers, pesticides, herbicides and other continual inputs in order to achieve a high and consistent crop yield. Though this so called 'conventional' agriculture increases per-area food production, it drains natural resources and impair the quality of both crops and the environment. In contrast, organic farming uses cultural and biological inputs instead of synthetic fertilizers and chemicals for crop nutrition and pest management. Deficiency and imbalance of all essential nutrients is a serious problem in organic farming, especially for crops which need different nutrients in varying proportions. Providing essential nutrition from organic sources is a real challenge. This lacuna can be answered by phyto accumulators/ phyto-extractors. These are the plant species which have the capacity to absorb and accumulate specific nutrient elements from soil. Identification of plant species with high micronutrient uptake will be useful for crop nutrient management in organic farming. Use of this plant biomass in the form of green manure, mulch or as compost can solve the riddle of micronutrient deficiency in organic farming. Plant growth depends on the amount of nutrients present in biomass. However, there is considerable difference between species than crops in the amount of nutrients present in the biomass, due to the differential ability of species to accumulate nutrients for growth. *Glyricidia maculeata*, *Calotropis gigantea*, etc are popular for their high nutrient content. These plants are useful to correct deficiency of specific nutrients. Also, the roots of phyto-accumulators absorb nutrients from chemical pollutants from soil, and water, thus it acts as an uptake removal mechanism of those otherwise near to impossible removable chemicals. Hence, a vegetative green lush is made by converting non-cultivable area to a cultivatable one.

**Keywords:** Phyto-accumulators, Organic farming, Micronutrient deficiency, Green revolution

**Corresponding author:** sssadarshsss@gmail.com

## **E-WASTE, WORLD AND INDIAN STATISTICS AND ITS SUSTAINABLE WAYS OF RECYCLING-A SHORT REVIEW**

**Rishu kumar<sup>a\*</sup>, Ravindra Kumar<sup>b,c</sup>, Rohit Kumar Singh<sup>b</sup>, Payal Das<sup>b,c</sup>, Anup Kumar Sadhukhan<sup>b</sup>, Biswajit Ruj<sup>c</sup>**

<sup>a</sup> Chemical Engineering Department, NIT Surathkal-575025

<sup>b</sup> Chemical Engineering Department, NIT Durgapur-713209

<sup>c</sup> Environmental Engineering Group, CSIR-CMERI, Durgapur-713209

### **ABSTRACT**

E-waste problem rapidly increases across the world due to rapid change in technology and advancement. E-waste contains many components some are toxic that can harm human health and the environment if not handled properly. Iron and steel constitute about 50% of the e-waste, followed by plastics 21%, non-ferrous metals 13%, and other constituents. Non-ferrous metals consist of metals like copper, aluminium and precious metals like silver, gold, platinum, palladium etc. In India, e-waste management is more significant due to the bulk generation of indigenous e-waste and the dumping of e-waste from other developed countries. The current trends of e-waste sources, generation and accumulation in India are compared with that of other countries have been discuss here. This helps in visualizing the future scenario of e-waste in India. There have been several legislations regionally, country-wide, and globally to deal with this situation. The features of some of them have been addressed here. India has adopted a three-level e-waste management system i.e., environmentally sound technologies (EST) and includes steps such as dismantling, segregation, shredding, hammering, CRT, electromagnetic and eddy current separation and other techniques. Comparing these conventional methods with newer and more sustainable recycling technologies of pyrometallurgy, hydrometallurgy and bio-metallurgy and their advantages and shortcomings have been considered. E-waste management theories can be used for a better approach towards e-waste management and their safe disposal. This paper provides information about the statistics of e-waste generation and technologies available for their safe disposal and energy/material recovery.

**Keywords:** E-waste, Environmental hazards, Metal's recovery, E-waste Legislations, E-waste management

**Corresponding author:** rishu777kumar@gmail.com

## **ENVIRONMENT DRINKING WATER AND PUBLIC HEALTH**

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**B. Sravya , S. Sowmika, M. Reshma Anjum, M.Sankari**

Department of Biotechnology

Sri Padmavathi Mahila Visvavidyalayam Women's University, Tirupathi

### **ABSTRACT**

Water is one of the essential components to life. Water is crucial renewable resources, which is vital for sustaining all forms of life, food production, economic development, and for species well being etc. It is the core of life that helps us to exist and also, the most energetic that keeps us alive. The water quality depends on various anthropogenic and natural factors that cause pollution and contamination of water. Ground water in the form of wells and springs is often the only source of water supply especially in villages and small towns. The importance of underground water varieties from good quality fresh water (potable), to medium (local, industrial) or inappropriate is playing key role. The stress on water environment as a result of increased industrialization, which aids urbanization, is becoming very high thus reducing the availability of clean water. Groundwater is one of the important components in development of any area. It is the major clean, agricultural and industrial source of water. Approximately one third of the global population depends on groundwater for drinking water. Drinking water quality is important for public health. Groundwater is a particularly important resource in arid and semi-arid regions where surface water and precipitation are limited. Contaminated groundwater has harmful effects on health. The objective of this analysis is to evaluate causes of groundwater pollution and contamination as well as pollution types and the effects of groundwater contamination and pollution on public health.

**Keywords:** Ground water, Contamination, freshwater, Public health

## **ABATEMENT OF FLUORIDE FROM POLLUTED WATER AND ITS ABILITY TO SUPPORT SUSTAINABLE DEVELOPMENT WITH POSSIBLE POLICY SUGGESTION: A SYSTEMATIC REVIEW**

**Supriti Khan\*, Bhaskar Bishayee, Arup Saha, Aparajita Mallick Nath,  
S. R. Debbarma, Biswajit Ruj**

Environmental Engineering Group  
CSIR-Central Mechanical Engineering Research Institute

### **ABSTRACT**

Groundwater contamination by fluoride is a very serious and harmful problem all over the world, especially in developing countries. Fluoride is a satisfactorily realised complex derived from fluorine, the halogen group's lightest member. Fluorine, the 13th most abundant element on the planet, makes up around 300 mg/kg of the earth's shell. Fluoride has dual effects on human health. Fluoride is helpful to human health in the range of 0.5 mg/L to 1.5 mg/L fluoride concentration. Several fluoride mitigation techniques such as adsorption, ion exchange, coagulation-precipitation, electrocoagulation, membrane and biological process are available to eradicate extra fluoride from synthetic and contaminated groundwater at the community and household levels. With comprising of all these methods, adsorption has proven to be the most effective due to its simplicity, economical, eco-friendly, easily available, cost effective and high removal efficacy. Over the past few years, various naturally accessible low-cost adsorbents, several waste materials, and various bio related adsorbents have been investigated to see how effective they are in the de-fluoridation process. However, the lack of time for the adsorbent to exhaust has posed a difficulty to the scientific community in terms of developing a long-term de-fluoridation procedure. In this case, a linked or integrated adsorbent material may be the optimum option for achieving a longer adsorbent material exhaustion time for de-fluoridation. A techno-economic assessment along with suitable policy suggestions have been investigated to justify the feasibility of the brighter processes. Such a review is expected to spur important recommendations among the scientific community to prevent the widespread risk of fluoride contamination to give clean and safe water.

**Keywords:** De-fluoridation, Adsorption, Natural available material, Novel strategy, Policy Suggestion

\*Corresponding author: supriti.czone@gmail.com

## **PHYTOREMEDIATION TECHNOLOGY FOR CHROMIUM CONTAMINATED SOILS**

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**S. K. Kabi, M. Kumar, N. K. Dhal and N.C. Rout**

Environment and Sustainability Department,  
CSIR-Institute of Minerals and Materials Technology, Bhubaneswar

### **ABSTRACT**

The use of chromium (Cr) has been increased since last two-three decades due to its high demand in different industries. The anthropogenic activities and waste products from industries like steel, leather, tannery and dye production has released the chromium into soil and water bodies causes the environmental pollution. This hazardous element mostly occurs in two stable forms i.e. Cr<sup>6+</sup> and Cr<sup>3+</sup> and hexavalent form is more toxic, mutagenic and carcinogenic as compared to its trivalent. Behavior of Cr in soil and its transfer/accumulation in plants and different plant parts vary with plant type, soil physio-chemical properties and its chemical form. Microbes present in the soil plays an important role in speciation and behavior of Cr in soil. For the uptake of Cr, plants rely on the specific and non-specific transporter channels of essential ions. The accumulation of chromium is mostly seen in root tissues region of plants with a limited translocation to shoot parts. Cr toxicity had adverse effects on plants physiological, morphological and biochemical processes. Apart from these effects, Chromium also affects the plant growth, nutrient uptake and photosynthesis process, induces enhanced generation of reactive oxygen species (ROS) and causes lipid peroxidation and alteration of antioxidant activities. Plants have various defense mechanisms against Cr toxicity via anti-oxidative enzymes such as complexation by organic ligands, compartmentation into the vacuole and scavenging ROS. The transfer of contaminated water and soil into the agricultural field may enter into the food chain can cause serious health hazards. In order to resolve the problem, the authors suggest phytoremediation technology to remediate the contaminated soils through plant-microbe interaction.

**Keywords:** Chromium, Soil, Plant-Microbe, Toxicity, Phytoremediation

## **A FACILE SYNTHESIS & CHARACTERIZATION OF ALPO<sub>4</sub> BASED CATALYST AND ITS APPLICATIONS FOR CO<sub>2</sub> DECOMPOSITION**

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**Karthika Devi. K., Vidhyalakshmi. G & Chellapandiankannan\***

Department of Chemistry, Manonmaniam Sundaranar University,  
Abishekappatti, Tirunelveli

### **ABSTRACT**

Global warming refers to the rise in earth's temperatures mainly due to the greenhouse effect caused by increased levels of carbon dioxide which is a major contributor. The reduction of CO<sub>2</sub> has been extensively studied by many research groups using chemical, photochemical, and biological method. In this study we reported an innovative catalytic process to decompose CO<sub>2</sub> in a U-shaped catalytic reactor packed with mesoporous molecular sieves such as AlPO<sub>4</sub> and Mg-AlPO<sub>4</sub> in the pore range of about 10 nm. These molecular sieves are synthesized by simple sol-gel method using Aluminum hydroxide, Orthophosphoric acid, Magnesium sulphate as a source material and Tetraethylenepentamine as a template. Their characterization were determined by related equipment for understanding the nature of the material which shows that the material have high crystalline nature and possess tetrahedral framework with thermal stability of 600°C. The synthesized catalyst is effectively used for decomposition process and analyzed by Gas Chromatography. The optimal conditions like temperature, flow rate, catalyst dosage and time on stream are carried out. Decomposition of CO<sub>2</sub> into CO and O<sub>2</sub> is carried out for 5 hours. This catalytic process attains 98% of CO<sub>2</sub> conversion. It is observed that the AlPO<sub>4</sub> shows 27% of complete decomposition (O<sub>2</sub>) and 71% of partial decomposition (CO). Similarly Mg-AlPO<sub>4</sub> shows 28% of complete decomposition and 70% of partial decomposition. Experimental results reveals that both catalysts are active for long time. After the completion of catalytic reaction, furthermore, the activity of the catalyst can regenerate by calcination process. We expect this work to provide useful insights to control global warming by this decomposition method.

\*Corresponding author: chellapandiankannan@gmail.com

## PRODUCTION OF BIODIESEL FROM USED FRYING OIL OVER A MESOPOROUS ALUMINOSILICATE

**Krishnaveni M. and Chellapandian Kannan\***

Department of Chemistry, Manonmaniam,  
Sundaranar University

### ABSTRACT

Biodiesel is an excellent substitute for fossil fuels and can be produced from used frying oil (UFO), a promising source for small-scale production of biodiesel. The quantities of UFO generated by different countries each year are significant. The problem with reusing frying oil for food is that it has many free radicals, which over long time scales cause various ailments to humans. Free radicals attach to healthy cells, leading to heart and skin diseases. In recent years, heterogeneous catalysts such as structured mesoporous materials have become of significant interest in biodiesel synthesis because of their environmental adaptability, non-corrosiveness, reusability, selectivity and the easy separation of the products. In this work, heterogeneous catalysts mesoporous AlSiO<sub>4</sub> and Zn-AlSiO<sub>4</sub> were synthesized using simple methods with triethylamine as a structure-directing agent. The synthesized material was characterized by means of several spectroscopic analyses including X-ray diffraction, infrared spectroscopic analysis, thermogravimetric analysis and surface area analysis to identify the framework structure, surface morphology and surface area of the catalyst. Heterogeneous catalytic transesterification of UFO was executed in a liquid phase heterogeneous catalytic reactor. The products were analyzed by HPLC. The process parameters were optimized to produce a maximum biodiesel yield of 97.5% for Zn-AlSiO<sub>4</sub>.

**Keywords:** Used frying oil, mesoporous, triethylamine, biodiesel, transesterification, aluminosilicate

\*Corresponding author: chellapandiankannan@gmail.com

## **OUTDOOR AND INDOOR FACTORS INFLUENCING TRACE GASES (NO<sub>2</sub>, SO<sub>2</sub> AND NH<sub>3</sub>) LEVELS INSIDE VENTILATED HOMES**

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**Kirti Singh<sup>1</sup>, Dr. Aparna Satsangi<sup>2</sup>**

<sup>1</sup> Dayalbagh Educational Institute, Dayalbagh, Agra

<sup>2</sup> Dayalbagh Educational Institute, Dayalbagh, Agra

### **ABSTRACT**

With the ongoing improvements in quality of life, breathing environment has become an essential area of concern for researchers in the twenty-first century. Presently, the whole world continues to be affected by the rapid spread of the COVID-19 pandemic because of which the quarantine implications and lockdowns have also increased the time spent indoors. Therefore, determining the effects of indoor air pollution has become an important issue to be studied. In this study, we studied the relation between the sources of trace gases (NO<sub>2</sub>, SO<sub>2</sub> and NH<sub>3</sub>) collected outdoors and indoors. A clear variation in the concentration was observed both indoors and outdoors during the day and night time. The results suggested that the concentration of trace gases was higher in indoors as compared to that of outdoors, it is due to the inefficient combustion of cooking fuels inside homes which is the main contributor of the above mentioned trace gases. Regarding, the outdoor concentration vehicular emissions were the main contributors, but as the samples were collected in a residential colony the concentration outdoors were less. The concentration and the sources contributing trace gases indoors were also influenced by the infiltration of outdoor air and by the indoor activities carried out by inhabitants. This suggests that independently from the outdoor air quality, the inhabitant's habits and customs can significantly alter the indoor air quality and determine the indoor concentrations of several hazardous contaminants. Therefore, actions to improve urban air quality will result in improved indoor air quality. In addition, modernization of apartments, especially replacing old windows and changing the heating system would also contribute to the improvement of indoor air quality, and thus quality of life.

## **CALCIUM-SULFO-ALUMINATE: AN ECO-CEMENTING MATERIAL ALTERNATE TO PORTLAND CEMENT**

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**S. D. Muduli, S.M. Mustakim, M.S. Jena and N. K. Dhal**

Environment & Sustainability Department  
CSIR-Institute of Minerals and Materials Technology, Bhubaneswar

### **ABSTRACT**

Portland cement occupies a major commodity for construction sector in the world since its invention. Lime stone is the major raw material being used along with other additives to prepare Portland cement (OPC). Portland cement is prepared by mixing the clinker with few percentages of gypsum. In making the clinker for OPC, limestone is sintered at 1450OC - 1500OC temperature, which is a very energy intensive process and adds most of the carbon load to the environment. So, the major environmental problem is that production of 1 ton of Portland cement adds about 1ton of CO<sub>2</sub> to the atmosphere. In context to the environmental point of view emission of CO<sub>2</sub> in manufacture of Portland cement is a serious threat for global warming. Here trials have been taken to look for the alternate of Portland cement, where CO<sub>2</sub> emission can be reduced. Hence Calcium-Sulfo-Aluminate (C-S-A) cement is an option to develop alternate low lime clinker to substitute Portland cement to reduce CO<sub>2</sub> load. Calcium sulfo-aluminate is a compound having the similar cementing property and characteristics like hydraulic cement alternate to Portland cement, which can be prepared with low lime content and less emission of CO<sub>2</sub>. In the current research work different weight % of limestone, bauxite, gypsum along with chemical activators are grounded up-to 400micron size followed by sintering at 1200oC temperature. The developed clinkers are mixed with sulphate source which acts as set regulator to act as cement. It is added to avoid the reaction of aluminates with water. After that mortar cubes are been prepared to observe the strength of the developed product. The details of the research work and its finding will be presented during the presentation of seminar.

**Keywords:** Calcium-Sulfo-Aluminate, eco-cementing material & Portland cement

## A REVIEW ON LOW-COST PHOSPHOROUS REMOVAL TECHNIQUES FROM DOMESTIC AND INDUSTRIAL WASTE WATER

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**Rosalin Das**Fakir Mohan University, Balasore, Odisha, India- 756089  
rosalindas.geology@gmail.com

### **ABSTRACT**

This review article comprehends the efficient techniques of removal of Phosphorous from domestic and industrial waste water which are cost effective. The removal of excess of phosphorous during wastewater treatment is vital for ensuring and protecting the ecosystem. A major source of Phosphorus is from agricultural fertilizer dissolution, manure and organic wastes from sewages and industrial effluents. The excess of the element in water, speed up eutrophication. Hence controlling phosphorous concentration from industrial and municipal waste water prevents eutrophication of surface water. The raw waste water phosphorus level is 200-300mg/l and discharge limit are 15mg/l. Excess concentration of phosphorous causes many water quality problems including increased purification costs, decreased recreational, loss of livestock and the possible lethal effect of algal toxins on drinking water. The removal of P from wastewater can be performed using physico-chemical methods, biological treatment, and/or combinations of both. The physical method involves sand filtration and membrane technologies. The most common chemical P-removal options involve dosing metal salts to either pre-treated influent, conventional activated sludge (CAS) reactors. P removal rates are typically proportional to the mass of chemical added. The chemical adsorptive media are manufactured from natural products, such as apatite, bauxite, lime stone, industrial wastes such as, fly ash, steel sludge or ochre. Phosphate removal rate found to be 91% when Polonite is used to treat municipal wastewater over a period of 1 year with a P-sorption capacity of 120 g/kg. Other chemical precipitation of soluble phosphorous, use metal salts i.e., aluminum based chemical product e.g., Alum, iron based chemical products e.g., ferric chloride. From the biological treatment, algae will uptake excess of P for its growth requirements. Algal treatment solutions are typically either closed or open suspended systems, or biofilm systems, most commonly using flat-bed or tubular orientation. In Bio treatment process only 15 to 30% of Phosphorous get removed. Polyphosphate-accumulating organisms (PAOs) are bacteria that can help facilitate the process of removing phosphorus. This paper presents the techniques and results of phosphorous removal treatment on wastewater.

**Keywords:** Phosphorous, waste water, Physio-chemical, biological treatment, P-removal

**Corresponding author:** rosalindas.geology@gmail.com

## **STUDY OF WATER QUALITY OF NATHSAGAR (JAIKWADI) DAM**

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**D. J. Sonawane<sup>1</sup> and R. R. Dandawate<sup>2</sup>**

<sup>1</sup>Department of History, Shree Dnyaneshwar Mahavidyalaya,  
Newasa, Ahmednagar

<sup>2</sup>Department of Zoology, Arts, Commerce and Science College

### **ABSTRACT**

An attempt was carried to study Physicochemical investigation of Nathsagar Dam, Paithan District Aurangabad. The study was carried during Year 2019-20. During this study Hydro biological parameters such as Temperature, PH, Alkalinity, DO, Free CO<sub>2</sub>, Total Hardness was done. The causes of water pollution are also studied in his research. Along with this geographical study of Dam is also done.

**Keywords:** Hydro biological, Water quality, Investigation, Parameters.

**Corresponding author:** <sup>1</sup>dr.sonawane@gmail.com; <sup>2</sup>drajendra2006@gmail.com

## POTENTIAL OF MACRO-ALGAE FOR PHENOL REMOVAL FROM AQUEOUS SOLUTION

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**Karishma D. Shah and Nayana H. Brahmbhatt**

Department of Biology, V. P.& R.P.T.P Science College, Sardar Patel University,  
Vallabh Vidhyanagar-388120, Gujarat, India.

### ABSTRACT

This paper deals with determining efficiency of *Sargassum johnstonii* biomass for phenol removal from aqueous solution using batch adsorption study. Effect of pH, adsorbent dose, concentration and contact time on bio-sorption process was evaluated. This experiment indicates that the bio-sorption is strongly impacted by pH of the solution. At lower pH, phenol can strongly make H-OH bonding with algae polysaccharide chain. This study proved that marine brown algae are low cost alternative approach for phenol removal.

**Keywords:** Bio-sorption, Effluent treatment, Seaweed biomass, Isotherm Study, Phenol optimization

## NUTRIENT REMOVAL EFFICIENCIES OF MACROPHYTES: A LAB SCALE STUDY

**Sudarshan.P<sup>1, 2\*</sup> and Ramachandra T.V<sup>2</sup>**

<sup>1</sup> Department of Biosciences, Mangalore University, Dakshina Kannada District, Karnataka-574199.

<sup>2</sup> Energy and Wetlands Research Group, Centre for Ecological Sciences,  
Indian Institute of Science, Bangalore

### ABSTRACT

Pollution and eutrophication due to the sustained discharge of untreated wastewater has been a major problem across the world. Water pollution has been posing serious challenges with the serious health consequences to biota of an ecosystem. This necessitated treatment of wastewater before it is discharged to the environment. Various processes available for remediation of polluted environment are as follows-ion-exchange, evaporation, precipitation, and chemical reduction; microorganisms and phytoremediation. Among these approaches phytoremediation is found to be an efficient and cost effective approach for treating wastewater. The current study was conducted to assess the removal efficiency of EC, TDS, pH, nitrite, nitrate, total nitrogen, phosphate, ammonia, COD, BOD from domestic wastewater by 3 macrophytes-*Eichhornia crassipes*, *Pistia stratiotes*, *Lemna minor* in lab scale constructed wetland. The experimental unit was setup using four treatment groups of plastic tanks filled with 10 litres of diluted sewage water. Equal quantities of macrophytes were transferred to experimental units containing diluted wastewater. Wastewater samples were collected from each units and analyzed every 2 days. The evaporation loss was compensated by filling the wastewater. The experiment was carried out for 21 days. All water quality parameters were conducted according to APHA. Overall, *Pistia stratiotes* showed highest nutrient removal efficiency than *Eichhornia crassipes* and *Lemna minor*. It had maximum removal efficiencies for nitrite, total nitrogen, phosphate, COD, BOD and EC. *Lemna minor* showed maximum removal efficiency of ammonia and TDS while *Eichhornia crassipes* had maximum removal efficiency of nitrate among studied macrophyte species. All the 3 macrophytes had highest removal efficiency of phosphate while control showed maximum removal efficiency of ammonia among nutrient and other parameters.

**Keywords:** Macrophyte, Phytoremediation, Wastewater

## MECHANISTIC INTERPRETATION OF PHOTOCATALYTIC DISINFECTION OF MULTI-DRUG RESISTANT BACTERIA: AN ALTERNATIVE APPROACH TO COMBAT MICROBIAL CONTAMINATION IN WATER

**Arpan Ghosh<sup>a</sup>, Ananyo Jyoti Misra<sup>a</sup>, Amrita Mishra<sup>a</sup>, Suraj Kumar Tripathy<sup>a b</sup>**

<sup>a</sup> School of Biotechnology, KIIT Deemed to be University, Bhubaneswar, Odisha

<sup>b</sup> School of Chemical Technology, KIIT Deemed to be University, Bhubaneswar, Odisha

### ABSTRACT

Water pollution by multidrug-resistant (MDR) bacteria is the leading cause of gastrointestinal infections worldwide, posing a serious threat to public health. As a result, there is an urgent need to develop unconventional strategies for purging water-borne pathogenic bacteria that have the potential for community-scale applications. The efficacy of visible-light assisted photocatalytic disinfection (PCD) of two MDR strains isolated from the environment; namely *E.coli* and *S.aureus* using Ag@SnO<sub>2</sub>@ZnO, was tested. Ag@SnO<sub>2</sub>@ZnO was found to be more effective than Fe-doped ZnO, (ZnO) and Titanium Dioxide for PCD process. Fluorescence microscopy and electron microscopy (FESEM) analysis suggested that PCD caused full bacterial cell death due to bacterial cell membrane damage. In the presence of Ag@SnO<sub>2</sub>@ZnO, experimental evidence suggests that •O<sub>2</sub>– may be the most important component in disinfecting the target strains, in a visible-light assisted PCD process. Based on the results of the Resazurin assay, it is hypothesised that reactive oxygen species (ROS) produced during PCD may have hampered the bacteria's oxido-reductase enzyme system, stifling its metabolic activity. Crystal structure and particle size of Ag@SnO<sub>2</sub>@ZnO was found to be unaltered during the photocatalytic process indicating its potential for reusability. Atomic Emission Spectroscopic analysis confirmed that there had been no leaching of metal ions from the aforementioned nanocomposite, making the treated water safer for further usage. A comparative assay with other known contaminants of water pollution, and its high effectiveness in disinfecting real water samples collected from natural sources, make this an ideal candidate for water disinfection using alternative approaches.

## **APPLICATION OF BIOMASS WASTE DERIVED BIOCHARS FOR REMOVAL OF ANIONIC DYE FROM WATER**

**Mayank Singh<sup>a1</sup>, Mohd. Ahsan<sup>ab</sup>, Disha Mishra<sup>a</sup>, Tanmay Karak<sup>c</sup>, Puja Khare<sup>ab</sup>**

<sup>a</sup>Crop Production and Protection, Division, CSIR-Central Institute of Medicinal and Aromatic Plants,  
Lucknow - 226 015, India

<sup>c</sup>Upper Assam Advisory Centre, Tea Research Association, Dikom-786101, Dibrugarh, Assam, India

<sup>b</sup>Academy of Scientific and Innovative Research (AcSIR)

### **ABSTRACT**

In this study, four biochar were prepared from different crop residue waste i.e. sugarcane bagasse (SBB), coconut shell (CNB), paddy straw (PDB), and distilled waste of lemongrass (LGB) evaluated for removal of Remazol Brilliant Blue R from the aqueous system. The RBBR adsorption capacities of biochar were 97% to 79% for SBB, 99.9 to 99.47% for CNB, 66.1-48% for PDB, and 78-68% for LGB, dominantly controlled by their aromaticity and mineral content. The Langmuir and Freundlich isotherm and pseudo-second-order kinetic models have described the chemisorption of RBBR on biochar surfaces. The thermodynamic data suggested that adsorption was spontaneous and endothermic. These biochars demonstrated excellent reusability (till four cycles with 50-61% regeneration). The purified water and biochar dye sludge demonstrated no phytotoxicity. The findings obtained in this study may provide supports for the potential of biochars for anionic dye removal from water and utilization of generated sludge for zero waste-producing technologies in the future.

**Keywords:** Biochar, Remazol Brilliant Blue R Dye, Adsorption, Biochar dye sludge

## **BIOCHAR PRODUCTION: THE WAY OF UTILIZATION OF AGRICULTURAL WASTE SYSTEM FOR SUSTAINABLE DEVELOPMENT**

**Mohd Ahsan, Mayank Singh and Puja Khare**

Environmental Chemistry Laboratory, Crop production and Protection Division, Central Institute of Medicinal and Aromatic Plants, P.O.-CIMAP, Near Kukrail Picnic Spot, Lucknow-226 015, India.

### **ABSTRACT**

The crop residues burning poses a serious problem to the environment and human health due to the emission of toxic gasses and particulate matter. This study examines the possibility of biochar production from different crop residues and its utilization as a soil fertility enhancer, and alternative fuel as a sustainable solution. The total quantity of residue burnt in India is 98.4 MT/year to 131.9 MT/year which 22%, 21%, and 10% of total crop residue burning in UP, Punjab, Haryana respectively. The estimated total biochar yield from each crop i.e  $3.36\text{--}4.15 \times 10^4$  Kt/year,  $4.42\text{--}8.41 \times 10^4$  Kt/year,  $2.67\text{--}4.61 \times 10^3$  Kt/year and  $4.04\text{--}7.01 \times 10^3$  Kt/year from wheat, paddy, sugarcane and maize residues respectively. Therefore, biochar dose and feedstock could be optimized with the soil type to get the optimum results and the variation in the application rates (0.1–29.6 t/ha) and enhancement in the crop yield (5–178%) as compared to control worldwide. Thus, variable application rates, that is, 0.1 t/ha (wheat), 4, 29.6 to 10 t/ha (paddy), 2 t/ha (maize) and 1.5 t/ha (sugarcane) were chosen for estimations of crop productivity. This study advises that the production of biochar from crop residue could be beneficial not only for the environment but also for the farmers.

**Keywords:** Biochar, CO<sub>2</sub> sequestration, crop-residue burning

## **NAVIGATING TOXICOLOGICAL PARADIGMS: ETCHING ROADMAP FOR ECO-HEALTH**

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**Suhel Parvez**

Department of Toxicology, School of Chemical and Life Sciences,  
Jamia Hamdard, New Delhi

### **ABSTRACT**

Human activity is greatly responsible for polluting environment by addition of chemical substances such as pesticides, fungicides, heavy metals that result in depletion of eco-quality along with a negative impact on the biotic communities. Indiscriminate release of contaminants into the environment disturbs the delicate ecological balance of the earth. Pesticides have been used indiscriminately over the years, resulting in situations that are not conducive to a healthy environment. Fish has been established as a well standardized model for testing harmful responses to xenobiotic, particularly pesticides, in ecotoxicology. Fish have been used as good models for testing the toxicity and other impacts of pollutants on animals because their biochemical reactions are similar to those of mammals and other vertebrates. Fish physiological and toxicological characteristics, such as morphological indices, antioxidant responses, and energy metabolic parameters, can be altered by environmental stressors. Biochemical analysis to monitor toxicity in the environment, on the other hand, isn't always accurate in anticipating the harmful effects on ecosystems. This is due to an increase in the number of unknown compounds and pollutant combinations in the environment. As a result, new approaches are needed to demonstrate a firm link between chemical exposure and biological consequences. A combination of Eco toxicological experiments and models is required for a more comprehensive analysis of toxicological paradigms and a better understanding of eco-health.

## **RISING AIR POLLUTION AND ITS IMPACT: A CASE STUDY OF GURGAON CITY**

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**Aruna Paarcha**

Assistant Professor, Department of Geography,  
Jamia Millia Islamia, New Delhi

### **ABSTRACT**

Air pollution is increasingly predictable as a threat to public health and acknowledged as an important and modifiable determinate of respiratory diseases in urban environment. Differences in vulnerability and susceptibility due to different population characteristic, may affect the risk of developing a health effect and its severity. The present study evaluates systematic literature on air pollution, and its health effects on population of Gurgaon to identify the risk of exposure. Air pollution is responsible for many health problems in the urban areas. Of late, the air pollution status in Gurgaon has undergone many changes in terms of the levels of pollutants and the control measures taken to reduce them. Gurgaon, officially Gurugram, is a city located in the northern Indian state of Haryana, of life and bustle, verging on the chaotic as well as traditional occupations and ultra-modern industries. Gurugram is India's second largest information technology hub and third largest financial and banking hub. Gurugram is also home to India's largest medical tourism industry. Gurugram has seen the rapid urbanization in the recent years, be it in terms of Corporate Offices or infrastructure or increasing population seeking job opportunities here. Urbanization results in huge social, environmental and economic changes. This study is an attempt to review the effects of superfast urbanization in Gurugram through its adverse impact on the human health and society. It is a part of the National Capital Region of Delhi. It is a large and planned industrial city. Air quality of Gurugram was detrimental to human health and kept on deteriorating with time. Suspended Particulate Matter (SPM), Nitrogen oxides (NOX) and various other pollutants were above the recommended standard. Adverse health effects (coughing, wheezing, hypertension etc.) has shown positive association with air pollutants, specifically with particulate matter. A more comprehensive research construing long term effect of air pollution on human health is thus, necessary for advocating policy or guidelines for measuring and understanding the harmful effects and also for the control of air pollution.

**Keywords:** Urbanization, Air pollution, Health effects, Control measures.

## **EFFECTS OF FLY ASH AMENDED SOIL ON PHYSIOLOGICAL, BIOCHEMICAL ATTRIBUTES AND ANTIOXIDANT RESPONSES OF MEDICINALLY POTENT PLANT *Withania somnifera* (L.) DUNAL: RECYCLING INDUSTRIAL COAL WASTE IN A SUSTAINABLE MANNER**

**Moh Sajid Ansari\* and Abrar Ahmad Khan**

Lab of Environmental Botany and Plant Pathology, Department of Botany,  
Aligarh Muslim University, Aligarh-202002, U.P, India

### **ABSTRACT**

Coal fly ash (CFA), an industrial solid waste generated by coal-fired thermal power stations during pulverized coal combustion, is currently one of the largest solid wastes worldwide. Coal fly ash should be disposed of in an environmentally safe, affordable, and sustainable manner. It is a remarkable soil supplement for plant growth and yield since it contains essential macro and micro nutrients and porosity. The effects of the different levels of fly ash on ashwagandha (*Withania somnifera* (L.) Dunal) were investigated in this study. A pot experiment with several fly ash addition treatments was carried out in a randomized complete block design. After evaluating soil and FA nutritional level using an energy-dispersive X-ray spectrometer (EDX), various amounts of FA with soil were combined (5, 10, 15, 20, and 25%). Furthermore, a scanning electron microscope (SEM) observed an expansion in the stomatal pore and size of the FA-treated ashwagandha leaves. The growth substrate containing 15% CFA showed to be the best suited for growing ashwagandha. Plants cultivated in 15% CFA supplemented soil had significantly higher ( $P \leq 0.05$ ) growth and yield, photosynthetic pigments rate, nitrate reductase (NR) activity, carbohydrate, and protein contents than the control. In comparison with the control, overall activities of antioxidative enzymes (SOD, CAT, and POD) had become significantly increased with 15% CFA supplemented soil. CFA can be used as a soil supplement in agricultural systems to boost arable land production cost-effectively and environmentally sustainable.

**Keywords:** antioxidants activity; coal fly ash; energy-dispersive X-ray spectroscopy; nitrate reductase activity; scanning electron microscope; *Withania somnifera*.

**Corresponding author:** sajidamu12@gmail.com

## **OZONE (CONSERVATION) – PAST-PRESENT-FUTURE: A REVIEW**

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**Dr. T. S. Harsha.**

Chairman, Department of Environmental Science, Karnataka State Open University  
Manasagangotri, MYSORE – 570 006, Karnataka State, INDIA

### **ABSTRACT**

Ozone is a colorless triatomic oxygen gas. Chemically, it is very active and it reacts readily with a great many other substances. Near the Earth's surface, those reactions cause rubber to crack, hurt plant life, and damage people's lung tissues. But ozone also absorbs harmful components of sunlight, known as "ultraviolet B", or "UV-B". There are many situations where human activities have significant effects on the environment. Ozone layer damage is one of them. The objective of this paper is to review the origin, causes, mechanisms and effects of ozone layer depletion as well as the protective measures of this vanishing layer. One of the main reasons for the widespread concern about depletion of the ozone layer is the anticipated increase in the amounts of ultraviolet radiation received at the surface of the earth and the effect of this on human health and on the environment. In the absence of other changes, stratospheric ozone abundances should rise in the future as the halogen loading falls in response to regulation. However, the future behaviour of ozone will also be affected by the changing atmospheric abundances of methane, nitrous oxide, water vapour, sulphate aerosol, and changing climate. The UNEP, Governments of the world, including United States have cooperatively taken action to stop ozone depletion with the "The Montreal Protocol on Substances that Deplete the Ozone Layer", signed in 1987. In fact, global warming, acid rain, ozone layer depletion, and ground-level ozone pollution all pose a serious threat to the quality of life.

**Keywords:** Tri-atomic Gas, Dobson Unit, UNEP, Montreal Protocol.

**Corresponding author:** envrao@rediffmail.com, raoamer@gmail.com

## **AMELIORATION OF ATRAZINE INDUCED TOXICITY BY ENDOPHYTIC BACTERIUM *Bacillus sp.* STRAIN CIMAP-A7 IN *Andrographis paniculata* L.**

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**Pratibha Tripathi and Puja Khare**

Crop Production and Protection Division,  
CSIR-CIMAP, Lucknow-226015

### **ABSTRACT**

The present work investigated the potential of plant growth promoting endophytic bacterium *Bacillus* sp. strain CIMAP-A7 in reducing atrazine induced phyto-toxic effects in *Andrographis paniculata*, an important medicinal plant. Endophyte CIMAP-A7 inoculation remarkably reduced atrazine soil content, by 78 and 51 % at lower and higher dose (lower: 25 and higher: 50 mg kg<sup>-1</sup>) respectively, than their respective control treatment. Reduced plant atrazine accumulation in CIMAP-A7 inoculated treatments with enhanced total chlorophyll, carotenoid, protein and metabolite content under both contaminated and un-contaminated treatments was recorded. Atrazine revealed a non-significant decrease at lower dose while at higher dose 22 and 36 % decrease was recorded in metabolite content and plant dry weight of *A. paniculata*, respectively. Atrazine induced oxidative stress of *A. paniculata* was also maneuvered by CIMAP-A7 by reducing stress enzymes, proline and malondialdehyde accumulation under contaminated soil conditions than uninoculated treatments. Also, presence of atrazine metabolites deisopropylatrazine and desethylatrazine strongly suggests role of CIMAP-A7 in atrazine mineralization however, absence of these metabolites in uninoculated soil and all plant samples were recorded. These findings advocates that for the amelioration of atrazine induced stress with no/least pesticide content in plant tissues such plant-endophyte co-interactions would be efficient in remediation of atrazine contaminated soils and ensure safe crop produce.

## **MIXED PRECURSORS DERIVED GRAPHITIC CARBON NITRIDE FOR WASTE WATER TREATMENT**

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**G.R. Dillip**

Energy Institute, Center of Rajiv Gandhi Institute of Petroleum Technology,  
Bengaluru 560064, India

### **ABSTRACT**

Graphitic carbon nitride ( $\text{g-C}_3\text{N}_4$ ) has become one of the most promising photocatalysts for the following reasons: Non-metallic properties, abundant raw materials, thermal, physical, and chemical stability. Herein, the author introduced a novel method for preparing  $\text{g-C}_3\text{N}_4$  through the conventional sintering method using mixed precursors (i.e., melamine and thiourea). Four different samples were obtained by changing the melamine and thiourea weight ratios. The physio/photochemical properties of the samples were investigated through various analytical methods such as X-ray diffraction (XRD), UV-Vis-NIR spectrophotometer, scanning electron microscopy (SEM), photoluminescence (PL), Brunauer-Emmett-Teller (BET), and X-ray photoelectron spectroscopy (XPS). The  $\text{g-C}_3\text{N}_4$  with higher melamine (1.0 g) and lower thiourea (0.25 g) weight ratio sample [MT-GCN-A] exhibit high specific surface area (14.28  $\text{m}^2 \text{ g}^{-1}$ ), pore size (23.57 nm), and bandgap (2.88 eV) compared to other samples. When used as a photocatalyst in degrading Congo red (CR) under UV and visible-light irradiation, MT-GCN-A shows higher performance than different  $\text{g-C}_3\text{N}_4$  photocatalysts. The obtained outcomes prove that the proper amount of melamine and thiourea derived  $\text{g-C}_3\text{N}_4$  could accelerate the separation and transfer of photogenerated electron-hole pairs, leading to photocatalytic activity improvement in the waste-water treatment.

**Keywords:**  $\text{g-C}_3\text{N}_4$ , Melamine, Thiourea, Congo red, Waste-water treatment

**Corresponding author:** dillip.ngr@gmail.com/gdillip@rgipt.ac.in

## **DEGRADATION IBUPROFEN DRUG UNDER SOLAR LIGHT IRRADIATION USING POLY(O-PHENYLENEDIAMINE)/SB<sub>2</sub>O<sub>3</sub> NANOHYBRIDS**

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**Ufana Riaz**

Materials Research Laboratory, Department of Chemistry,  
Jamia Millia Islamia (A Central University), New Delhi-110025, India

### **ABSTRACT**

The degradation of a non-steroidal anti-inflammatory drug(NSAID) Ibuprofen (IB) in aqueous solution using Sb<sub>2</sub>O<sub>3</sub> and POPD/Sb<sub>2</sub>O<sub>3</sub> nanohybrids using solar light radiation is described. The prepared POPD/Sb<sub>2</sub>O<sub>3</sub> nanohybrids were characterized by TGA, FE-SEM-EDX, FT-IR, XRD, TEM, and UV-Vis studies. The thermal stability was found to follow the order: 24%-POPD/ Sb<sub>2</sub>O<sub>3</sub>> 18%-POPD/Sb<sub>2</sub>O<sub>3</sub>> 12%-POPD/Sb<sub>2</sub>O<sub>3</sub>> 6%-POPD/Sb<sub>2</sub>O<sub>3</sub>> Sb<sub>2</sub>O<sub>3</sub>.UV-Vis diffuse reflectance spectroscopy (DRS) studies showed that the band gap of Sb<sub>2</sub>O<sub>3</sub>, POPD, and POPD/Sb<sub>2</sub>O<sub>3</sub> nanohybrids were found to be 3.35 eV, 1.57 eV and 1.67 to 1.35 eV respectively. Ibuprofen drug was chosen as a model reaction to evaluate the photocatalytic activities of Sb<sub>2</sub>O<sub>3</sub>, POPD and POPD/Sb<sub>2</sub>O<sub>3</sub>, using solar light radiation. The catalytic activities of pure Sb<sub>2</sub>O<sub>3</sub> and nanohybrids were in the order of 24%-POPD/Sb<sub>2</sub>O<sub>3</sub>> 18%-POPD/Sb<sub>2</sub>O<sub>3</sub>> 12%-POPD/Sb<sub>2</sub>O<sub>3</sub>> 6%-POPD/ Sb<sub>2</sub>O<sub>3</sub>> Sb<sub>2</sub>O<sub>3</sub>. The nanohybrids were observed to degrade the drug pollutant by 91% within a short span of 60 min. The degraded drug fragments were identified using liquid chromatography-mass spectrometry (LC MS). The possible photocatalytic mechanism has been proposed, taking into account the synergistic effect between Sb<sub>2</sub>O<sub>3</sub> with POPD.

**Keywords:** Antimony oxide; POPD; Ibuprofen; photocatalytic degradation; solar light

**Corresponding author:** ufana2002@yahoo.co.in

## **ACUTE TOXICITY EVALUATION OF HERBICIDE ON FISH (POECILIA RETICULATA)**

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**S Siva Shankar Prasad<sup>a\*</sup> and D. Easwaramoorthy<sup>b</sup>**

<sup>a</sup>Research Scholar, Department of Chemistry, B.S. Abdur Rahman Crescent Institute of Science & Technology, Chennai, Tamil Nadu, India.

<sup>b</sup>Professor & Head, Department of Chemistry, B.S. Abdur Rahman Crescent Institute of Science & Technology, Chennai, Tamil Nadu, India.

### **ABSTRACT**

A Laboratory experiment was conducted to evaluate the acute toxicity in Fresh water fish with herbicide (Pendimethalin 15 % + Pyrazolesulfuron 0.15% GR) formulation was studied. A static exposure was performed as per the guidance Document on Toxicology for Registration of Chemical Pesticides in India. "Acute Toxicity- Fish", OECD test guideline (OECD TG 203). Initially a range finding experiment was conducted with five concentrations each concentration two replicates each replicate containing ten freshwater fish (*Poecilia reticulata*) were exposed to five different concentration of 1, 10, 25, 50 and 100 mg /L, concurrently a control group was maintained, based on the results of range finding experiment, Limit test was conducted with concentration 100 mg/L with containing ten freshwater fish (*Poecilia reticulata*) were exposed. The Limit test no mortality was observed in control and fish exposed to 100 mg/L throughout the experimental period. During the conduct of the experiment fish were observed for toxicity sign at approximately 3, 6, 24, 48, 72 and 96 hour after exposure. No toxicity signs were observed in control and fish exposed to 100 mg/L throughout the experimental period. The method validation and concentration verification was performed. The concentration verification of the compound in the exposure medium sample was carried out for the concentration of high concentration (100 mg/L). The sample at 0 hour and 96 hour were analyzed. The mean recovery concentration for Pendimethalin 15 % + Pyrazolesulfuron 0.15% GR at 0 hour 98.23 %, 98.13 % and at 96 hour 97.59 %, 95.00. Based on the results, LC50 of Pendimethalin 15 % + Pyrazolesulfuron 0.15% GR., observed over a period of 96 hour for freshwater fish (*Poecilia reticulata*) was found to be greater than 100 mg/L.

**Keywords:** Herbicide, Fish Toxicity, LC50

**\*Corresponding author:** siva.surisetti@gmail.com, hodchem@crescent.education

## **ADVANCED TECHNOLOGIES FOR WASTEWATER TREATMENT**

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**T.V.N. Sai Prathyusha**

Department of Biotechnology

Sri Padmavati Mahila Visvavidyalayam (Women's University), Tirupathi,  
Andhra Pradesh, India.

### **ABSTRACT**

The rapid growth of the industries and population leads to increasing generation of industrial and municipal wastewater. This wastewater threatens directly or indirectly the human health and industrial processes. The importance of highly efficient wastewater treatment is evident from aggravated water crises. Generally, physical and chemical methods used for waste water treatment but these methods are expensive and pollute the environment. Therefore, it is necessary to develop a rapid, simple, eco-friendly, effective, and efficient method for eliminating pollutants from industrial and municipal wastewater. Biotechnology is a promising solution to address this problem, including treatment and monitoring processes. The main directions and differences in biotreatment process are related to the surrounding environmental conditions, biological processes, and the type of microorganisms. Biotechnology makes use of microorganism's resource for pollutant removal from wastewater hardly by changing the surroundings. When compared to physical and chemical technology, biotechnology costs lower for actual waste water treatment and are more suitable for current eco-friendly development.

**EXAMPLES:** Moving Bed Biofilm Reactor, Anaerobic Ammonia Oxidation Process, Denitrifying Anaerobic Methane Oxidation, Integrated Biotreatment Process, Anaerobic Sludge Blanket Biological Aerated Filter and Advanced Oxidation Process based on Fenton reaction and so on.

**Keywords:** Wastewater, Pollutant, Treatment, Biotreatment, microorganisms

## **METHANE FARMING: AN OPPORTUNITY FOR SELF EMPLOYMENT**

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**Dr. Dhanwate K.G.**

Associate Professor and HOD in Geography,  
Shri Dnyaneshwar Mahavidyalaya, Newasa, Dist- Ahmadnagar.(M.S. INDIA)  
Affiliated to Savitribai Phule Pune University Pune.

### **ABSTRACT**

Methenogenesis is a process of fermentation in which Methane ( $\text{CH}_4$ ) gas is release. This is mainly used as a fuel. Animal dung as well as other biodegradable waste ferment in biogas plants releasing methane gas mainly used for household cooking and also can be used to produce electricity and to fill the gas cylinders of different size. The produced electricity can be used to establish a "Battery Charger Centre" as an opportunity for self employment to the youths.

**Keywords:** Methenogenesis, Methane gas, Self employment.

## **STUDY OF WATER QUALITY OF RIVER, GODAVARI AT PRAVARASANGAM DISTRICT AHMEDNAGAR, MS AND ITS SOCIOECONOMICAL IMPACT ON ENVIRONMENT AND SOCIETY**

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**\*Dr S.S.Tanpure \*\* DR R.R.Dandawate**

\*Department of Political Science, Jijamata College of Arts and Science Bhende  
BK.Dist.Ahmednagar, MS

\*\* Department of Zoology Arts, Commerce & Science College, Sonai, Ahmednagar, MS

### **ABSTRACT**

The present study deals with the analysis of Physical Parameters of Godavari River at Pravarasangam, District Ahmednagar Ms, India., which is backwater of Jaikwadi Dam. Samples were collected for one year period from January 2019 to December 2019. For The water quality the parameters were studied like temperature, pH, TDS, Alkalify, Acidity, Turbidity, etc. The water Temperature ranges 32-35 °C, pH 8 to 10, TDS values ranged between 298 to 175. The quality of water indirectly affect on living organisms & also agricultural crops i.e. socioeconomically effect on environment. The detailed study is given in work

**Keywords:** Water Quality, Environment, Alkalify, etc.

**\*Corresponding author:** sambhaji.tanpure123@gmail.com

## **TO STUDY OF MANAGEMENT STYLES AND INNOVATION IN INDIAN WOMEN ENTREPRENEURS ENVIRMENT**

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**Dr. Sanjay B. Shinde**

Associate professor in commerce  
M.Com, MBA, SET, GDC&A, M.Phil, Ph.D.  
MES, Shri Dnyaneshwar Mahavidyalaya Newasa,  
Ahmednagar (MS), INDIA

### **ABSTRACT**

Studies suggest that management style affects organizational innovation. However, not much is known about innovation in women-owned enterprises, especially in a developing society such as Nasik. The current study, therefore aims to examine how Nasik women entrepreneurs perceive and manage innovation. Due to the exploratory nature of the analysis, a qualitative approach is adopted. 10 women entrepreneurs are interviewed regarding their perception and implementation of innovation, as well as the problems they face and their solutions to those problems, based on the responses, 4 distinct management styles are identified. The study has several theoretical and practical implications. In particular they provide direction on women's development issues to policy-makers and managers, as well as researchers in the areas of culture, gender and innovation.

**Keywords:** Women entrepreneurs, Management style, Innovation, Qualitative Approach

**INTEGRATED EFFECT OF BIOFERTILIZERS ON GROWTH & NUTRIENT UPTAKE  
OF *Saccharum officinarum*****Dr. Vitthal Eknath Darandale**Assistant Professor Department of Botany  
M.E.S Arts, Commerce & Science College, Sonai, Ahmednagar, MS**ABSTRACT**

A field experiment was conducted during the year of 2019-20 at Research farm of Mula Factory Sonai, Ahmednagar, Maharashtra to study the "Integrated effect of biofertilizers on growth & nutrient uptake of Sugarcane (CO-86032)". The experiment was laid out in randomized block design with three replications. There were seven treatments viz., T<sub>1</sub>-Control, T<sub>2</sub>-RDF, T<sub>3</sub>- RDF + FYM + PSB + Azobacter, T<sub>5</sub>- RDF + FYM + PSB + Acetobacter, T<sub>6</sub>-RDF + FYM + PSB + Azospirillum, T<sub>7</sub>-RDF + FYM + PSB + Azobacter+ Acetobacter + Azospirillum.

The results showed the significant response to growth parameters viz., Germination percentage, Plant height, Leaf area. Among the different treatments, maximum increase in the growth parameter was found in treatment T<sub>7</sub>= RDF + FYM + PSB + Azobacter + Acetobacter + Azospirillum which was followed by treatment T<sub>5</sub>& T<sub>6</sub>. The similar results were also obtained for biochemical properties viz., total Chlorophyll contain 1.993 mg fr.wt & nitrate reductase activity 675.96  $\mu\text{M NO}_2\text{-g}^{-1}$  fr.wt hr<sup>-1</sup> for treatment T<sub>7</sub>.

The maximum increase in nutrient uptake was recorded in treatment T<sub>7</sub> - 258.95 N, 82.19 kg ha<sup>-1</sup> P 363.15 kg ha<sup>-1</sup> P which was followed by treatment T<sub>5</sub> & T<sub>6</sub>.

Considering the experimental finding it is concluded that use of biofertilizers either individually (Azobacter, Acetobacter & Azospirillum) or in combination with FYM & RDF showed positive effect on growth, biochemical properties & nutrient uptake.

**Keywords:** RDF- Recommanded dose of fertilizer, PSB – Phosphorus Solubilizing Bacteria, FYM – Farm Yard Mannure, etc.

**Corresponding author:** vitthalrao.darandale@gmail.com

### **National Environmental Science Academy (NESa)**

206, Raj Tower-I, Alaknanda Community Centre, New Delhi - 110 019  
Contact Number: 011-2602 3614  
Mobile: 9971850015/ 9811238475/ 9971383650  
E-mail: 2021wmsd@gmail.com

[nesa-india.org](http://nesa-india.org)

### **Bhubaneswar City Knowledge Innovation Cluster (BCKIC)**

Campus 11, KIIT-Deemed to be University, Bhubaneswar-751 024, Odisha  
Mobile: +91-9811687020  
E-mail: prashant@bckic.in

[bckic.in](http://bckic.in)

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