International Conference on Pollution Control for Clean Environment (ICPCCE-2023)

15-16 December 2023

Indian Institute of Technology Bhubaneswar

"Environmental pollution in an incurable disease; it can only be prevented."

Barry Commoner

PREFACE

Dear Colleagues,

It is a great privilege for us to present the book of abstracts of the first International Conference on Pollution Control for Clean Environment (ICPCCE-2023) to the authors and delegates of the event. We hope that you will find it useful, exciting and inspiring.

The collection of abstracts contains the papers submitted to the ICPCCE 2023, which was held at Indian Institute of Technology Bhubaneswar during December 15-16, 2023. There was a significant representation, with participants coming from different universities of India and abroad.

The Conference aims to provide a platform for discussing the issues, challenges, opportunities and findings of pollution control strategies for a clean environment. Hopefully, it will also spark innovative ideas, foster research relations or partnership between the various institutions.

We are progressing from an environmental paradigm based on cleanup and control to one including assessment, anticipation, and avoidance. The environmental problems of greatest immediate concern have changed over the past quarter of a century, and the technologies required to address those problems have changed as well. While modern societies face growing concern about global environmental issues, developing countries are experiencing complex, serious and fast-growing pollution problems of their own. Environmental pollution is more than just a health issue; it is a wider social issue in that pollution has the potential to destroy homes and communities. Despite this, many developing countries either have not developed environmental pollution control measures, or have not provided adequate implementation structures to ensure that policies are effective.

This book of abstract discusses the occurrence of pollutants in different environmental media, occurrence pathways and risk and impact assessment of pollution. The abstracts of different research topics provide advanced information about effective monitoring, detection, sustainable practices, cleaner and innovative treatment technologies, for contaminant removal. This also includes energy-positive technologies and recent advances in the upgradation of existing systems. The life cycle assessment, application of environmental indicators, and circular economy for pollution control strategies have also been presented extensively. This Conference addresses different categories pollution and their management and papers are expected to fit broadly into one of the four main broad-ranging categories with their subcategories:

Track 1: Environmental Monitoring and Management

- Detection of emerging contaminants, micropollutants in different environmental
- media
- Appropriate Technology for Sustainability
- Cleaner Production & Emerging Sustainable Practices
- Methods and procedures for pollution risk assessment
- Environmental impact assessment of environmental pollution

- Life cycle assessment of pollution control technologies
- Application of environmental indicators
- Circular economy

Track 2: Water Pollution Control

- Surface water, groundwater pollution & prevention
- Sustainable wastewater treatment, reuse and product recovery
- Emerging innovative wastewater technologies
- Emerging contaminant removal from wastewater
- Energy positive wastewater technologies
- Common effluent treatment and process modeling
- Up gradation of conventional sewage treatment plant
- Water pollution control using Non-thermal plasma

Track 3: Air Pollution Control

- Air pollution and control
- Emission sources
- Atmospheric modeling and numerical prediction
- Interaction between pollutants
- Carbon capture and storage
- Control technologies
- Indoor air pollution and prevention
- Air pollution control using Non-thermal plasma

Track 4: Solid Waste Management and Resource Utilization

- Waste Avoidance and Minimization
- Municipal solid waste management
- Plastic waste management
- E-waste management
- Hazardous waste management
- Material recovery from solid waste
- Recycling and upcycling

We hope that this publication will provide the reader a broad overview of the latest pollution prevention practices, and that it will be a valuable reference source for further research. We would like to express our sincere appreciations and thanks to all the authors for their contributions to this publication. We would like to express our gratitude and appreciation for all of the reviewers for their constructive comments on the papers. We would also like to extend our thanks to the members of the organizing team for their hard work.

And we are looking forward to further cooperation and future meetings at Indian Institute of technology Bhubaneswar.

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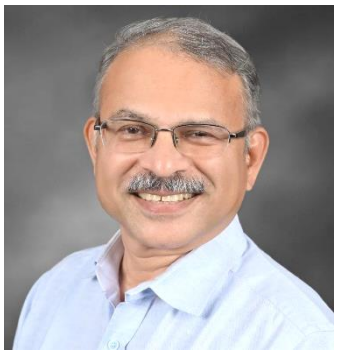
MESSAGE FROM CHIEF PATRON ICPCCE 2023



Prof. Shreepad Karmalkar
Director, Indian Institute of Technology Bhubaneswar

यत् ते भूमे विश्वनामी क्षिप्रं तदापि रोहतु
मा ते मर्म विमरुगवरी मा ते ह्रुदयमर्पिपम्

This verse from Atharva Veda implies: "Oh! Mother earth, when I dig out substances from your body, let your wounds heal quickly. Let me never hurt the essence of your vitality and turn you barren." I am glad to note that Indian Institute of Technology (IIT) Bhubaneswar and its members are highly committed towards protecting the natural environment while developing infrastructure to convert this place into a hub of education and intellect. It is heartening to learn that taking a step further, the School of Infrastructure and School of Electrical Sciences of the Institute are jointly organizing the first International Conference on Pollution Control for Clean Environment (ICPCCE-2023). I believe the conference will address the issue of environmental pollution, with deliberations on the development of advanced technologies, evolution of new management practices, and innovative ways to have a clean and green environment. ICPCCE-2023 provides a platform for the Scientists, Engineers, and Professionals to share their knowledge and experience.

I would like to congratulate and convey my sincere appreciation to the Conveners and the organizers for their initiative and efforts in organizing the conference. On behalf of IIT Bhubaneswar, I would also like to welcome the keynote speakers and participants. I wish ICPCCE-2023 all the success.

MESSAGE FROM PATRONS ICPCCE 2023

Prof. Sujit Roy
Dean Continuing Education
Indian Institute of Technology Bhubaneswar

I am very much delighted to learn that the School of Infrastructure and School of Electrical Sciences of the Indian Institute of Technology Bhubaneswar are jointly organizing first International Conference on Pollution Control for Clean Environment (ICPCCE-2023) during 15-16 December 2023. I must congratulate the Conveners, Dr. Rajesh, Dr. Sankarshan and Dr. Manaswini for organizing the conference. Environmental Pollution has been a global concern. There are many persistent issues, which need to be addressed for control of rising levels of pollution. I am sure deliberations on these issues will definitely evolve some tangible solutions, which can be directly beneficial at the local and global context. I am glad to know that the conference has received huge response in terms of paper submission from the various parts of the globe.

I am aware that the organizing team, faculty, staff and students involved, are working hard for organizing the conference. The office of continuing education is always there to support for smooth functioning of such events at institute. I would like to put on record my sincere appreciation to all the people, who are working hard with dedication for organizing the conference, and also the keynote speakers and participants for their interest in the conference. I wish the conference a grand success.

MESSAGE FROM PATRONS ICPCCE 2023

Prof. Sumanta Haldar
Head of the School of Infrastructure
Indian Institute of Technology Bhubaneswar

I am delighted to provide this message on behalf of the School of Infrastructure, Indian Institute of Technology Bhubaneswar, for the first International Conference on Pollution Control for Clean Environment (ICPCCE-2023), which the School of Infrastructure is organising in collaboration with the School of Electrical Sciences, IIT Bhubaneswar.

In the face of mounting environmental challenges, we must band together to combat pollution and protect the planet we call home. Pollution is a major threat to our environment because it affects the air we breathe, the water we drink, and the soil that supports life. This conference intends to address the crucial issues surrounding pollution control and its impact on creating a cleaner, healthier environment. Environmental sustainability is an extremely important matter, as we are all well aware of.

This is indeed an auspicious occasion to have so many distinguished and world-renowned personalities gathered together to deliver lectures on various topics of importance to various pollution control strategies. We are grateful to each and every one of the lecturers for accepting the invitations and visiting IIT Bhubaneswar on this occasion.

I extend my warm welcome to all the keynote speakers who have international experience and expertise in their subject. I believe the event will be an excellent learning opportunity and will be beneficial to all.

I wish the participants all success in the event.

MESSAGE FROM PATRONS ICPCCE 2023

Prof. S R Samantaray, FNAE
Head of the School of Electrical Sciences and OPTCL Chair Professor
Indian Institute of Technology Bhubaneswar

I am extremely happy that School of Electrical Sciences and School of Infrastructure are jointly organizing the 1st Edition of International Conference on Pollution Control for Clean Environment (**ICPCCE-2023**) during 15-16 December 2023 at IIT Bhubaneswar. The major focus of the conference includes various themes on the occurrence of different pollutants, emerging contaminants, micropollutants in water, wastewater, and aquatic environments including risk and impact assessment of pollutions.

The conference has four tracks including Environmental Monitoring and Management, Water Pollution Control, Air Pollution Control and Solid Waste Management and Resource Utilization. The outcome of the conference will be definitely ready reference for environmental engineers, practitioners and policymakers for building sustainable models for pollution control.

The conference is well received and designed to disseminate new knowledge on the latest trends in the above mentioned areas. I strongly believe that the participants will leverage maximum from the sessions and invited talks and, will be highly benefited by attending this conference.

I congratulate the team for organizing such a prestigious conference **ICPCCE-2023** and wishing the conference a grand success.

MESSAGE FROM CONVENERS ICPCCE 2023

Prof. Rajesh Roshan Dash
School of Infrastructure
IIT Bhubaneswar

Dr. Sankarsan Mohapatro
School of Electrical Sciences
IIT Bhubaneswar

Dr. Manaswini Behera
School of Infrastructure
IIT Bhubaneswar

It is our great pleasure to welcome you to IIT Bhubaneswar and to the first International Conference on Pollution Control for Clean Environment (**ICPCCE-2023**). The conference aims to provide opportunities for persons working in the field of Environmental Science and Engineering to share their research and practical experience as well as to exchange research ideas for finding solution to Environmental problems. The conference will be having eight keynote addresses and more than 135 technical presentations in 2 days with 24 parallel sessions, in both offline and online mode. The technical presentations will focus primarily on the four tracks i.e. Environmental Monitoring and Management, Water Pollution Control, Air Pollution Control, and Solid Waste Management and Resource Utilization. The sub-themes under each of the tracks are focusing on the recent research to the progress of knowledge and technology development to combat current emerging environmental problems that are of interest for researchers globally.

We take the opportunity to register our warm thanks to all the authors for their participation, keynote speakers for their valuable time. We would like to thank all the reviewers, technical and advisory committee members for their help and guidance, the organising committee members and student volunteers, who have generously given their time for organising the Conference, and the concerned institute functionaries, officers and staffs for their support. We are sincerely indebted to Director, IIT Bhubaneswar, Dean Continuing Education, Head of School of Infrastructure, and Head of School of Electrical Sciences, for their guidance and support. We extend our sincere thanks to **Springer** for publishing the conference book and sponsoring the best paper awards. We are grateful to all our sponsors; *SERB, India, M/s Merck Life Science Private Limited, M/s Surya Enterprises, M/s Bishandayal Ventures, M/s Ranjan Kumar Rout, M/s Centre for Envotech and Management Consultancy Pvt. Ltd., M/s SJ Environmental Solutions* and *M/s Das Scientific* for supporting the event.

This conference will lead us towards a sincere and participative action plan for various advanced systems and processes and to derive solutions for the present problems in pollution management in different environmental media. We are confident that the participants will have ample opportunities to benefit from the technical knowledge shared on this platform. We hope your participation and contribution to the conference will be valuable, fruitful and memorable. Wish you all have a good time at IIT Bhubaneswar.

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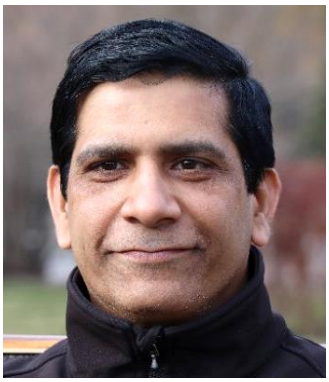
Keynote: 1



Circular Economy Approaches in Environmental Management to achieve UN SDGs

Prof. Brajesh Kumar Dubey
Department of Civil Engineering,
Indian Institute of Technology Kharagpur, West Bengal, India

Abstract

This keynote presentation aims to offer insights into how an approach centred on the circular economy (CE) in solid waste management (SWM) can contribute to achieving the targets outlined in the UN Sustainable Development Goals (UN-SDGs). The fundamental principles guiding the UN-SDGs, such as public health, environmental considerations, resource value,and economic development, align closely with the factors propelling the expansion of wastemanagement initiatives. Therefore, prioritizing a circular economy framework in the post-COVID economic agenda is crucial for meeting UN-SDG objectives. Nevertheless, challenges in policy, technology, and public engagement may impede the transition to the CE model. Addressing these hurdles could involve fostering niche growth through the development of distinct waste management-driven green jobs, formalizing the role of informal waste pickers, and focusing on education and training for informal workers. The presentation will underscore the importance of creating green jobs by investing in recycling infrastructure to tackle climate change concerns, a key focus of the UN-SDGs. CE-based product designs and business models will promote multifunctional goods, prolonging product and component lifespans, and intelligent manufacturing to enable both public and private sectors to maximize product utility, thereby reducing waste generation and offering long-term economic and environmental advantages. The study also advocates for robust policies that prioritize investments in decentralizing solid waste systems, localizing supply chains, promoting recycling and green recovery, facilitating information sharing, and fostering international collaboration to effectively realize the UN-SDGs.

Keynote: 2

Exploring Biological and Bio-Electrochemical Technologies for Imparting Sustainability to Wastewater Treatment

Prof. Makarand M. Ghangrekar
Department of Civil Engineering,
Indian Institute of Technology Kharagpur, West Bengal, India

Abstract

Growing scarcity of fresh water reserves and ever-increasing demand for water have led to a condition where the option of reuse of treated wastewater need to be encouraged. Innovative wastewater treatment plants aiming not only at treating the wastewater, but also providing benefits, such as facilitating reuse of treated water, resources or nutrient recovery, are the need of the day. Conventional sewage treatment either require huge land or high capital, maintenance and operational costs, and/or huge energy requirements; which make them unsuitable for use in developing countries. Energy efficient low-cost wastewater treatment systems are the best choice for such countries. Anaerobic treatment systems excel in such respect. A pilot-scale (400 m^3/day) up-flow anaerobic sludge blanket-moving bed biofilm (UASB-MBB) reactor followed by a high-rate algal pond (HRAP) was designed, constructed and operated to remove organic matter, nutrients and pathogens from low strength sewage (chemical oxygen demand, COD, of about 230 mg/L) generated on campus. This UASB reactor demonstrated annual average total COD removal efficiency of 63 ± 8% and total suspended solids (TSS) removal of 86 ± 7%. The HRAP following UASB reactor demonstrated nitrogen removal of 85 ± 3%, phosphate removal of 91 ± 1% and up to 3 log coliform reduction, thus producing treated effluent suitable for horticulture reuse. Biomass granulation has been achieved in the UASB reactor, which has not been reported earlier anywhere while treating such low strength sewage, which was possible due to proper hydrodynamic design. Also, life cycle costing of the installed 300 m^3/day and 1350 m^3/day sewage treatment plants comprising of moving bed biofilm reactor and tertiary treatment combinations will be presented.

Keynote: 3

Recasting Air Quality Management in India

Prof. Mukesh Khare
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Abstract

Air pollution stands as a significant global challenge. Enhancing the quality of the air we breathe has become a paramount societal goal. Exposure to poor air quality remains a primary cause of respiratory and cardiovascular ailments among vulnerable communities. Urban areas are rapidly expanding in diverse ways, leading to concerning spikes in pollutant levels, particularly in swiftly urbanizing regions.

The Urban Air Quality Management (UAQM) framework outlines a series of measures aimed at achieving specific air quality objectives in defined geographical areas. This requires collaborative efforts from governmental bodies, businesses, industries, NGOs, and the public. However, executing action plans based on this framework faces obstacles due to insufficient coordination among administrative institutions within the existing air quality governance system.

Presently, air quality policies are crafted at the national level and then relayed to state-level departments for dissemination, eventually reaching state pollution control boards for implementation. However, this approach heavily favours the state pollution control boards and lacks integration with district or local bodies. The divide between national, state, and district/local authorities in terms of legal responsibilities, operational scale, monitoring, and enforcement hampers the effective implementation of air quality policies, resulting in heightened negative impacts on human health.

Revamping the air quality governance structure is crucial. It should prioritize managing sources at the lowest administrative levels, like municipalities, to efficiently target resources according to local conditions. Local authorities, armed with community insight through participatory approaches, should drive the shaping and execution of policies addressing pollutant exceedances. National- level policies should tackle broad issues such as vehicle fuel quality, engine technology, and combustion emissions, while empowering local authorities with the responsibility of implementing action plans to improve ambient air quality and continuously assess present and future air quality in their respective regions. Moreover, local authorities should designate Air Quality Management Areas (AQMA or hotspots) and devise action plans that complement national efforts.

Keynote: 4

Innovative Cover System for Zero Emissions at Landfills

Prof. Krishna R. Reddy

Civil, Materials, and Environmental Engineering, University of Illinois, Chicago, USA

Abstract

Fugitive methane (CH_4), carbon dioxide (CO_2) and hydrogen sulfide (H_2S) emissions from landfill surfaces that are not targeted by landfill gas (LFG) collection systems escape into the atmosphere and cause detrimental impacts on public health and the environment. Alternate cover systems such as biocovers have emerged as a low-cost alternative to mitigate these fugitive emissions. Biochar, a highly porous material derived from gasification of biomass such as waste wood, has shown to be an effective biocover material that enhances microbial oxidation of CH_4 to CO_2 thereby mitigating the CH4 emissions to the atmosphere. However, the problem of LFG emissions still remains unsolved due to the impending emissions of CO_2 and H_2S into the atmosphere. Steel slag, a byproduct from steel making industries, has shown promising potential to mineralize CO_2 to stable carbonates and H_2S to stable sulfides due to its high alkalinity and chemical composition. We are developing a cover system (called biogeochemical cover system) with an aim to achieve zero emissions from landfills by using steel slag in combination with biochar to mitigate the CH_4, CO_2 and H_2S emissions at landfills. Moreover, such a cover system provides a commercial outlet for discarded steel slag fines, which currently have no established beneficial use. In this presentation, our research studies aimed to elucidate biogeochemical reactions associated with biochar and steel slag and to design an optimal biogeochemical cover system to achieve zero emissions from landfills will be described.

Keynote: 5

The Future of Water Purification by Electrical Discharge Plasmas

Prof. Selma Mededovic Thagard

Dept. of Chemical Engineering, Clarkson University, USA

Abstract

The use of electrical discharge plasma for treating contaminated water has been studied for over three decades. During that time, dozens of different reactor configurations have been demonstrated for the degradation of phenols, dyes, pharmaceuticals, pesticides, and warfare agents, among other compounds. However, despite their ability to degrade and in some cases completely mineralize these compounds, very few bench-scale reactors have been upscaled to demonstration levels. One exception is the plasma-based treatment of poly- and perfluoroalkyl substances (PFAS), a notoriously toxic group of chemicals found in water of nearly 200 million. Americans, where the field-demonstrated process has been shown to be superior compared to existing electrically driven destructive techniques. This talk attempts to position the current state of research on plasma-based water treatment in relation to the general needs of the water treatment industry. This is achieved by tying the fundamental processes occurring at plasma-liquid interfaces to the plasma reactor design, and discussing the challenges and advantages of the heterogeneous nature of multiphase plasma systems. The most promising future directions of plasma-based water treatment are also discussed.

Keynote: 6

Sustainable Reuse of Wastewater for Irrigation

Prof. Daniel D. Snow
Nebraska Water Sciences Laboratory, University of Nebraska, Nebraska, USA

Abstract

Continued access to water of adequate quality is a fundamental tenet of the United Nations sustainabledevelopment goals. Irrigation is the largest single use of freshwater worldwide, yet except in areas of water scarcity, little progress has been made toward developing wastewater treatment technologies for irrigation. Discharge of municipal wastewater to streams continues to release traces of biologically active contaminants that impact use for aquatic organisms and human health. Irrigation with agricultural wastewater, while adding nutrients to crops also releases residues of veterinary pharmaceuticals and antibiotics with unknown implications for human and ecosystem health. While technologies exist for adequate treatment of municipal and agricultural wastewater to drinking water quality standards, it is quite expensive and unnecessary for irrigation uses. Demonstration of low-cost technologies supporting safe wastewater reuse for irrigation remains an elusive, but critically important constraint to achieve UN sustainable development goals.

Keynote: 7

Biogas Plants in India: Potential, Assessment, Challenges and Road ahead

Prof. Ajay S. Kalamadhad
Dept. of Civil Engineering,
Indian Institute of Technology Guwahati, India

Abstract

Conventional sources of energy like fossil fuels are available in limited quantities and harm environment. So, for sustainable growth, renewable energy is the only way forward. Biomass-based energy has untapped potential and is one of the most economical and best-proven options among the various alternative energy sources available. To fully utilize the biomass, the estimation of the possible potential is much needed. A state-wise biomass database is valuable for localized bioenergy policy. However, in India, a state- To fully utilize the biomass, the estimation of the possible potential is much needed. A state-wise biomass database is valuable for localized bioenergy policy. However, in India, a state-level biomass resource database is inadequate. State-wise potential of biogas from various of sources including crop residues, livestock and poultry wastes, municipal solid wastes, and wastewater (sewage and industrial) was assessed. The overall estimated biogas potential from organic waste in India is 74.795 billion m3 /year. Currently, digesters with a generation capacity of 3.635 billion m 3 /year are achieved in India. This indicates the massive gap between the potential and its utilization. Even though biogas plants are assumed to be environment friendly but biogas' emission through leaks and intentional release is regular with poorly maintained digesters, which questions the environmental benefits it might have. The significance of biogas as a cooking fuel, electricity fuel and bio-CNG was assessed. The findings indicate the biogas production can reduce 20% of GWP from India's household cooking. Furthermore, it also demonstrates that electricity and bio-CNG from biogas emits less carbon equivalent (GHGs) along its value chain than alternative fuel. However, there are barriers (both technical and non-technical) in disseminating large-size biogas plants. Hence, different mitigation strategy needs to be formulated for the successful adoption of a large- scale biogas plant in India. Successful implementation of biogas plants will propel the development of bioenergy generation, while simultaneously tackling the pressing issues related to the management of waste.

Keynote: 8

Quaternary Wastewater Treatment – Removal of POP and PFAS

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Abstract

The increasing global concern about persistent organic pollutants (POPs) and per- and polyfluoroalkyl substances (PFAS) in the environment has led to the development of advanced wastewater treatment technologies, which can be integrated to the conventional wastewater treatment processes as quaternary treatment. This paper provides an overview of the quaternary treatment processes specifically tailored for the removal of PFAS and POPs from wastewater. Focus is given to the challenges of analysing and removing PFAS from wastewater. This paper delves into the complexities and advancements in quaternary wastewater treatment. The definition of POP and PFAS with the focus on the analytical challenges associated with pollutant characteristics and analytical issues. It highlights the difficulty in detecting and quantifying these substances owing to their diverse chemical structures and the presence of unknown precursors and transformation products. Following the analysis discussion, the removal technologies for PFAS in quaternary wastewater treatment are discussed. It provides an in-depth review of various advanced treatment methods, including granular activated carbon (GAC) adsorption, ion exchange resins, and advanced oxidation processes (AOPs). Examples from full size installations and full-size plants and challenges with pilot plants erected in the frame of EMPEREST project will be discussed.

Paper ID: 3

Effect of Plastic Waste on UCS, CBR and Swelling Characteristics of Fly Ash Stabilized Clay Soil

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Abstract

High swelling clay soils cause a greater financial loss to property owners than earthquakes, floods, hurricanes, and tornadoes combined. These soils are always a challenge for civil and geotechnical engineers. Clay soils with montmorillonite mineral may be significant hazard to engineering constructions such as buildings, roads, canal linings etc., due to their ability to shirk or swell with change in the water content. Though numerous studies are carried out on swelling soils by various researchers, still in the light of utilization of plastic waste, a study is conducted in the laboratory to bring out the effect of plastic waste on Unconfined Compression Stress (UCS), California Bearing Ratio (CBR) and Swelling behavior of fly ash stabilized clay soil. Clay soil used in the present study possesses free swell index of 100%, liquid limit of 54% and % fine fraction (silt & clay) 68. The fly ash proportions used in the study are 0%, 2%, 4%, 6%, 8% and 10%. The plastic waste cut into smaller pieces was added to the fly ash stabilized clay in the proportions of 0%, 0.5% and 1% by dry weight of soil. From the results, it is found that the effect of plastic waste on UCS and CBR is not significant but, the free swell index has reduced from 100% to 30%.

Keywords: UCS, CBR, FSI, fly ash, plastic waste, clay

Paper ID: 5

Feasibility of Sewage Treatment Plant with changing influent characteristics and quantity

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Abstract

As urban population is increasing in Indian cities, the demand for wastewater treatment capacity is never met accordingly. Centre for Science and Environment (2016) report projected that 78% of urban India sewage is not treated. Jaipur city with present 4.1 million population has its first major Sewage Treatment Plant (STP) of 125 Million Liters per Day (MLD) at Delawas in the year 2006. Since commissioning, the gap between demand versus treatment capacity widened and situation went critical from 2019 onwards. Delawas STP was a perfect example of waste to energy, wastewater through gravity was coming from 25-kilometer area. The effluent characteristics were in concurrence with regulatory norms. With just a decade, STP failed technically. Increase in population with mushrooming of industries changed the influent characteristics and quantity. With design capacity of 125 MLD, STP was unable to handle untreated waste of the order of 160-190 MLD. Untreated waste was discharged to Dravyavati River without any treatment. This paper analyzed the technical and major issues regarding the failure of STP and upgrading it as per NGT (National Green Tribunal Norms). This includes failure of Activated Sludge Process (ASP), upgrading to SBR (Sequential Batch Reactor), issues of high volume of toxic raw sewage untreated and huge financial burden due to adherence to 2019 NGT norms.

Keywords: Delawas STP, National Green Tribunal, Population Growth, Toxic influent, Untreated effluent.

Paper ID: 11

The Influence of Groundwater Nitrate Contamination on Odisha State

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Abstract

Globally, nitrate pollution in groundwater is a major issue since it poses health concerns when taken in high concentrations, especially for young children and pregnant women. Industrial activity, poor waste disposal, and agricultural runoff are the main causes of nitrate pollution. Odisha has a high prevalence of nitrate contaminated groundwater as a result of a number of reasons, including the usage of fertilizers, wastewater discharges, and leachate from septic tanks. In the current study, the most seriously impacted districts in the state of Odisha as a result of excessive nitrate concentrations, their causes, and the exposure of at-risk people to nitrate risk were emphasized. The fluctuations in concentration and health risk caused by groundwater nitrate contamination can be seen through a correlative and geographical analysis using ArcGIS. The findings suggested that excessive nitrate pollution in Odisha state's N-W districts was a result of fertilizer application, which is common in the region. According to assessments of human health hazards, children between the ages of 0 and 6 have greater health risks than adults. It is obvious that developing and offering the state a better approach is necessary to stop additional nitrate polluting of the groundwater.

Keywords: Groundwater; nitrate contamination; health risk and management strategy.

Paper ID: 12

Pharmaceutical Pollution in Indian Waters: An Emerging Environmental Challenge

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Abstract

In recent years, a growing environmental concern has risen as pharmaceutical compounds are being detected in natural water bodies. This is mainly due to their direct disposal into the rivers or inadequate removal during wastewater treatment processes. While many developed nations have established guidelines for their monitoring, India lacks specific policies despite being one of the major pharmaceutical manufacturers and consumers. This review paper presents a comprehensive study of the numeral, spatial and temporal extent of these contaminants. It covers literature reported over the past two decades, which reveals a significant presence of antibiotics and NSAIDs, detected both in STPs and waterbodies in India. A notable diversity has been observed across all the states, with certain classes of drugs reported more frequently than others which could be due to a lack of comprehensive monitoring. Thus, the findings underscore the urgency for continuous monitoring and implementation of advanced biological treatment techniques. This will play a pivotal role in formulating guidelines that are intricately connected with sustainable development goals 3,9,12 and 14.

Keywords: Pharmaceutical Active Compounds (PhACs); emerging contaminants; micropollutants; water pollution.

Paper ID: 13

Geotechnical Characterization of Municipal Solid Waste in Raipur City

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Abstract

The design and maintenance of landfills is complicated by the heterogeneous nature of municipal solid waste (MSW), making its disposal on land has major problem. The shear strength parameters and physical properties of MSW govern landfill stability. These factors, such as cover liner, leachate, leachate collection system, and gas collection systems, are also crucial in interactions between the waste body and landfill structure within the landfill system. The Geotechnical characteristics of MSW are crucial for the design of the landfill and slope stability issues in the MSW analysis. This study presents the laboratory results of the geotechnical properties (moisture content, Grain size distribution, unit weight, Specific Gravity, Atterberg limits, Compaction, Triaxial, and Permeability) of MSW in Raipur City. Based on the experimental results, recommendations are made for the safe disposal of solid waste and its operation.

Keywords: Municipal Solid Waste; landfill; leachate; Physical characterization; Geotechnical properties of MSW

Paper ID: 15

Assessment of Physicochemical Characteristics and Groundwater Pollution Potential of Urban Landfill Leachate

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Abstract

This study examines leachate's physical and chemical characteristics from urban landfills and its ability to pollute groundwater sources. Improper waste separation practices create waste materials that decompose anaerobically and produce leachate. Leachate carries toxic elements that can pollute nearby natural water sources. The study examines the characteristics of the leachate using the leachate pollution index (LPI). However, the LPI is a powerful environmental tool for measuring pollutant concentration within the leachate and can detect the extent of pollution caused. Samples were collected from a landfill in Vilholi, Nashik (MH), India, during the pre-monsoon and post-monsoon seasons. Through SEM & EDAX analysis, the presence of heavy metals such as Lead, Zinc, Titanium, Cadmium, and Mercury were tested, and around 13 physicochemical parameters were measured for the analysis. The study summarizes the risk of groundwater contamination and suggests ways to prevent contamination in the landfill by studying the presence of heavy metals in the leachate. The analysis shows that the LPI range of the leachate sample is between 25-30, indicating that the sample is still under stabilization process and has a higher chance of sub-surface water pollution. The study recommends remedial measures to mitigate the impact of leachate percolation and dispersion.

Keywords: Municipal Landfill Leachate; Groundwater Pollution; Leachate Pollution Index.

Paper ID: 16

Effect of Seasonal Changes on Leachate Characteristics of Municipal Solid Waste Landfill

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Abstract

Landfills are responsible for leachate generation and contain a variety of pollutants, which can cause serious pollution of groundwater and other water sources. Variations in leachate characteristics are due to seasonal effects, which significantly affect leachate composition. However, prior knowledge of such parameters at different seasons can minimize the hazardous impacts and be suitable for a proper leachate treatment system. This study shows the effect of seasonal changes on physicochemical parameters and heavy metals of leachate generated by the Nashik City landfill. The results presented in the paper show the rainy season leachate characteristics were increased as compared to other seasons due to municipal solid waste mixing in rainwater and percolating into the ground. The research work would enable the installation of a more effective seasonal specific leachate management system by the concerned authorities and field practitioners at such landfills.

Keywords: Landfill leachate; Seasonal effects, leachate characteristics

Paper ID: 17

Congo Red Dye Removal from Aqueous Solution using Non-Thermal Plasma

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Abstract

Electrical discharge-based advanced oxidation processes were used with the gas bubbling technique in the presence of a catalyst for the efficient removal of dyes from aqueous solutions. The advantage of non-thermal plasma treatment over conventional treatment methods for the removal of pollutants is the mineralization of the pollutants into harmless byproducts. For the removal of Congo red dye, the effects of different factors like applied voltage, initial concentration of the dye, initial concentration of the catalyst, gas flow rate, and treatment time were looked at. In the presence of gas bubbling and a catalyst with non-thermal plasma, an 85% dye removal efficiency was observed at an applied voltage of 22 kV for a treatment time of 15 minutes.

Keywords: Non-thermal plasma; Dielectric barrier discharges; wastewater treatment; Advanced oxidation process; Degradation.

Paper ID: 18

Natural Luffa Fiber Composite: A Path to Sustainable Resource Deployment

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Abstract

Natural fibers provide numerous advantages like lightweight nature, affordability, robust mechanical properties, high strength-to-weight ratio, eco-friendliness, recyclability and so on. These attributes have propelled the utilization of natural fibers in composite materials to the forefront of industrial innovation, primarily because of their potential to drive sustainability initiatives and minimize carbon footprints. Among these, Luffa cylindrica, commonly known as the natural sponge or luffa gourd stands out as a promising candidate to supplant synthetic fibers in composite materials facilitating sustainable resource deployment. The raw luffa fibers were alkalized and converted into short fibers that were used for making luffa fiber layers. Hand layup technique was used for fabrication of single-layer (1L), double-layer (2L), and quadruple-layer (4L) short luffa fiber epoxy composites. The effect of the fiber layer weight percentage on the tensile, flexural and inter-laminar fracture (Mode II) of the composites was analyzed in universal testing machine maintaining the ASTM standards. The mechanical and thermal properties of a high weight percentage fiber composite appeared to be superior to those of a low weight percentage fiber composite. Tensile strength (26.92 MPa), flexural strength (35.24 MPa) and inter-laminar fracture energy (807.62 J/m^2) are all high for the 4L luffa/epoxy composite. The thermal analyses of composites were conducted using thermogravimetric analysis (TGA) and it was observed that addition of more fiber-layers increases the activation energy and thermal stability of the composite. The 4L luffa composite has found to have highest activation energy about 97.06 kJ/mol and thermal stability about 455 °C than the other two. The significance of the current work reveals that this fiber composite may have high applications in various technical fields.

Keywords: Luffa fiber, Mechanical properties, Thermal properties, Inter-laminar fracture, Hand layup

Paper ID: 20

Development of 3-D Surface Cost Response Maps to Forecast Rapid Cost for Biological Treatment of Wastewater by Moving Bed Biofilm Reactor

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Abstract

Moving Bed Biofilm Reactor (MBBR) is employed for economical municipal and industrial effluent treatment. However selection of the treatment technology should have a techno-commercial rationale so that the effective cost for sustainable implementation encapsulates economic and fiscal aspects. The objective of this paper is to highlight the study made to work out the profile of variation of cost of WWTP with MBBR for different input BOD at varied flow rates and development of 3-D surface cost response maps based on generated data sets to provide instant information on cost of WWTP with MBBR. These 3-D maps are extracted from software by use of the data obtained as output from a model developed for system design, determination of bill of quantities and cost. No literature cost data has been used in this context. These 3-D maps developed for WWTPs with MBBR technology may be used to forecast costs for construction, operation and maintenance for twenty five years. This will provide stakeholders reliable and rapid cost information for WWTP with MBBR technology and enable them for comparison with other alternatives for a prudent selection of technology, particularly for decision makers.

Keywords: BOD, Cost Function; MBBR; WWTP; 3-D Surface Cost Response Maps.

Paper ID: 21

Removal of Heavy Metals from Sewage Sludge by using Zeolite Socony Mobil-5

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Abstract

Sewage sludge contains a sizable amount of organic matter and nutrients that can be beneficially used for crop growth, but the primary technical challenge associated with land application of sludge pertains to the elevated levels of heavy metal (HM) concentrations. This research paper underlines the importance of resolving this significant environmental and health threat by investigating the potential of synthetic zeolites as a sorbent for their removal or immobilization. Adsorption, specifically with the use of a synthetic Zeolite Socony Mobil-5 (ZSM-5) was identified as costeffective and environmentally friendly. The study focuses on the removal of Cu, Cr, and Mn, which showed maximum removal efficiencies of 21.1%, 30.8%, and 54.4% respectively. The findings suggest that kinetic adsorption occurs in two stages - rapid sorption at the early stages and slower sorption thereafter, best described by the pseudo-second-order kinetic model. For any given ratio ofamendment of sewage sludge with ZSM-5, the adsorption amenability in terms of percentage reduction for different HMs was found to follow the order: Mn>Cr>Cu. This study is a step towards developing an effective solution for mitigating hazardous impact of sewage sludge disposal from wastewater treatment plants and utilization for agricultural purposes.

Keywords: Adsorption; Extraction; Heavy Metals; Sewage Sludge; Synthetic Zeolite

Paper ID: 22

Potential of Cement Kiln Dust as Alternative Material to BOF Slag in Biogeochemical Cover for Carbon Dioxide Sequestration

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Abstract

Municipal solid waste (MSW) decomposition in landfills generates landfill gas (LFG) emissions, primarily methane (CH_4) and carbon dioxide (CO_2), accompanied by trace amount of hydrogen sulfide (H_2S) and other non-methanogenic organic compounds. Despite using gas collection systems and conventional soil covers in MSW landfills, fugitive CH_4 and CO_2 emissions persist. In this regard, researchers from University of Illinois Chicago (UIC) developed a biogeochemical cover (BGCC) to mitigate CH_4, CO_2, and H_2S emissions. It consists of biochar-amended soil as the biocover layer for microbial oxidation of CH_4 and basic oxygen furnace (BOF) slag as the drainage layer for CO_2 and H_2S removal through carbonation and sulfidation. However, implementation of BGCC cover on large scale may face challenges due to limited availability of BOF slag near landfills. Therefore, there is a need to identify alternative materials that can replace BOF slag in BGCC cover while maintaining comparable carbonation capacity. Cement kiln dust (CKD), a byproduct of cement industry, can be a potential alternative to BOF slag, owing to its high calcium content. Hence, a series of batch experiments were conducted with CKD under typical ambient conditions, with varying moisture content levels. The selected moisture content levels for the batch experiments for CKD were 10%, 20%, 30%, and 40%, all of which were below the water holding capacity of CKD (62.3%). Additionally, batch experiments with BOF slag were also conducted at 10 and 20% moisture content under same ambient conditions for comparison purpose. The experimental results showed that the highest short-term (24-hour) and long-term (ultimate) CO2 removal capacities were achieved at 30% moisture content, measuring 171.2 mg/g and 225.1 mg/g of CO2, respectively. Notably, the ultimate carbonation capacity of CKD at 30% moisture content surpassed that of BOF slag, which achieved its highest capacity at 20% moisture content, by a factor of 2.25.

Keywords: Landfills; Greenhouse Gas; Biogeochemical Cover; Carbon Dioxide Sequestration; Carbonation**.**

Paper ID: 23

Removal of Congo Red from Synthetic Wastewater by Ridge Gourd Fiber as Adsorbent

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Abstract

Congo red (CR), which has a complex molecular structure with various diazo aromatic groups, is widely used in textile industry as an anionic dye. Several effective techniques have been used to remove dyes from wastewaters. Among those, adsorption is considered as one of the most effective and reliable methods as it is economical, highly efficient and easy to operate. In the present study, the removal of CR from synthetic wastewater was studied using ridge gourd fiber as an adsorbent in a batch mode process. The influence of various operating parameters such as pollutant concentration, adsorbent dose, contact time, pH, and temperature on the decolorization efficiency of CR were investigated through the experimental studies. The study found that there was a decrease in colour removal efficiency as the pollutant concentration increased. The maximum colour removal efficiency, i.e. ~80% was achieved at a pollutant concentration of 10 mg/L, adsorbent dose of 25 g/L, with a contact time of 45 minutes in acidic condition. The decolorization efficiency was higher in the acidic pH range.

Keywords: Congo Red; Ridge Gourd Fiber; Decolorization; Adsorption

Paper ID: 25

A Statistical Analysis of PM2.5 Pollutant in Different Areas of Gandhinagar and Ahmedabad, Gujarat, India: Trends, Violations, and Seasonal Variations

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Abstract

This study aims to employ descriptive statistics to compare the behaviour of PM2.5 in three diverse areas of Gujarat, India: Sector 10 (Gandhinagar), Maninagar, and Vatva (Ahmedabad) which are less populated with green space, highly populated and industrial zone respectively. Additionally, an examination of seasonal fluctuations in these specific areas was conducted through the use of charts and inferential statistical analyses. The findings indicate that there were frequent instances of non-compliance with the National Ambient Air Quality Standards (NAAQS) recommendations in the areas of Maninagar and Vatva. Furthermore, it was noted that there were significantly elevated levels of PM2.5, particularly during the winter season in comparison to the other seasons.

Keywords: PM2.5; statistical analysis; seasonal variation

Paper ID: 26

Optimization of Biogas Production through Anaerobic Co-digestion of Food Wastes and Chicken Manure: A Kinetic Study and Economic Analysis

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Abstract

The current trend encourages waste to energy drive technology, specifically anaerobic digestion (AD), is pivotal for sustainable energy by converting organic-rich waste compounds into clean biogas. In our previous work, we did research on different types of samples from biomass and agro wastes to generate biogas in a limited amount. This paper investigates strategies to boost AD efficiency, emphasizing enhanced biodegradability and methane potential via co-digestion of selective combination of substrates. A study on the biogas production by possible selection of wastes and its blend with chicken manure (CM) was examined. The two alternatives were charged into 1cubic meter capacity based HDPE sample bio-digesters in the ratio of 1:1 of water to waste. They were subjected to anaerobic digestion under a retention time (35-45 days) and mesophilic condition (26°C- 43°C). The Chemical-physical characterization of the wastes was resolute with bacterial analysis. This study also investigates the anaerobic co-digestion (co-AD) of food wastes (FW) and chickens manure (CM) with Napier grass, focusing on biogas production, methane yield, and kinetics. Different FW and CM concentrations were tested, with biogas methane composition analyzed every 15 days using gas Analysis method with a thermal conduction sensor (TCD). A notable result was the 70% FW and 30% CM mixture yielding the highest biogas generation of 68% and methane yield 82%, with a 17.52% increase in methane purity compared to normal FW. Further FW and CM concentration increases limited impact. The study used the modified Gompertz models with high R2 values (0.947–0.999), low RMSE (0.08–0.61), and minimal forecast errors (<10.00%). The adapted Gompertz model exhibited a lag phase between 10 to 28 days.

Keywords: Anaerobic co-digestion; food wastes; chicken manure; methane; kinetic modeling

Paper ID: 27

Exploring the Variations of Ozone Pollution and Influencing Factors Along NH-16 in Kharagpur, West Bengal, India

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Abstract

The present study is aimed to assess the ground-level ozone (O_3) at an open-traffic site on National Highway 16 (NH-16) in Kharagpur, West Bengal, India. O_3 concentration was measured using the Serinus 10 ozone analyzer, an instrument approved by the USEPA. Manual traffic count was made. Local meteorological information was obtained using a portable weather meter. Results reveal that elevated traffic levels during the morning and evening periods were associated with lower O_3 levels, while the opposite trend was observed at noon. A good positive correlation (r^2 = +0.84) was obtained between temperature and O_3 levels, while a negative correlation (r^2 = -0.87) was observed between traffic count and O_3 concentrations. Furthermore, relative humidity emerged as the significant meteorological factor influencing diurnal variations in O_3 levels. These findings underscore the need for future research initiatives and the development of policies addressing O_3 pollution.

Keywords: Ozone; Correlation; Emissions; Traffic; Meteorology

Paper ID: 28

Application of Artificial Intelligence for Predicting Landfill Gas Generation and Settlement: A Review

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Abstract

Municipal solid waste landfills, which are complex engineering systems, are influenced by coupled mechanical, hydraulic, biochemical, and thermal processes that occur in the waste mass. Current landfill modeling, to understand these intricacies, often relies on simplified numerical or empirical approaches, which can lack generalization or fail to account for all relevant processes. The advancement of artificial intelligence (AI), machine learning (ML), and deep learning (DL) technologies is providing new opportunities to comprehend intricate data sets. These methods have shown promise in various environmental fields, employing data-driven ML/DL models and AI based optimization techniques to simulate complex processes and predict performance. The potential for the use of the same in simulating landfill processes and predicting landfill performance indicators, like gas generation and settlement, is immense. Hence, the aim of current study is to perform a comprehensive literature review outlining past research efforts integrating AI/ML/DL techniques in predicting landfill gas generation and settlement. First, a brief introduction to various evolving AI based techniques is provided followed by a comprehensive literature review of applications to landfills. Overall, the use of these technologies in landfill modeling is still in early stages with numerous studies focusing solely on predicting landfill gas generation rates and/or landfill gas compositions. Few studies have also utilized ML-based models to predict settlement based on field-observed data. Recently, complex coupled models have been developed to accurately model landfills; however, these models are computationally intense. Hence, integrating AI based models to surrogate such complex numerical models will be very useful to optimize landfill design and operations.

Paper ID: 29

CFD Simulation of Airflow and Pollutant Dispersion in Long Street Canyons

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Abstract

This paper employs computational fluid dynamics (CFD) simulations, validated by experimental data, to examine the impact of building configurations on urban airflow and the dispersion of vehicular CO emissions from a ground-level source. The study focuses on two-dimensional (2D) symmetric, step-up and step-down canyons characterized by different building height ratios (BHR) which may be defined as the ratio of height of the downwind building to that of an upwind building (BHR = 1, 0.5, and 2). The findings suggest that the step-down configuration leads to more adverse wind conditions and poorer dispersion of pollutants compared to symmetric and step-up configurations. Furthermore, concentrations tend to be elevated on the leeward side of the wall in the case of step-up and symmetric canyons, whereas the results show the opposite trend for step-down canyons. The findings mentioned above are valuable in comprehending how building configurations can impact both the wind environment and the level of pollutant exposure risk for pedestrians and residents living near roads.

Keywords: CFD; Street Canyon; RANS; Dispersion

Paper ID: 33

Assessment of Urban Water Bodies Health Using Water Quality and Ocular Surveys in Sambalpur, Odisha

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Abstract

This research paper presents a comprehensive study on the health assessment of urban water bodies in Sambalpur, Odisha, aligning with the overarching theme of the "Detection of emerging contaminants, and micropollutants in different environmental media". The study combines water quality analysis and ocular surveys to evaluate the current state of these vital water resources.

Sambalpur, like many urban areas, faces growing challenges related to water quality and pollution in its water bodies. To address these issues, our research collected extensive data on the water quality of various urban water bodies, encompassing parameters such as pH, dissolved oxygen, turbidity, and contaminant levels. This data provided insights into baseline water quality conditions and potential sources of pollution. In addition to water quality data, we conducted ocular surveys of these water bodies to create a Water Body Health Score Card. This innovative tool allowed us to assess the overall health and condition of each water body based on visual observations, including factors such as litter accumulation, aquatic biodiversity, and the presence of algae and other indicators of water body health. Finally, the research includes case studies showcasing recently developed strategies for pollutant removal from various environmental media, with a focus on practical field implementation. These case studies offer valuable insights for environmental engineers, policymakers, industrial engineers, and researchers, contributing to the conference's objective of disseminating knowledge and facilitating collaboration among stakeholders.

This research paper provides a holistic assessment of urban water body health in Sambalpur, Odisha, aligning with the ICPCCE-2023 theme. By combining water quality analysis and ocular surveys, we offer insights into pollution control, sustainable practices, and innovative strategies for preserving these critical environmental resources.

Paper ID: 34

Assessing the Impact of Floods and Storms on Water Sources

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Abstract

In recent decades, there has been a notable increase in the frequency of natural disasters, with water emerging as the pivotal force driving nearly 90% of these catastrophic events. India, in particular, has grappled with 384 natural disasters between 2000 and 2022, impacting a staggering 1.1 billion individuals. Among these calamities, floods and storms have reigned as the most prevalent disasters for 23 consecutive years, affecting over 412 million people. These crises have inflicted significant human and property losses, often leaving affected populations without shelter or essential resources for survival. This study delves into the repercussions of various natural disasters, including floods and storms, on the water quality of sources. Through a comprehensive examination of existing literature, we seek to elucidate the diverse scenarios that arise from these disasters. By understanding the multifaceted impacts, we aim to identify effective mitigation measures and foster the development of technologies that can offer valuable support in these critical situations.

Keywords: Floods; Storms; Water Quality; Disaster Impacts; Mitigation Measures

Paper ID: 35

Extended Producer Responsibility for Plastic Waste Management in Developing Countries - An Indian Context

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Abstract

Rapid urbanization and industrialization in developing countries drive a significant surge in municipal solid waste (MSW), with plastic waste emerging as a major contributor due to its widespread usage. In India, plastic waste is escalating at an alarming 16% annual rate, potentially doubling by 2050. India's plastic waste management (PWM) policies are currently inefficient and undergoing transition. India has recently introduced extended producer responsibility (EPR) as a PWM policy tool, aiming to make producers, importers, and brand owners (PIBOs) accountable for managing their products' end-of-life. Effective EPR implementation is crucial for fostering plastic waste recycling and transitioning toward a circular economy for sustainable development. This article explores the evolution, development, and challenges associated with EPR implementation in developing nations, particularly India and suggests potential solutions. Persistent challenges include inadequate data, limited transparency, high transportation costs, remote waste collection deficiencies, and insufficient plastic waste management infrastructure. To address these issues, recommendations encompass focusing on remote areas, integrating the informal sector, enhancing waste collection, and adopting technology to improve data availability and transparency. These actions not only tackle environmental concerns but also create jobs and reduce health risks, offering valuable guidance to decision-makers and authorities for enhancing plastic waste management by identifying EPR gaps and suggesting effective implementation strategies.

Keywords: Rapid Urbanization; Plastic waste management; Extended Producer Responsibility; Circular Economy; Sustainable development

Paper ID: 36

Review of Decentralized Wastewater Treatment Technologies and Systems

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Abstract

Nowadays, large volumes of wastewater is being generated from the cities and travels very long distances from their point of generation to the Conventional Centralized Wastewater Treatment Plants (WWTPs), which in turn results in various operational troubles. Also, the WTPs are sometimes unable to handle the large volumes of wastewater generated from the cities, as a result waste is discharged either with partial treatment or even with no treatment, which causes pollution of land or water bodies. So now a days it is being proposed that residential/commercial/industrial areas have to treat their waste prior to discharge. So, in view of this, on-spot, safe and complete treatment of wastewater is needed for the places of sewage generation, the typical examples include slums, labor camps, the army in transit, fairs and exhibitions, holiday homes, industries, resorts, etc. Specific treatment units must be designed for specific needs as well as the option of recycling or using the treated water. A Decentralized Wastewater Treatment Plant (DWTP) may be the need of the hour which can be deployed anywhere in need particularly where a conventional WTP is not there or is not working or does not function properly or where freshwater is scarcely available so that the effluent can be reused for various non-potable uses. The present paper reviews the various DWTP systems along with typical technologies being adopted in these systems.

Keywords: Centralized wastewater Treatment plant; Decentralized Wastewater Treatment Systems; Effluent; Freshwater; Reuse.

Paper ID: 38

Assessment of exposure to Fine Particulate Matter, Specifically Silica, in a Stone Crushing unit: A case study at Neem Ka Thana District, Rajasthan

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Abstract

This study is part of a comprehensive study investigating the prevalence and quantification of Silicosis in Rajasthan. It documents a thorough assessment of fine particulate matter, primarily Silica, within a stone-crushing unit. PM1 accounts for 46% of PM2.5 emissions and 88% of particles have aerodynamic diameter between 5µm -10µm. The presence of respirable crystalline silica in ambient air ranges from 64% to 48%, as obtained from Fourier-transform infrared spectroscopy (FTIR) and X-Ray diffraction analysis (XRD) analysis. Spirometry tests on 28 workers provide vital health information, with 13 persons (46%) having Forced vital capacity (FVC) values less than 80% of the predicted value, indicating probable obstructive lung diseases. Furthermore, 62% of subjects have lung ages that exceed anticipated values, indicating the presence of respiratory problems.

Keywords: Stone crushing; PM2.5; Respirable silica; Dust; Silicosis

Paper ID: 39

Economical Solutions to Revitalize Rivers: A Review on In-Situ Drain Treatment Technologies

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Abstract

The global issue of wastewater management has arisen due to the generation of vast quantities of wastewater that are proving difficult to handle, resulting from the increasing population, mainly due to unsustainable water consumption. In India, a significant portion of its populace resides in rural regions, where the absence of adequate sewerage systems compounds this issue. In-situ drain treatment technologies play a pivotal role in addressing the pressing global challenges of water pollution. These innovative methods represent a paradigm shift in wastewater management, offering sustainable and economical solutions that minimize environmental impact and maximize resource recovery. At its core, in-situ drain treatment refers to the purification and management of wastewater at or near its source of generation rather than relying on conventional centralized treatment facilities. This decentralized approach not only reduces the burden on overloaded municipal systems but also minimizes the energy and infrastructure required for the long-distance transportation of wastewater. One key feature of in-situ technologies is their adaptability to diverse settings, from urban areas to remote rural locations. These technologies, when modified to account for local circumstances, effectively remove contaminants, including pathogens and pollutants, from wastewater, rendering it safe for disposal or even reuse in non-potable applications like irrigation. They encompass a range of solutions, such as constructed wetlands, septic systems, and advanced on-site treatment units that employ cutting-edge techniques like membrane filtration and bioremediation. Furthermore, in-situ drain treatment systems allow the extraction of valuable materials such as nutrients and organic matter. This not only reduces the environmental footprint of wastewater disposal but also contributes to a circular economy by repurposing these resources in agriculture or energy production.

Keywords: In-situ, sewage, drain, treatment.

Paper ID: 40

MOS Based Sensor Technology for Monitoring and Controlling of Gaseous Pollutants

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Abstract

One of the leading contributors to the global environmental burden is air pollution. Air pollution is the major concern as it contaminates atmospheric air by toxic gasses which are hazardous to human health, materials, vegetation and environment. The major air pollutants are oxides of nitrogen, oxides of sulphur, oxides of carbon, hydrocarbons etc., from Industries, automobiles and naturally occurring phenomena such as volcanic eruption, forest fire etc. It is observed that treatment of these harmful gasses from vehicular/Industry exhaust is possible by various pre and post combustion techniques. One of the post combustion techniques is using electrical discharges (Non-Thermal Plasma/NTP) has shown promising results in the laboratory. NTP method is oxidizing in nature hence converting the lower oxides of nitrogen (NO & NO_2) to higher oxides of nitrogen (N_2O_4 & N_2O_5). In order to provide the ideal solution, detection and monitoring of these oxides of nitrogen has become contented lately. Therefore, the current work is intended to design a cost-efficient, fast response, compact and effective gaseous sensor to detect the higher oxides of nitrogen majorly. The sensitivity of the targeted gaseous pollutant on the sensor was analysed using COMSOL Multiphysics 6.1 by performing the modal analysis by varying the Eigen frequencies which influenced the pressure, velocity and temperature of the gas sensor model created.

Keywords: Air Pollution; Nitrogen Dioxide (NO_2); Tin Oxide (SnO_2); Dinitrogen Tetroxide (N_2O_4); Dinitrogen Pentoxide (N_2O_5)

Paper ID: 41

FeLLU: Federated Learning-based LSU Model for Smart Cities Air Quality Forecasting

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Abstract

The proliferation of the Internet of Things (IoT) has garnered widespread attention due to its versatile applications across manufacturing, commerce, and education industries. Within urban contexts, IoT plays a pivotal role in transforming cities into "smart cities" by offering many applications and services. Nevertheless, these innovative urban solutions carry a significant environmental challenge: air pollution. In this context, the utilization of Deep Learning (DL) and Federated Learning (FL) techniques presents a solution for addressing forecasting challenges, particularly in scenarios involving volatile patterns of air contaminants (ACs) within vast and diverse datasets. The synergy of DL and FL has inspired us to harness the power of DL-based Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU) models. These models form the foundation of our novel approach: Long Short-Term Gated Recurrent Unit (LSU). We employ the LSU method for accurate predictions of future air quality, while FL facilitates our model's secure, decentralized, and distributed training. This study aims to achieve exact future air quality predictions by employing this innovative approach. To gauge the efficacy of the FeLLU framework, we conduct a comparative analysis against other machine learning models, utilizing a range of evaluation metrics.

Keywords: Weather Research (WR); FL; LSTM; GRU; IoT; SVR; Smart City (SC); ACs.

Paper ID: 42

Sustainable Strategies for Climate Change, Energy Demands, and Waste Management

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Abstract

The increasing global population has raised significant concerns regarding the environmental and climate impacts of food waste, and agricultural/forest residues. However, these waste materials hold great potential for generating renewable fuels to meet our growing energy demands. Various methods, including anaerobic digestion (AD), landfilling, composting and pyrolysis have been employed to address these waste challenges. Furthermore, India generates about 288 Mt of agricultural residue and 117 Mt of food waste respectively. Which indicates that these wastes have huge potential to produce renewable fuel to meet the energy needs of the country. This paper explores a comprehensive techno-environmental analysis of the integration of (AD) and pyrolysis as a synergistic approach for the treatment of agricultural residues and food waste. The bio-oil and syngas produced from pyrolysis will undergo reforming and conversion into biomethane within the AD process. The biochar from pyrolysis will be added to the digester to enhance microbial stability and system robustness. This also supports carbon capture and storage in the soil, contributing to overall environmental sustainability.

Keywords: Food waste; pyrolysis; bio-oil, syngas; bioeconomy.

Paper ID: 43

Nanosecond Pulse Energized Plasma with Novel Groundnut and Pine Waste for NOx Curtailment in Diesel Engine Exhaust

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Abstract

This research focuses on agricultural waste products being formulated as organic adsorbents and used in conjunction with nanosecond pulsed plasma for NOx removal. The focus here is on laboratory studies on diesel engine exhaust treatment. Three different types of wastes from the groundnut and the pine nut industries were analysed and tested as adsorbents at the laboratory level. Without plasma, very little NOx removal was observed, but in conjunction with plasma, a removal efficiency of above 60% was found for groundnut husk pellets and pinecone pellets. Another formulation of groundnut waste, the groundnut husk ash had a higher NOx removal efficiency of 87% in conjunction with plasma. These wastes are being explored for NOx adsorption characteristics for the first time. The obtained results indicate that the utilization of easily decomposable organic wastes which are cheaply available, can be a viable option for industries who want to control NOx emissions.

Keywords: nanosecond pulsed plasma

Paper ID: 44

Performance Evaluation of Semi-Dry Flue Gas Desulfurization in Pulverized-Coal Fired Boiler

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Abstract

Flue gas desulfurization (FGD) technologies play a critical role in the reduction of oxides of sulfur (SOx) emissions from coal-fired power plants, a significant source of air pollution and acid rain. Semi-dry flue gas desulfurization (SD-FGD) technology, has garnered attention due to its effectiveness and versatility. This research paper presents a comprehensive performance evaluation of SD-FGD technology when applied to pulverized coal fired boilers. This research paper provides an in-depth analysis of the application and performance evaluation of SD-FGD technology in pulverized coal fired boilers (PFB) using Novel Integrated Desulfurization (NID), including its principles, mechanisms, operational considerations, and environmental benefits, and, this study aims to provide valuable insights into the effectiveness of SD-FGD in emissions control for coal-fired power generation.

Keywords: Semi-dry flue gas desulfurization, flue gas desulfurization, pulverized coal-fired boiler, novel integrated desulfurization.

Paper ID: 45

Parameters Influencing the Performance of a Municipal Solid Waste Incineration System: A Comprehensive Analysis in Indian Context

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Abstract

Rising population and associated waste generation combined with limited land availability for waste management has made it essential to explore sustainable techniques for municipal solid waste (MSW) management. One of the many techniques for managing MSW in many economies is incineration, which in addition to waste destruction, also utilizes waste as fuel to recover energy. However, it is very important to identify the parameters affecting the performance of a solid waste incineration system as it can help us to possibly optimize the incineration process, in terms of efficient waste destruction with energy recovery and minimization of environmental and economical impacts. This study aims to identify and comprehensively analyze the factors that affect the performance of a MSW incineration system, and to understand their implications on framing sustainable waste management strategies.

Keywords: Solid waste management; incineration; sustainability; municipal solid waste; incinerator performance.

Paper ID: 47

Sustainable Recycled Aggregate Concrete using GGBFS as Replacement of Binder- A Review on Compressive Strength and Microstructural Properties

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Abstract

The utilization of solid waste in the production of sustainable concrete has gained substantial attention in recent years due to its potential to improve both mechanical and durability properties while addressing environmental concerns. Recycled aggregate concrete (RAC) has emerged as an eco-friendly alternative to conventional concrete. Moreover, ground granulated blast furnace slag (GGBFS), a by-product of the steel industry, has been recognized for its potential as a partial replacement for cementitious binders in concrete. Several studies have been conducted to study the influence of GGBFS as a binder replacement on the compressive strength and microstructural properties of RAC. The present paper presents an up-to-date review of the reported literatures on this area. This review demonstrates that an appropriate percentage of GGBFS replacement can significantly improve the compressive strength of RAC. Moreover, the microstructural analysis has revealed that GGBFS contributes to the refinement of the pore structure, reduced calcium hydroxide content, and increased densification of the cementitious matrix, which enhance its mechanical properties and durability properties making GGBFS based RAC more sustainable. Moreover, this review will be immensely helpful to the builders for application of GGBFS based RAC in construction and to researchers for future research.

Keywords: Recycled aggregate concrete; Ground granulated blast furnace slag; Recycled coarse aggregate; Compressive strength; Microstructural properties.

Paper ID: 48

Catalyzing Diesel Exhaust through Discharge Plasma in a Reactor Packed with Lignite Ash/Waste Ceramic Tiles: Role of Pellet Diameter on $DeNO_x$ Efficiency

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Abstract

Recently plasma catalysis with pellets made from industrial waste is gaining significance in enhancing the removal efficiency of oxides of nitrogen (NOx) in diesel exhaust. In this paper, an attempt has been made to understand the role played by the size of the pellets when they are packed in a finite volume of plasma reactor. The parametric study was carried out on the exhaust of a 10 hp diesel engine by exposing the gaseous pollutants to pulsed discharge plasma in the presence of lignite ash pellets. Different sizes of the pellets were tested for NOx removal efficiency and a pellet size of about 5mm diameter appeared to be critical. The next phase of the experiments was carried out with this critical diameter of pellets but made from another major industrial waste, broken ceramic tiles. About 89% decrease in NOx (DeNOx) efficiency was achieved with these broken tiles in plasma catalysis mode. A comparative study was also made at a larger diameter of tiles-based pellets which exhibited lesser DeNOx efficiency, thus emphasizing the need for identifying suitable size of the pellets in plasma catalysis. Further, a study was carried out to ascertain the fact that catalytic reaction dominates in plasma catalysis rather than the adsorption.

Keywords: Plasma catalysis; Ceramic waste; Diesel exhaust; NOx reduction; Electrical discharges.

Paper ID: 49

Status of Municipal Solid Waste Litter Management in India: Challenges, Opportunities and Environmental Threats

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Abstract

The study presents a comprehensive analysis of the prevailing conditions of municipal solid waste litter (MSWL) management within the Indian context. The article explores the intricate web of challenges (such as increasing population, poor public awareness and policy framework) faced by urban local bodies (ULBs) in the collection, transportation, and disposal of MSWL. It also highlights the concomitant environmental threats such as health hazardous and marine pollution associated with poor MSWL management. This review elucidates the shortcomings in MSWL infrastructure, underscoring issues such as deficient waste segregation practices, inadequate disposal facilities, and the prominence of the informal waste sector. Additionally, it provides a meticulous examination of the environmental ramifications, emphasizing the dissemination of contaminants into the atmosphere, water bodies, and soil, thereby delineating the resultant health implications. Moreover, it also accentuates the significance of public participation and awareness campaigns as catalysts for MSWL reduction and segregation. Finally, the article offers a scientifically grounded resource, catering to the exigencies of policymakers, researchers, and environmentalists. It offers an empirically supported elucidation of the present state of MSWL management in India, complete with a strategic blueprint for addressing extant challenges, leveraging latent opportunities, and attenuating the scientifically substantiated environmental threats arising from MSWL.

Keywords: Municipal Solid Waste Litter, Street Cleaning, Marine Pollution, Environmental Hazardous.

Paper ID: 52

Environmental Impact of Groundwater Contamination Monitoring for Pollution Measurement and Transmission: A Case Study of Water Quality Parameters Approaches from a Region of the Salem District, Tamil Nadu, India

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Abstract

The contamination of groundwater based on contamination factor and water Quality index. A thirty groundwater samples were collected during April 2022 and analysed for groundwater quality based on Physicochemical parameters. Groundwater contaminated in Mallur area surrounding textile mills which that contaminated water due to the discharge of textile industry wastes, municipal wastes, anthropogenic activities. Water Quality Index (WQI) is the important factor which is interprets contaminated groundwater and environmental impact surrounding Salem district. Groundwater quality for domestic and irrigation purposes was examined by using WHO and BIS standards. The water quality index in Salem district ranges from 15 to 244 due to the high value percentage industrials effluents. In Kumarapalayam area have high values of chloride content i.e. 275 mg/l due to the surrounding textile effluents that can be produced some textile industries. Seven locations such as Mettur, Gangavalli, Achchanguttaipatti, Sankagiri, Pappampadi and Siruvachur, Tammampatti have high values of TDS due to the urban anthropogenic waste input, but also in the rural areas due to the leaching of agricultural irrigation water. According to the higher values of TDS could be due to low water levels within the aquifers and sediment effect. Further this study reveals that Environmental Impact Assessment (EIA) ofgroundwater pollution around Salem district especially industrial areas. The Water quality Index (WQI) value is high in the location of kumarapalayam and Panchukalipatti respectively i.e 235.28 and 475.56.

Keywords: Groundwater contamination; WQI; Physico-chemical parameters; TDS; EIA.

Paper ID: 54

Morphology and Polymer-based Source Apportionment of Microplastic Contamination in Water Supplying Reservoirs of Ranchi: An Effective Tool for Mitigation

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Abstract

Microplastics (MPs) (≤ 5 mm) are ubiquitous in nature and have inhabited every sphere of our planet. Studies around the globe have focused on their impact on biological organisms and the environment. The world is thinking over ways to control these particles from entering the environmental matrices and human beings. One of the primary requirements for managing this pollution is the source apportionment of the particles to identify their origin and control at the onset. In this current study, we have attempted to do the source apportionment of microplastic particles in the drinking water-supplying reservoirs of Ranchi. It was done based on their abundance, morphological, and polymeric characterization coupled with field observation of the sampling locations. Results confirmed 04 significant types of MP particles (fragments, films, fibers, and foams) in all three reservoirs ranging between 1233 – 2291 particles belonging to 08 polymer types. Finally, based on the source appropriation, we could identify the most probable sources and their contribution toward the MP contamination of the study area. This can help adopt the appropriate management strategies to curb MP pollution in any setup with similar conditions to control microplastic pollution.

Keywords: Microplastic; Count, Morphology, Polymer, Source appropriation.

Paper ID: 55

Comparative Study of Testing Indigenous Air Filters for Coarse and Fine PM Removal

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Abstract

Air pollution has become a serious global issue, which has significant impacts on both human health and the environment. Over the past decade, air quality has deteriorated due to various anthropogenic activities including construction, urbanization and industrialization. These activities release hazardous particles and harmful gases into the atmosphere, contributing to poor air quality. Developing countries such as India have been particularly affected, with some of their cities among the most polluted worldwide. To address this serious concern, it is imperative to develop and implement air pollution control technologies for both indoor and outdoor environments. This study focuses on the structured investigation of the performance of locally available air filter media in terms of their removal efficiency for submicron and micron-size particles. Various indigenous air filter media are subjected to rigorous testing to evaluate their overall and size-specific filtration efficiency and corresponding differential pressure drop. The results of these performance evaluations are then compared to their effectiveness in removing coarse and fine particles from the air. This research aims to provide valuable insights into the development of effective air filtration systems to combat air pollution.

Keywords: Air purification, Fine PM, Course PM, Air filters, Air pollution Control Technology.

Paper ID: 57

Application of Life Cycle Assessment (LCA) in Vernacular Architecture: A Critical Review

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Abstract

Vernacular architecture is a sustainable form of architecture that involves traditional building practices developed over generations to adapt to local climate conditions. With rising concerns about global warming, interests are escalating in incorporating sustainable design principles into vernacular architecture to create environment-friendly and energy-efficient structures. Life cycle assessment (LCA) is a proven methodology to measure the damage caused to the environment and effects in construction materials. Applying LCA to vernacular architecture can identify opportunities for reducing carbon emissions and improving energy efficiency in the construction industry. This paper aims to present a literature review of case studies and research findings to highlight the potential of vernacular architecture as a sustainable solution in the construction industry. It further seeks to explore how LCA can be effectively applied to assess and improve the environmental performance of various techniques and materials native to vernacular architecture.

Keywords: Vernacular Architecture; Life Cycle Assessment (LCA); Climate Change; Sustainability; Building Materials.

Paper ID: 60

Environmental Challenges in Coal Mining: Investigating Dust Pollution, Heavy Metals, and Sustainable Remediation with Indigenous Plants

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Abstract

High-concentration toxic metal-bearing particles in coal mine area road dust, when re-suspended, contribute significantly to particulate matter, thereby adversely affecting air quality and human health. Singrauli, Madhya Pradesh, was selected as the sampling site. Sampling were focused on trees, shrubs, and dust from the roadside. Notably, among all the locations studied, those in close proximity to the thermal power plant were found to be significantly contaminated with metals. Gastric phase had higher metal accumulation, indicating greater bioaccessibility than the intestinal phase. Specifically, in areas near the coal mine and industrial zone, Pb accumulated at rates of 24.8% and 22.7%, respectively, in the gastric phase, in the gastric phase. Additionally, trees like Ficus bengalensis and Butea monosperma were observed to be effective dust collectors for particulate matter (PM) of various sizes, including PM 10, 2.5, and 0.2µm. Additionally, the species B. monosperma exhibited tolerance to metals, including As, Cu, Cr, Fe, Ni, Mn, Pb, and Zn. Out of all the shrubs, Lantana camara demonstrated a greater capacity for accumulating metals like Cu, Mn, Zn, and As. The research suggests employing these plants to effectively capture both PM and associated metals, with the goal of establishing green belts in urban areas.

Keywords: Dust particle, Heavy metals, Dust retention capacity, Bioaccessibility, and Plants.

Paper ID: 61

Photocatalytic Degradation of Sulfamethoxazole in Aqueous Solution by 3D Porous MoS_2 Decorated Graphene Aerogels

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Abstract

In recent years, layered transition metal dichalcogenide is attracting tremendous attention for photocatalytic degradation of pharmaceutical pollutants. In particular, molybdenum disulfide (MoS_2) is extremely appealing for visible-light photocatalysis due to its exceptional solar spectrum response and other distinguishing characteristics. However, owing to the high recombination of the photogenerated charge carriers, the widespread use of MoS_2 as a photocatalyst is severely restricted. Herein, we report a three-dimensional (3D) MoS_2 decorated graphene aerogel (MoS_2/GA), as a highly active photocatalyst for the removal of sulfamethoxazole (SMX) under visible light irradiation. In order to enhance the photocatalytic performance, the composite aerogel was chemically activated, employing sodium hydroxide as the activating agent. The treated MoS_2/GA exhibited better photocatalytic activity for removal of SMX from aqueous phase compared with pristine MoS_2/GA. A maximum SMX removal efficiency of 91% was achieved within 120 min of visible light irradiation. Additionally, recycling experiments demonstrated the good photocatalytic stability of the as-developed aerogel, which is beneficial from the viewpoint of practical application. Further, the photocatalytic mechanism was also investigated via radical trapping assay. It was found that holes played a vital role in the photocatalytic degradation of SMX. Overall, the findings of this work demonstrate a promising strategy for the fabrication of highly effective photocatalyst for degradation of pharmaceutical contaminants.

Keywords: photocatalysis; aerogel; visible light; chemical activation; sulfamethoxazole.

Paper ID: 62

Technological Solution for Sewage Disposal in High Altitude Area

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Abstract

Sewage treatment is biggest environmental concern worldwide. Different techniques are implemented to manage sewage, its treatment and disposal of effluent as per terrain, temperature in local area, space available, cost of sewage treatment, capacity based on manpower for which sewage treatment is being planned. Leh is a high altitude area with its typical environmental, geographical and economical constraint for the population. Water table is very high in the region due to flow of River Indus and River Zanskar. In a year approximately for eight months temperature drops to sub-zero levels. In such harsh environment the techniques used in plain areas for sewage management and treatment are ineffective. A comprehensive study on sewage treatment in this research paper brings out problems of sewage disposal in high altitude, technological developments and technical solution and review of various sewage treatment implemented by various agencies in Leh. The study encompasses the holistic approach towards efforts environmental protection by most appropriate sewage management techniques.

Keywords: Sewage effluent, Sewage Treatment, High Altitude Area, Sub-zero temperature.

Paper ID: 63

Synthesis and Application of Iron-Impregnated Anaerobic Sludge-Based Hydrochar Electrocatalyst for Enhanced Performance in Microbial Fuel Cell

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Abstract

Microbial fuel cell (MFC) is a promising avenue to combat the unprecedented dependence on fossil fuel-based electricity for treating wastewater. However, low power generation due to sluggish oxygen reduction reaction (ORR) and expensive cathode catalysts have limited its widespread application on a commercial scale. Therefore, employing carbon-based inexpensive catalysts synthesised using sludge can serve as an economically viable approach for sludge reuse and accelerate the ORR in MFC. The current investigation focuses on the catalytic action of iron-impregnated anaerobic sludge-based hydrochar (HF) in improving the performance of MFC. The synthesis of HF followed the hydrothermal carbonisation of anaerobic sludge obtained from the up-flow anaerobic sludge blanket reactor mixed with ferric chloride. The operating voltage observed in case of MFC–HF was 291 ± 18 and 355 ± 27 mV in MFC–Pt. The power density and COD removal efficiency of MFC–HF were 8.18 ± 0.49 W m^{-3} and 75.11 ± 3.57 %, which were 64% and 92% higher compared to that of MFC–Pt, respectively. Overall, the present findings showcase the ability of metal-doped anaerobic sludge hydrochar to accelerate the ORR in MFC.

Keywords: Bioelectricity; Hydrochar; Hydrothermal carbonisation; Oxygen reduction reaction; Sewage sludge

Paper ID: 66

Experimental Investigation of Photocatalytic Efficiency of TiO_2 Over Cement Plaster in Reducing Urban Air Pollution

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Abstract

Photocatalysis is widely used for the treatment of air pollution caused by the emission of pollutants and harmful gases like volatile organic compounds (VOCs) from indoor and outdoor sources. Some VOCs are carcinogenic and degrades very slowly in the atmosphere. A major part of our time we spent indoors inside some infrastructure whether it is a residence or workplace, where we are exposed to those pollutants frequently. This paper investigates the photocatalytic efficiency of TiO_2 in reducing such air pollutants when applied over the building surface. To accomplish the goal, cement mortar samples are prepared with various doses of TiO_2 (ranging from 6.18E-03 g/cm^2 to 0.0412g /cm^2) and investigated further for the rate of degradation of VOCs inside batch reactors in the presence and absence of sunlight. In addition, the surface characterization was also performed to understand the microstructural properties of TiO_2-coated plastered samples. The obtained results showed the variation of degradation rate from 0.9E-04±0.00001 to 1.7E-04±0.00011 min^{-1}cm^{-2} for various initial concentrations of TVOC in the range of 600 ppm to 2900 ppm over a period of 100 minutes. The selected approach demonstrated the maximum degradation rate constant of 5.4E-04 min^{-1}cm^{-2} corresponding to 15% of TiO_2 dose by cement weight. This shows the viability of TiO_2 in the purification of polluted air and advocates its widespread use on building surfaces.

Keywords: Fouling; Cleaning; Ion exchange membrane; Permeability; Response surface methodology.

Paper ID: 67

RaCe: Reinforcement Learning-based Indoor Air Pollution Control System

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Abstract

Due to the evolution of societal norms and the expansion of urban areas, there is a growing recognition of the significance of physical well-being. However, a substantial portion of our time is spent indoors, leading to a pressing concern regarding indoor environmental contamination. This contamination has substantial implications for the health of individuals today. Therefore, we investigate indoor air pollution's root causes and create a strategy to minimize its influence. Moreover, this investigation scrutinizes the origins of indoor pollutants and evaluates the health hazards linked to indoor pollution to curtail its adverse consequences on human health.

Keywords: Indoor Air Pollution; Control; Reinforcement Learning (RL); Ammonia; Q-learning.

Paper ID: 69

Deep Learning for Predicting Liquid Fuel Production via Co-Pyrolysis of Medical Waste Plastics and Delonix Regia

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Abstract

The unremitting population growth and industrialization caused augmented global energy requirements, resulting in challenges such as fossil fuel depletion, ecological pollution, and energy shortages. These confronts have emphasized the need to harness rich renewable energy resources (biomass), by enhancing thermo chemical conversion methods like co-pyrolysis. This paper explores biomass and waste plastics co-pyrolysis for high-valued production of biofuels. It highlights co-pyrolysis advantages, product yields, mechanisms, synergistic effects among biomass and waste plastics, and the impact of key parameters, such as feed ratio, reactor temperature, and oil yields. In a tubular reactor, non-catalytic co-pyrolysis experiments were conducted, employing Delonix Regia (DR) powder and varying proportions of medical waste plastics (PP). The pyrolysis temperature was systematically varied in 50°C increments, spanning the range from 450°C to 600°C. The study encompassed a spectrum of feed compositions, ranging from 0 wt. % to 50 wt.% of PP within the mixture. Physicochemical and fuel properties were evaluated in accordance with ASTM standards, supplemented by modern sample characterization methods such as GCMS and FTIR. Notably, the gross calorific value of the organic fraction of bio-oil demonstrated a significant enhancement, ranging from 22.45 MJ/kg to 33.96 MJ/kg, in direct correlation with the rising proportion of polypropylene (PP) in the co-feed, spanning from 0 wt.% to 50 wt.%. Leveraging deep learning techniques for pattern recognition and data analysis, this study validates experimental outcomes and highlights the feasibility of using deep learning to predict non-catalytic co-pyrolysis yields of polypropylene (PP) and Delonix Regia (DR) for fuel oil production. It offers a promising avenue for enhancing co-pyrolysis efficiency and sustainability.

Keywords: Delonix regia; medical waste plastics; co-pyrolysis; waste to energy; deep learning.

Paper ID: 71

Understanding Variations in Physiochemical Water Quality Parameters of the Yamuna River in Delhi NCR: A Comparative Approach

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Abstract

In this research paper, a comparative analysis of water quality parameters in the Yamuna River at various locations within the Delhi National Capital Region (NCR) has been conducted. The Yamuna River holds immense significance in Hindu mythology, ranking second to the Ganges as a sacred river playing a vital role in maintaining ecological balance. The research extensively investigates pollution levels in the Yamuna River, focusing on specific parameters across different locations including Yamuna at Wazirabad, Yamuna at Nizamuddin, Yamuna at Okhla Bridge (the inlet of the Agra canal), Yamuna at Okhla after meeting with Shahdara drain, Yamuna at Hathnikund, Yamuna at Kalanaur Yamuna Nagar, and Yamuna at Sonipat for a span of time from 2012 to 2021. The research tracks annual variations in key parameters, including temperature, dissolved oxygen, pH, conductivity, biochemical oxygen demand (BOD), nitrate concentrations, fecal coliform, and total coliform counts. This extensive and longitudinal analysis provides critical insights into the dynamic state of the Yamuna River's water quality, highlighting trends and variations in these vital parameters.

Keywords: Yamuna River; Water Quality Parameters; Delhi NCR.

Paper ID: 72

Microplastics: Occurrence and Characterization in Soil Matrices of Central India

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Abstract

Microplastics are one of the emerging contaminants which have been found in almost every environmental matrix. Considering the significance of this fact, scientists are trying to identify and characterize this emerging contaminant in a variety of abiotic as well as biotic matrices, so that effective preventive measures may be adopted. However, literature shows that most of the studies have been carried out in the marine water, surface water, and air; while soil matrix has largely remained untouched. Therefore, present work has been carried out in the soil matrices of Bhopal, Central India. Samples were collected from the agricultural and tourist site soil in Bhopal. Samples were further processed to obtain microplastics, which were later characterized microscopically and spectroscopically. Analysis revealed that on an average tourist site soil had 75.2 particles/kg while agricultural site soil had 30.8 particles/kg. Chemical composition analysis showed that polyethylene, polypropylene, polyethylene terepthalate, polyvinyl chloride etc. were the most common type of microplastic particles in the soil of Bhopal.

Keywords: Agricultural; Bhopal; emerging contaminants; Microplastics; soil.

Paper ID: 73

Interaction of Plant-soil Microorganisms in Agriculture and Soil Enrichment

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Abstract

In the twenty-first one of the major challenges will be environmental change, sustainable crop production, and food security. With the increase in population, the need for sufficient food has risen. Production is a challenge for farmers. The current food production method in agriculture is to get maximum yield with maximum use of chemical pesticides and fertilizers, developing along with the long list of sustainable environmental and health challenges. To have good agriculture farming practices attention has to be paid to a mechanism involving ecological phenomena such as plant invasion region-rise, species dominance, old field succession, and soil health. Bacterial genera PSB, KMB, Bacillus, Trichoderma, Metarhizium, Verticillium, and Az spirillum are studied examples for plant growth and soil enrichment promotion. Studies proved the mode, action, and effects; these bacterial genera can be used as biofertilizers, plant strengtheners, and soil enrichers. There is wide scope and growth with the use of such microorganisms leading to perfect technologies in the right way, and more predictable and continuous effects on sustainable plant growth and soil enrichment. The forthcoming challenges of farmers will benefit from interdisciplinary research example – crop production, education, food security, and plant-soil interaction. The interaction of plant soil microorganisms altogether offers promising and environmentally friendly operation for natural and conventional organic farming at the global level in turn need of the hour.

Keywords: Plant-soil microorganisms, Crop production, sustainable environment, and food security

Paper ID: 74

Green: Green Approximate Computing for Next Generation Sustainability

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Abstract

Pursuing sustainable computing has emerged as a critical imperative in the era of rapid technological advancement and escalating computational demands. This endeavor centers on enhancing energy efficiency and minimizing waste to achieve a Net Zero emissions state within the technology sector. Green Approximate Computing (GAC) has surfaced as a promising solution, bridging the chasm between technological progress and environmental responsibility. GAC achieves this by reducing CPU cycles by utilizing ONNX models, resulting in substantial energy savings. It finds a natural application in fields like Data Science, Big Data, and Machine Learning, where approximate results are often sufficient. Fundamental techniques employed by GAC include loop perforation, batch processing, data sampling, and precision scaling. These strategies involve accepting minor inaccuracies in exchange for vastly improved efficiency. GAC successfully balances precision and energy consumption, leveraging algorithmic and architectural approaches to curtail energy usage and reduce carbon footprint while maintaining service quality. By integrating the various facets of GAC into modern computing paradigms, we glimpse a greener, more sustainable digital future on the horizon, where technology and environmental responsibility are harmoniously intertwined.

Keywords: ONNX Model; Loop Preformation; Data Sampling; Green Approximate Computing; Net Zero Emission.

Paper ID: 75

Mercury Dynamics in the Third Pole

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Abstract

Mercury (Hg) poses significant environmental and health risks due to their long-lasting presence. These concerns are particularly relevant in Asia, where pesticide use and mercury emissions have risen sharply alongside changing agricultural practices and industrialization. Research in transatlantic mountain regions suggests that alpine areas act as regional hotspots for volatile substances like mercury due to orographic cold trapping. This effect may be also pronounced in the Hindu Kush Himalaya (HKH) a fragile and unique high altitudinal ecosystem with low temperatures and partial ice cover, which resembles the environment in polar regions and therefore is also known as the "*third pole*". A critical knowledge gap exists regarding mercury's distribution, transport, and impact on the Himalayan region, especially its influence on glacier-fed ecosystems. Our review delves into mercury's behavior and environmental risks in the HKH, revealing preliminary evidence of long-distance transmission in this vulnerable region. As Himalayan glaciers, vital for water supply, rapidly melt, this could exacerbate downstream mercury threats, highlighting the urgency of our findings.

Keywords: Orographic cold Trapping; Mercury; Hindu Kush Himalaya; Bioaccumulation; Semi-volatile pollutants.

Paper ID: 76

Spatial Analysis of Hydroclimate Change on Climate Resilient Agriculture Strategy in Ajoy River Basin, India

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Abstract

Climate resilient agriculture (CRA) is a very important dimension with increases agriculture production as well as ensures food security. This strategy would meet the UN's goals. The present objectives attention on the opportunity in CRA for river basin scale management system. It is based on long-term historical and future climate and hydrological condition by Geographical Information System framework in Ajoy River basin in West Bengal, India. The slope of the linear regression and standardized anomaly index were applied for the spatial pattern of the climatic (temperature and precipitation) and hydrological conditions (actual evapotranspiration, potential evapotranspiration, vapor pressure deficit, runoff, and climate water deficit) from TerraClimate dataset (1958-2020). Future climate trend analysis (2021-2100) has been employed through the CMIP6 (EC-Earth3) shared socio-economic pathway (SSP 2) 4.5 dataset. The spatiotemporal water storage analysis has been determined from the Gravity Recovery and Climate Experiment (GRACE) of JPL and CSR data (2002 -2021). The validation has been executed by regional groundwater level data through the different machine learning classification algorithm. Boruta technique was applied for sensitivity evaluation of hydrometeorological conditions in the river basin scale managemt. However, the negative trend of precipitation (about−0.04 mm/year) found in the southern region whereas, the northern region showed a positive trend (about 0.10 mm/year). It was found that downward of the river basin showed a high fluctuation rate of groundwater level from 12.70 to 15.78 mbgl. The results can be proposed for future development of sustainable agriculture monitoring and management purposes.

Keywords: Climate-resilient agriculture, hydrological conditions, machine learning, groundwater level, GIS.

Paper ID: 79

Comparative Analysis of CO_2 Adsorption Capacity for Amine-Modified Activated Carbon Prepared from Jujube Seed

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Abstract

Due to the rapid industrialization and urbanization, the Carbon Dioxide (CO_2) concentration in the atmosphere increases. For capture of carbon dioxide, adsorption has been proven to be successful approach. Among many adsorbents Activated Carbon (AC) is an attractive adsorbent used for CO_2 capture. Our present research recommends a comparative study of the adsorption capacity of three different amines-impregnated AC such as Diethylene tri amine activated carbon (DETA-AC), Tetra ethylene Penta amine activated carbon (TEPA-AC) and Di ethanol amine activated carbon (DEA-AC) for capture of CO_2. From CO_2 batch adsorption analysis, it has been found that the DEA-AC shows greater CO_2 adsorption capacity i.e., 38 mg/g compared to DETA-AC and TEPA-AC with same impregnation ratio of 0.4.

Keywords: Activated carbon; Adsorbent; Adsorption; Carbon dioxide; Impregnation.

Paper ID: 80

Water Quality Assessment and Solution to Water Issues: A Case Study of Hattur Village

Rajani Digambar Mudgundi

Abstract

Water pollution is an important factor for concerning the quality of environment. Water has been used for many purposes, especially for agriculture, industry, recreation, and household. Nowadays, the quality of surface and ground water is declining due to several reasons. The pesticide in water has become an important problem in many developed countries. The use of pesticides was increased to obtain enough crops in many countries. This intensive use caused surface and ground water pollution. The proper pesticide use is extremely important to protect water resources for future use. In this study, Ground water quality of Hattur village has been assessed and effect of preliminary and primary treatment of water has been studied. Ground water samples collected from various points of sampling were checked for water quality parameters. The major source of contamination is uncontrolled use of pesticides. As the agricultural runoff along with Pesticides being the major source of N, P and K imparted hardness and alkalinity to ground water. Based on the raw water quality, general methodology decided for treating water so as to make it fit for consumption. For the treatment model, water quality checked for inlet and outlet.

Paper ID: 82

Impact of Potential Toxic Heavy Metals Pollution on the Estuarian Ecosystems of India: A Review

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Abstract

Estuaries are vital ecosystems that support diverse flora and fauna and are a major source of food and economic activities. Industrialization near coastal habitats has led to the increased presence of pollutants in coastal ecosystems. The estuary is a critical aquatic ecosystem supporting major industrial and residential settlements. But at the same time, it receives effluent discharges from these industrialized and urban settlements. India has one of the longest coastlines covering various coastal habitats, including estuaries. Estuaries in India's South-west and South-East coast are contaminated with different sources of heavy metal. In the present study, an attempt has been made to review heavy metal contamination distribution and assessment in the estuarian ecosystem of India's South-west and South-East coast.

Keywords: Heavy metal pollution, Estuarian ecosystem, India.

Paper ID: 83

Nonlinear Autoregressive Neural Network application for Mean Annual Temperature Prediction

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Abstract

This article presents a Nonlinear autoregressive neural network (NARNN) for time-series prediction of annual temperature range in India. The annual temperature data over the duration from year 1901 to 2011 has been considered for training of proposed model. The NARNN model has been trained using Levenberg-Marquardt algorithm. The NARNN model has been tested for prediction of annual mean temperature, annual minimum temperature and annual maximum temperature over the duration of 10 years from 2012 to 2021. The performance of the model has been analyzed in terms of Root mean square error (RMSE), Mean absolute error (MAE) and Mean absolute percentage error (MAPE). The findings testified that the NARNN model can be effectively used for time-series prediction of annual temperature with minimal error values.

Keywords: NARNN; Time-series prediction; Mean annual temperature; Training algorithm; Error indicators.

Paper ID: 84

Apatite's Carbon Quest: From Carbon Capture to Green Construction

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Abstract

Global warming is predominantly driven by anthropogenic carbon dioxide emissions, sparking increased enthusiasm for the utilization of innovative techniques to alleviate this issue. One such approach involves capturing CO_2 from sources such as fossil fuel power plants, waste incineration, etc. In this study, we delve into the use of fluorapatite (FAP) as a potential material for carbon sequestration. Our research explores different configurations of carbonate ions within FAP following carbon capture using first-principles based density functional theory (DFT). To check if the carbonated FAP is suitable for subsequent green construction, we calculate their elastic properties using DFT.

Keywords: Carbon-sequestration; Density Functional Theory; Elastic Constants; Apatite.

Paper ID: 85

Ion exchanger-supported metal nanoparticles for the removal of Lead, Cadmium, Chromium, and Arsenic from contaminated water: A Review

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Abstract

The prevalence of environmental contamination caused by hazardous heavy metals is increasing due to industrial, agricultural, mining, and waste disposal practices. Several scientific and technical improvements have been employed to address this issue, particularly in removing heavy metals from water and wastewater. Their presence on surface and groundwater was reported globally. Due to their carcinogenic nature, their presence in trace concentration is unacceptable. The ion exchange technique has shown great potential as a viable approach within traditional methodologies for eliminating heavy metals. This review examines the delicate synthesis, characterization, and performance validation of hybrid-ion exchangers in the context of heavy metal removal, namely lead, cadmium, arsenic, and chromium from contaminated water. The hybrid ion exchangers exhibited enhanced selectivity compared to the parent exchanger for target heavy metal species. This enhanced selectivity is primarily attributed to the synergetic effect of ion exchange followed by either redox reaction, adsorption, or other combinations. The comprehensive summary also encompasses the diverse applications of hybrid ion exchangers in numerous applications in the field of environmental remediation.

Keywords: Ion exchange; hybrid exchanger; heavy metal removal; contaminated water.

Paper ID: 86

Benzo Alpha Pyrene Inventory in Different Environmental Medias, India

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Abstract

Benzo(a)pyrene (BaP) are global pollutants, classified as polycyclic aromatic hydrocarbons (PAHs). Since 1998, PAHs have been listed in the Convention on Long Range Transboundary Air Pollution Protocol on Persistent Organic Pollutants. While the major sources of PAHs like Solid waste incineration, agricultural waste burning, power industry, ferrous and non- ferrous metal production and road transportation are highly active in India. There has been very limited study to understand the inventories and fluxes of BaP in the different environmental medias (air, water, soil, sediment, and vegetation). This study will bridge this gap by considering the six different emission sources and creating an emission inventory of BaP at 3.75° × 3.75° resolution. This project will target an important, hitherto unexplored area of modelling of BaP in the Indian context, despite the urgency highlighted by the lack of knowledge in this field.

Keywords: Polycyclic Aromatic Hydrocarbons biphenyls (PAHs); Benzo Alpha Pyrene (BaP); Persistence; Toxicity; Long Range Transport.

Paper ID: 88

Adsorption of Wastewater Pollutants by Microplastics

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Abstract

Microplastic pollution has emerged as a critical environmental issue globally, necessitating research and innovative solutions. Despite substantial research on microplastics and their adsorption capacity of different pollutants, little work has been done about the adsorption capacity of pollutant named as aniline. This work aims to examine the adsorption behavior of aniline, a prominent environmental pollutant resulting from industrial production, onto the surface of polystyrene microplastics (mPS). The adsorption of aniline on mPS particles of four different sizes (P1, P2, P3, and P4) was investigated. The effect of pH on the aniline adsorption, influences of ionic strengths on aniline adsorption, adsorption kinetics under different mPS particle sizes, in adsorption thermodynamics was studied. The results suggest that the adsorption of aniline exhibited an upward trend as the pH increased until reaching a value of 7, after which it declined.Moreover, aniline adsorption by mPS increased with decreased mPS particle sizes.

In conclusion, the findings of this study possess the capacity to establish a foundation for innovative and environmentally sound wastewater treatment technology, which can effectively address the issues of microplastic contamination and wastewater pollution.

Keywords: Polystyrene Microplastics; Adsorption; Wastewater Pollutants; Aniline; pH.

Paper ID: 93

Assessment of Toxic Heavy Metals in Soils, Around Oil Refinery, Bina District Sagar, Central India

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Abstract

Heavy metals are natural constituents of the soils and their concentration varies depending on parental materials. The content of heavy metal in soils has increased last few decades due to human activities as: distribution of fertilizers, pesticides, Petro-chemicals, industries, waste-disposal and air pollution. Due to these activities the life capacity of soils decreased and it polluted from the toxic heavy metals.

In this study, metals such as Cobalt (Co), Chromium (Cr), Copper (Cu), Nickel (Ni), Zinc (Zn) and Manganese (Mn), in the soil samples were analyzed to quantify their concentrations and comparison with the threshold values of metals as per the WHO, USEPA and CCME standards were used to demarcate their level of pollution present in the area.

Concentrations of toxic heavy metals (Co, Cr, Cu, Ni, Zn and Mn) have been determined based on different indices (indexes) such as Geo-accumulation Index (Igeo), Pollution Load Index (PLI) and Nemerow Pollution Index (P) in a 'quality wheat' producing region to assess presence and intensity of anthropogenic stress in polluting/contaminating soils around an oil refinery at Bina, district Sagar, Madhya Pradesh (established in 2011).

Keywords: Toxic heavy metal pollution, soil-contamination, Geo-Accumulation Index(I-geo), Pollution Load Index (PLI) and Nemerow Pollution Index (P), oil refinery, Central India.

Paper ID: 94

Photocatalytic Degradation of Bisphenol-A by rGO/g-C_3N_4/TiO_2 Under Visible Light Irradiation

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Abstract

The widespread occurrence of bisphenol A (BPA), a well-known endocrine-disrupting compound, in aqueous environments is a global concern because of its potential health impacts. Among the various technologies explored by the scientific community for removing BPA from aqueous matrices, heterogeneous photocatalysis has attracted tremendous attention because of its low cost, high efficiency, and environmentally benign nature. In this study, a ternary composite, i.e., rGO/g-C_3N_4/TiO_2, was fabricated via a facile one-pot hydrothermal method for photocatalytic degradation of BPA. The synthesized photocatalyst was comprehensively characterized using microscopy, spectroscopy, and surface analytical techniques. Upon exposure to visible light for 180 min, 72% degradation of BPA was achieved using rGO/g-C_3N_4/TiO2, which was several folds higher than that of the individual constituents. The enhanced photocatalytic performance of the rGO/g-C3N4/TiO2 composite can be attributed to the synergistic effect among the individual components, which results in improved light-harvesting and superior charge separation and transfer

Keywords: Bisphenol A; Photocatalysis; Reduced graphene oxide; Graphitic carbon nitride; visible light.

Paper ID: 95

Comparative Surface Water Quality Assessment in the Selected Dams of Ranchi District Jharkhand

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Abstract

This study presents the comparative surface water quality assessment of two selected dams namely Kanke dam and Getalsud Dam. Both the dams are supplying water to the various regions of Ranchi district; therefore their water quality monitoring has become essential. The 12 sampling points were selected in both dams for sampling. The physiochemical analyses of water samples were done for parameters namely pH, Turbidity, EC (electrical conductivity), TDS (total dissolved solids), Alkalinity, Acidity, DO (dissolved oxygen), BOD (biological oxygen demand), COD (Chemical oxygen demand), nitrate, phosphate and Heavy metal etc. The sampling was done seasonally like pre monsoon, monsoon and post monsoon from 2019-2020. The result of seasonal statistical analysis like descriptive analysis, Correlation analysis (CA), PCA (principle component analysis), factor analysis (FA) of the water quality confirmed the problem of TDS, EC, alkalinity and hardness in the dams in all seasons. WQI (Water quality index) analysis showed that the water quality was found poor to unsuitable on all the sampling points throughout the study area in all seasons. The HPI values in both dams were well below the critical index limit (100) in all seasons which confirmed that surface water is not polluted in terms of heavy metal. Thus the water quality of selected dams is needed to be monitored for checking further pollutant distribution.

Keywords: Catchment area, Heavy metal pollution indices (HPI), Statistical analysis, Surface water quality, Water quality indices (WQI).

Paper ID: 99

Appraisal of Hydrochemical Characteristics and Groundwater Quality in Parts of Shahjahanpur, Uttar Pradesh, India

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Abstract

This study evaluates the groundwater chemistry and outlines the major hydrogeochemical processes acting on the groundwater system of Shahjahanpur, Uttar Pradesh, India. For the said purpose, 54 groundwater samples were collected and analyzed for various physicochemical parameters during post-monsoon, 2018 and pre-monsoon 2019. Hydrogeochemically, the groundwater is dominantly of Ca+Mg-HCO3 type. Gibbs and various bivariate plots elucidate that silicate weathering dominantly influences the groundwater chemistry. Further, the results of chloralkaline indices indicate that ion exchange process is also controlling the chemical characteristics of groundwater to a certain extent. The relationship of SiO2 with TDS indicates the influence of both geogenic and anthropogenic factors in regulating the groundwater chemistry. Groundwater suitability assessment revealed that it is suitable for industrial and agricultural purposes

Keywords: Groundwater; Hydrochemistry; Water quality Index; Shahjahanpur

Paper ID: 100

Predictive Modelling of Biodiesel Production from Waste through Transesterification

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Abstract

Biodiesel production and use have been the topic of extensive research due to the ever-increasing emphasis on the creation of eco-friendly and low carbon footprint energy alternatives. Several process factors drive the biodiesel production process, which must be kept at optimal levels to ensure maximum productivity. Because biodiesel productivity and quality are also affected by the numerous raw materials used in transesterification, practical studies are required before making any assumptions about them. However, due to the high number of process parameters and the underlying non-linear relationship between the process parameters and responses, a brute force strategy of carrying out physical trials until the optimal process parameters are attained will fail. In this context, this research employs a machine learning-based prediction approach to quantify the response properties of the biodiesel manufacturing process as a function of process parameters. This paper investigates four powerful machine learning algorithms in depth: linear regression, random forest regression, AdaBoost regression and artificial neural network. Both random forest regression and AdaBoost regression show good accuracy in prediction modelling of biodiesel yield. However, random forest may be a better strategy for modelling biodiesel production because it gets the lowest error among the studied algorithms. Furthermore, random forest can be deployed more quickly because it was found to be insensitive to the amount of regressors used.

Keywords: Biodiesel; Machine learning; Linear regression; Random Forest regression; AdaBoost regression; Artificial neural network.

Paper ID: 101

Congo Red Removal from Aqueous Solution using Magnetic Hemp hurd Biochar Produced through Microwave Pyrolysis

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Abstract

This study investigates the potential of using modified magnetic hemp hurd biochar (MB) for the removal of congo red (CR) from aqueous solution. Biochar, produced via microwave pyrolysis of industrial hemp biomass, exhibited porous structure with an average diameter of 20-30 µm. The findings from the EDS and FTIR studies have substantiated the existence of iron content (~6.5 wt%), and prominent functional groups, such as alcohols, aldehydes or carboxylic acids, alkenes, and esters within the MB respectively. Significant removal of CR removal of 92% was observed under optimal conditions of 120 min, pH 8, and concentration of 0.6 mg/L of MB. After three adsorption-desorption cycles, the composite's removal effectiveness held steady at about 85% for 0.6 g/L of MB dose, suggesting its stability and reusability

Keywords: Magnetic biochar; Industrial hemp; Adsorption; Congo red; Microwave pyrolysis

Paper ID: 102

Effect of Traffic and Vehicular Attributes on on-Road Particulate Exposure

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Abstract

Particulate pollution is a severe environmental threat to human health. In addition, commuters are exposed to higher particulate matter (PM) concentrations due to additional exhaust emissions and soil dust resuspensions from on-road vehicles. The spatiotemporal exposure concentration can be predicted using various factors such as meteorological parameters, traffic parameters, vehicles' physical attributes, and road characteristics. Apart from estimating the PM exposure using meteorological parameters, no such association was established between on-road PM levels and the rest of the factors. Thus, a PM exposure study was carried out along one designated route in Varanasi, India, from January to March 2022. The study aimed to model the effect of traffic parameters and vehicles' physical attributes on on-road particulate exposure concentration. No significant correlation was observed between traffic fundamental parameters and on-road PM concentration. However, the exposure concentration was found to decrease with an increase in traveling speed. The vehicular attributes such as weight, volume, and area were found to have a moderate correlation with the fine (PM2.5) exposure concentration for maximum road segments. Thus, the study can predict the segment-wise on-road PM2.5 exposure concentration with vehicular attributes information.

Keywords: Air Pollution, Particulate Matter, PM2.5, PM10

Paper ID: 103

Behavior of Ferrochrome Sand in the Fresh Characteristics of GGBFS-fly Ash-Based Self-Compacting Geopolymer Concrete

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Abstract

Global warming compels construction sectors to think about eco-friendly building materials like geopolymer concrete (GPC) due to its ability to incorporate waste by-products against cement which is responsible for the reduction of the ozone layer due to the carbon dioxide emission in its production. Added advantages can be achieved if GPC is made self-compacting, called self-compacting geopolymer concrete (SCGC). In SCGC production, fine aggregate takes around 55-60% of the total aggregate volume. To overcome landfill and disposal issues of industrial solid wastes, their usage in the construction field has been encouraged. Ferrochrome slag (FCS) as a waste material is produced about 12-16 million tons annually. Hence, in this study natural fine aggregate (NFA) is replaced with FCS by 0% (control mix), 25%, 50%, 75%, and 100% to prepare ground granulated blast furnace slag (GGBFS)-fly ash (FA)-based SCGC cured under ambient temperature curing. Another control SCGC mix was prepared with only GGBFS and NFA 100% each free from FA and FCS to check the effect of FA addition in GGBFS-based SCGC. All six SCGC mix designs are prepared with four consistent mix parameters like 12M concentration of sodium hydroxide, the ratio of sodium silicate to sodium hydroxide as 2.5, superplasticizer (SP) dosage of 7%, and extra water of 24%. The freshly prepared concrete has undergone various workability tests to examine the filling ability (FLA) (slump flow, T50cm slump flow, V-funnel tests); passing ability (PA) (L-box, J-ring tests); and segregation resistance (SR) (V-funnel at T5minutes). The GGBFS-FA-based SCGC is perceived to be less workable than the GGBFS-based SCGC. Further, the FCS replacement up to 25% yields a better workable mix compared to all other replacements, and a complete replacement of NFA by FCS is not recommended for the GGBFS-FA-based SCGC. It is also realized that a workable SCGC mix can be prepared with waste material around 45% of the total concrete volume.

Keywords: SCGC, GGBFS, Superplasticizer, NFA, Ferrochrome Slag, Fresh properties

Paper ID: 104

Mechanism of Sewage Stabilization in the Single Pond System(s) of East Kolkata Wetland (EKW): A Critical Review

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Abstract

The majority of wastewater from Kolkata city flows through a network of canals within the East Kolkata Wetland (EKW). It undergoes natural treatment within the canals and is further treated in 264 sewage treatment cum fishery ponds situated on both sides of the main sewage canal before being discharged into the river Bidyadhari at Kultigung. Rate of biodegradation in the EKW pond(s) is recorded higher (k = 0.7 day-1) in comparison with in vitro (0.12 day-1) experiments. However, little is known regarding the mechanism of sewage stabilization in the single pond system(s) of EKW. Therefore, a total of 10 literatures (5.26%) were reviewed, out of 190 collected on EKW. It was found that wastewater stabilization in the EKW ponds is attributed to preparation of ponds by the local fishermen and farmers combining scientific and traditional knowledge. This is also influenced by the tropical climate of the area, substantial microbial diversity, organic carbon and nutrient content of the wastewater. It is also influenced by penetration of light deeper into the water column driven by the suspended particulate matter (SPM) dynamics which stratifies and subsequently de-stratifies temperature, pH and DO vertically through the water column. Soil microorganisms present at the soil and water column interface of the EKW pond(s) also significantly contribute in the wastewater stabilization process.

Keywords: East Kolkata Wetland, Ramser Site, Sewage stabilization, Single pond system

Paper ID: 105

Impact of Alkali Activator Types on Fresh Properties of GGBFS-Based Self-Compacting Geopolymer Concrete under Ambient Temperature

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Abstract

Self-compacting geopolymer concrete (SCGC) is the normal geopolymer concrete (GPC) possessing a self-compacting ability. Aluminosilicate minerals and alkaline activator solution (AAS) are the two principal elements that are majorly accountable for the geopolymerization process. Among the precursors available, ground granulated blast furnace slag (GGBFS)-based SCGC mixes exhibit better performance towards both short-term and long-term characteristics. The current study describes the impact of various alkaline activators like sodium hydroxide (SH), potassium hydroxide (PH), sodium silicate (SS), and potassium silicate (PS) in varying proportions on the fresh properties of GGBFS-based SCGC mixes. Nine mix designs were prepared including a control mix with SH and SS as alkaline activators. Four mixes formed with a combination of SS along with hydroxide solutions of sodium and potassium at changing proportions (SH: PH) [(75:25), (50:50), (25:75), (0:100)]. Similarly, another four mixes were proposed with constant SH solution in addition to silicate solutions of sodium and potassium at different combinations (SS: PS) [(75:25), (50:50), (25:75), (0:100)]. Mix proportions were prepared as per laboratory material characterization results based on Indian standards of binder materials (GGBFS), natural coarse aggregates (NCA), and natural fine aggregates (NFA) along with suppliers-provided properties of alkaline activators and superplasticizers. The workability results are interpreted through the filling ability (slump flow, T50cm slump, V-funnel); passing ability (L-box, J-ring), and resistance to segregation (V-funnel at T5minutes) test. The result signifies that SCGC mixes should not be prepared with 100% SH and SS or 100% PH and SS as AAS. SCGC mix with SH and SS: PS (25:75) exhibits the best workability results towards fresh properties of SCGC.

Keywords: SCGC, Sodium hydroxide, potassium hydroxide, Sodium silicate, potassium silicate, Fresh properties.

Paper ID: 107

Municipal Solid Waste Disposal Site Investigation Using Gis: A Case Study in Memari Town, West Bengal

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Abstract

The municipal solid waste per capita is almost 200 gm/day in West Bengal (2020–21). But only a few grams of waste per capita are carried to the final disposal site, whereas the rest is disposed of locally. Solid garbage, including plastic, causes severe damage if not disposed of properly. Improper treatment and management of small industries, hospitals, and domestic waste may pose a threat to the local environment and society. In the past few decades, solid waste, especially plastic, has become a real threat to the environment and ecosystem globally. To minimize such an impact, the related authorities have taken various measures, including banning plastic use, but still, it is in alarming quantity. Therefore, we have to rethink its management and proper disposal. In Memari town, the existing two sites of municipal disposal have both health and environmental issues. Therefore, finding a new, suitable location for the disposal site is an urgent need. Based on the Multi-Criteria Decision Analysis (MCDA) in the Geographical Information System application with ground validation, six suitable sites are identified from 17% of the suitable area. These six sites are proposed for dumping solid waste due to their minimum impact on the surrounding environment.

Keywords: Solid waste; GIS; MCDA.

Paper ID: 108

Performance and Mechanism of Vertical-Baffled Horizontal Sub-Surface Constructed Wetland for Rice Mill Wastewater Treatment

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Abstract

Despite the widespread use of constructed wetlands (CWs) in the treatment of various industrial wastewater, there is a dearth of research assessing its efficacy in treating rice mill wastewater (RMW). In this study, a vertical-baffled horizontal subsurface constructed wetland (HSSF CW) planted with *Canna indica* was developed which on average resulted in 89%, 65% and 95% of chemical oxygen demand (COD), lignin and phenol removal, respectively, from synthetic RMW (initial COD: 1980 ± 26 mg/L, lignin:150 ± 4 mg/L and phenol: 15 ± 0.2 mg/L). Utilising a vertical baffled HSSF CW resulted in a significant increase in the flow path length for wastewater treatment, which increased the contact duration of the wastewater with the bed media and rhizosphere and improved the treatment efficiency. A combination of sand, vermicompost, and lightweight expanded clay aggregate (LECA) was used as the bed media in order to promote the degradation of lignin and maintain optimal hydraulic conductivity within the system. The implemented HSSF CW demonstrated reduced spatial requirements and maintenance demands, as well as improved treatment efficiency for less biodegradable rice mill effluent. The present work is the first study of its kind.

Keywords: Constructed wetland; rice mill wastewater; phytoremediation; lignin; LECA

Paper ID: 109

A Sustainable 3D g-C_3N_4/WS_2 Photocatalyst for Treating Pharmaceutical Wastewater

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Abstract

Heterogeneous photocatalysis is recognized as one of the most promising approaches for sustainable wastewater treatment. Two dimensional (2D) semiconductors with quasi-resistance-free lateral charge transfer pathways and tunable optoelectronic characteristics like polymeric graphitic carbon nitride (g-C3N4) hold enormous potential as visible light-active photocatalyst for eliminating a wide range of pollutants from aqueous matrices. However, the photocatalytic activity of pristine g-C3N4 is not satisfactory from the viewpoint of practical application. Among the numerous tactics investigated by the global scientific community to overcome the fundamental issues associated with the widespread use of g-C3N4, constructing heterojunctions is recognized as one of the most promising options. For instance, the amalgamation of 2D g-C3N4 nanosheets with other 2D semiconductors like tungsten disulfide (WS2) can significantly improve the visible-light harvesting capacity and therefore the photocatalytic activity of the resulting heterojunction catalyst. However, such powdery heterojunction photocatalysts usually agglomerate in aqueous phase, and are also difficult to retrieve following decontamination. Herein, we have therefore constructed a 3D g-C3N4/WS2 self-supporting composite via a facile and scalable freeze-casting approach, and systematically investigated its photocatalytic activity under visible light irradiation for degradation of tetracycline (TC), a polyketide antibiotic. Approximately 91% degradation of TC after 2 h of visible-light irradiation. However, the introduction of ascorbic acid into the reaction medium results in less than 44% dissociation, which indicates that superoxide anion is the major ROS involved in driving the photocatalytic degradation process. Further, the photocatalysis end-products are potentially non-toxic, as inferred through a resazurin-based cell viability assay. Additionally, the reusability of the photocatalyst was assessed by conducting four consecutive photocatalytic experiments with the same batch of the photocatalyst. Although there was a minor drop-in photocatalytic activity at the end of the fourth cycle, the 3D material can be easily recovered for persistent usage. Overall, the results of this study suggest that 3D g-C3N4/WS2 warrants further widespread consideration for treating wastewater contaminated with emerging pharmaceutical substances and their residues.

Keywords: g-C3N4/WS2; photocatalysis; monolithic photocatalyst; tetracycline; wastewater

Paper ID: 110

An Empirical Study of Sewage Issues and Management Systems in a Rural Village of India

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Abstract

Village sewage systems can differ significantly depending on the location, size, state of the local economy, and local government policies. Rural communities frequently need better-built or unofficial sewage systems compared to urban regions. Some common sewage systems are Open Drainage Systems, septic tanks, Pit Latrines, Community sewage systems, Eco-friendly solutions, and some government initiatives. It's important to remember that a range of factors, such as resource availability, area geography, community preferences, and political legislation, affect the choice of a sewage system. As the importance of sanitation and environmental conservation is recognized, efforts are being made in rural areas to develop more effective and sustainable sewage solutions to promote public health and save the environment. This paper studies the sewage problems and proposes solutions for Pachokara Village in Jewar Block in Gautam Buddha Nagar District of Uttar Pradesh State, India. It is located 15 km South of the District headquarters and belongs to Meerut Division of Noida.

Keywords: Sewage Management, Rural village, Resource Map, Transect Walk, Seasonal Calendar, Problem tree.

Paper ID: 112

A Comprehensive Evaluation of Groundwater Vulnerability and Pollution Potential in the Upper Swarnrekha River Watershed - with Emphasis on Lineament Density

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Abstract

To ensure the protection of groundwater resources, it is essential to conduct a comprehensive pollution risk assessment and identify vulnerable zones in the weathered rock aquifer of the Upper Swarnrekha River watershed. An additional parameter Ld (lineament density) was incorporated in the DRASTIC and pesticide-DRASTIC (P-DRASTIC) models to check the control of structural features on the overall groundwater vulnerability. To enhance the reliability and validate the outcome of models, seasonal groundwater level fluctuation and the heavy metal pollution index (HPI) were introduced. Single parameter sensitivity analysis reveals that for modified models, lineament density is the most effective parameter, justifying the importance of structural features in hard rock aquifers. Results of DRASTIC and DRASTIC-Ld indicate that urban and industrial regions are at high risk to contamination. Conversely, P-DRASTIC and P-DRASTIC-Ld suggests that along with urban and industrial regions, agriculture areas show high susceptibility to contamination. The study region is more susceptible to contamination in the post-monsoon compared to the pre-monsoon, which was further supported by higher HPI values of >100. Despite shallow groundwater, exercising caution in construction within susceptible zones is essential. Lineament density in hard rock aquifers should be prioritized as it significantly influences the groundwater water potential of the region.

Keywords: Groundwater vulnerability; pollution potential; heavy metal pollution index; lineament density

Paper ID: 113

Sustainable Bioremediation Approaches for Petroleum Hydrocarbon Contaminated Agricultural Land: A Review

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Abstract

Petroleum hydrocarbons, are the organic molecules comprising of carbon and hydrogen, are derived from petroleum. They are common environmental pollutants brought on by human activities such as oil exploration, accidents and oil spills during transportation, leakage from storage tanks etc. Over the past century, the use of petroleum products in daily life enhanced the production of petroleum waste for refineries and petrochemical industries. Improper management of petroleum waste led to hydrocarbon contamination towards terrestrial as well as aquatic system. An estimated 35 million barrels of crude oil are carried annually across the oceans, endangering the marine species all over the world by contaminating the aquatic ecosystem through spills and breaches. Agricultural land is not immune to the effects of this contamination, which also include harm towards the soil, water, and air pollution. Lower soil fertility and productivity may result biologically from reduced microbial activity, variety, and composition. Additionally, crop output can be negatively impacted by hydrocarbon pollution, which has an effect on the agricultural industry's economy. There are several ways for used petroleum hydrocarbons to degrade, including physical, chemical, and biological procedures. Further, by the utilization of microbes, bioremediation removes toxins and pollutants from the environment. It can be achieved by Bio-pile, Bio composting, Landfill, Bioventing, phytoremediation etc. Through a number of mechanisms, contaminants trap by acting as filters or in the tissue. Additionally, pollution may have detrimental consequences on the environment and public health, highlighting the necessity for effective remediation techniques to address the issue. The implementation of biodegradation strategies may pave the way for treatment of hydrocarbon contaminated soil in an ecofriendly manner.

Keywords: crude oil; petroleum hydrocarbon; bioremediation; bacteria; solid waste management

Paper ID: 114

Exposure to Particulate Matter and its Association with Respiratory Deposition Doses Among Outdoor Exercisers in Agra city Over a Semi-Arid Region

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Abstract

Agra has been identified as one of the most polluted cities in the world. However, it was pointed out that the unavailability of health risk estimates based on long-term data for Indian cities has been pointed out as a hurdle in conducting a proper assessment. Regular exercise improves physiological processes and yields positive health outcomes. However, it is relatively less known that particulate matter (PM) exposure during outdoor exercises may increase respiratory health problems depending on PM levels. In this study, the respiratory deposition doses (RDDs) in the head airway (HD), tracheobronchial (TB), and alveolar (AL) regions of PM2.5, were estimated in adult males and females in urban outdoors and within house premises using PM samples collected at Technical College of Dayal Bagh Educational College, Dayal Bagh, Agra. The highest RDDs for different regions were found higher in the month of January compared with the remaining months. Respiratory deposition dose in the alveoli region of the lung was found to be considerable (0.26 µg/ min in females and 0.31 µg/ min in males) indicating the need for understanding the role of these particles in posing a health risk.

Keywords: Air pollution; Particulate matter; Exposure; Health risks assessment; Agra.

Paper ID: 118

Solar Photocatalytic Treatment for the Degradation of Ciprofloxacin using Modified TiO_2

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Abstract

There is a pressing need for larger-scale healthcare facilities due to the exponential growth of the world's population, leading to a significant increase in the usage of antibiotics. Ciprofloxacin (CIP) is one such persistent pharmaceutical contaminant that requires cutting-edge technology like advanced oxidation process (AOP) for its removal from wastewater. This work focuses on the examination of the solar photocatalytic degradation of CIP. Modified TiO2 catalysts were prepared by mixing TiO2 and Graphene Oxide (G) in various proportions such as 2%, 3%, 4%, 5% and 6%. Among the different combinations, the 5% G (TG5) catalyst exhibited uniform size, crystallinity, lower band gap energy of 2.8 eV and improved visible light absorption. Hence, TG5 was used for solar photocatalytic degradation studies. A 69.7% CIP degradation efficiency was attained within 120 min at an optimum pH of 8.4 and an initial CIP concentration of 3 mg/L and CIP preloaded TG5 of 1 g/L. The TG5 catalyst without CIP preloading exhibited enhanced degradation efficiency of 81.1% for CIP and 78.1% for TOC at 120 min.

Keywords: Ciprofloxacin; Wastewater Treatment; Advanced Oxidation Process (AOP); Solar photocatalysis; TiO_2.

Paper ID: 119

Assessment of Riverbank Filtration at Rushikulya River in Odisha, India

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Abstract

An age-old and cost-effective water treatment method is drawing river water through the aquifer adjacent to the river. This filtration process of drawing of water from the river, lake, etc. through the hydraulically connected aquifer is termed as riverbank filtration (RBF). Improvement in the quality of river water filtered through a 31-m thick sand-gravel unconfined aquifer at three infiltration wells (IWs) surrounded by Rushikulya River, in Badamadhapur (Odisha, India), was studied. Distances between river and the infiltration wells are 27 (IW1), 45 (IW2) and 100 m (IW3). Water from the river gets mineralized as it flows through the aquifer to the infiltration wells. The water from IWs showed 1.9 – 2.3 log reduction of turbidity in monsoon, 0.5 – 1.4 log reduction of turbidity in pre-monsoon and 1 – 1.4 log removal of turbidity in postmonsoon. Total coliform was reduced by 95.6 – 98.8% in IW1, 98.1 – 99.6 % in IW2 and 98.8 – 100 % in IW3. Similarly, UV-abs in the Rushikulya River was in the range from 0.095 to 0.16 cm-1. UV-abs in the IWs was in the range of 0.018 to 0.05 mg/L. Higher removal efficiency of pollutants was observed at the infiltration well located at a longer distance from the river.

Keywords: River bank filtration; Infiltration well; Rushikulya River; Turbidity; Total coliform

Paper ID: 120

Microwave Coupled Oxidation for Soft Drink Industry Wastewater Treatment

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Abstract

Soft drink industry wastewater (SDIW) is a challenging environmental concern due to its complex composition with high total organic carbon (TOC), total phosphate (TP), and total nitrogen (TN). This study compared microwave oxidation (MWO) and conventional oxidation method for the treatment of SDIW. The results indicated a superior efficiency of MWO in removing TOC, TP, and TN from SDIW compared to conventional oxidation. In MWO, the TOC removal from synthetic and real SDIW were 33.6% and 23.7% respectively in 15 min. The removal efficiency increased to 82.2% and 87.8% respectively in 60 min. The TN and TP removal efficiency were 82.16 % and 48.60 % for synthetic SDIW and 87.71 % and 48.90 % for real SDIW. In conventional oxidation TOC removal limited to 22.71% and 23.70% for synthetic and real SDIW respectively. The TN and TP removal efficiency were 39.63% and 15.50% for synthetic SDIW and 17.15% and 13.48% for real SDIW. The reaction kinetic analysis unveiled a modified first-order kinetic equation for TOC removal by MWO, with k and coefficient of determination, R2 values 0.086 min-1 and 0.95 for real SDIW and 0.082 min-1 and 0.93 for synthetic SDIW respectively. This comparative study provides valuable insights into the potential of MWO as an efficient and sustainable treatment method for complex SDIW.

Keywords: Microwave oxidation; Soft drink industry wastewater; Advance oxidation processes; Conventional oxidation; Wastewater treatment.

Paper ID: 121

Extraction of Value-Added Type-I Collagen from the Skin Waste of Rohu Fish (*Labeo rohita)*"

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Abstract

Utilizing waste generated from the fish processing in homes and industries is expected to be an environment friendly operation. The utilization strategy demands recovering value-added products from fish waste since fish waste is the potential source of valuable proteins, minerals, lipid-rich compounds, and other substances. Type-I collagen has been shown to be abundant in fish skin, bones and scales. Collagen is a major structural protein that accounts for around 25% of all the protein in vertebrates. Among various biomaterials, fish collagen offers superior biocompatibility, extraction ease and non-antigenicity. Besides having less infection emergence and higher religious acceptability, it is more biocompatible and ecologically friendly than mammalian collagen. The insoluble nature, biodegradability, porosity, and fibrous structure of collagen make it a suitable material for coating pharmaceuticals and active food components. The current study focused on the extraction and characterisation of acid soluble collagen from the skin waste of Rohu fish (*Labeo rohita*). SEM, UV spectra, and FTIR spectroscopy were used to characterize the type-I collagen extracted from the fish skin.

Keywords*: Labeo rohita*; Skin waste; Biomaterial; Collagen; FTIR

Paper ID: 122

Addressing the Climate Change Through CO_2 Sequestration of GGBFS Added Concrete

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Abstract

The rising atmospheric CO2 concentration, reaching nearly 40 billion tonnes every year, has prompted widespread global concern about greenhouse gas (GHG) emissions leading to a severe global warming. Carbon-sequestered concrete (CSC) emerges as a promising solution for addressing climate change by utilizing CO2 on a significant scale, fostering a sustainable future in the construction industry. With the aim of harnessing this capacity, the authors are evaluating and enhancing the carbon sequestration of different concrete types using a state-of-the-art CO2 mixing and CO2 curing facility. This sustainable concrete demonstrated a momentous overall CO2 uptake of 23% which includes enhanced CO2 uptake of more than 13% with improved progressive strength and reduced porosity due to densification and microstructure enhancement. Integrating Ground Granulated Blast Furnace Slag (GGBFS) into conventional concrete could mitigate a substantial portion of approximately 4 billion tonnes of global CO2 emissions annually resulting from the calcination processes in cement manufacturing facilities. By doing so, this approach contributes to advancing India's ambitious goal of achieving carbon neutrality by 2070.

Keywords: Carbon Sequestered Concrete (CSC); CO2 Uptake Capacity; Ground Granulated Blast Furnace Slag (GGBFS); CO2 Mixing; Thermo-Gravimetric Analysis (TGA);

Paper ID: 123

Electrocoagulation based Technology for Remediation of Arsenic and Fluoride from Groundwater: An Environmental Friendly and Economically Sustainable Option

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Abstract

Ground water is the largest source of drinking water for more than 80% population around the world especially in southeast Asian countries like India and Bangladesh. However, groundwater of many regions across the globe is contaminated with arsenic and fluoride. Amongst the different technologies, adsorption and coagulation-filtration based technologies have shown good performances for domestic (point of use) applications. However, these technologies are not perfectly suitable for community application due to their high treatment time and high treatment cost. The electrocoagulation (EC) has similar mechanism however in EC, coagulant is generated in-situ. In the present study, an electrocoagulation technology has been developed through subsequent scale-up of the laboratory based studies to intermediate pilot scale and then to real field for community application. The technology has shown good performance over wide range of arsenic (50-600 ppb) and fluoride (3-25 ppm) concentrations. The arsenic laden sludge from the EC process has been managed by immobilizing it into plastic paver blocks and bricks. Further, the life cycle assessment of the present field scale technology has shown lower emissions than aluminium hydroxide/oxide adsorbent based technology. Therefore, EC based technology has good potential to become a low cost environmental friendly technology for remediation of arsenic and fluoride contaminated water at community scale.

Paper ID: 124

Recycling of Aluminium Dross in Smelter Plant of NALCO

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Abstract

Aluminium smelters play a vital role in the global production of aluminium, yet they generate significant hazardous waste streams, posing environmental and health risks. One of the important hazardous wastes generated in the process is Aluminium Dross (White dross). This extended abstract outlines key aspects related to recycling of white dross in Smelter Plant, NALCO. The objective of this paper is to give an overview about the white dross generation, recycling and disposal in Smelter Plant, NALCO situated at Angul (Odisha), India.

Keywords: Hazardous Waste; Dross; Smelting; Recycling; Sustainable.

Paper ID: 126

Role of Plants in Treating Textile Effluents Using Constructed Wetlands

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Abstract

The current study evaluated the effect of plants on pollutant removal in horizontal constructed wetlands (HCWs) treating textile dyeing wastewater containing 50 mg L-1 Reactive Yellow 145 dye. Two HCWs were employed; one was unplanted, and another was planted with *Typha angustifolia*. Both HCWs were operated in continuous mode with a hydraulic retention time of 3 days. The pollutant removal efficiencies in planted and unplanted HCWs were 91% and 87% of colour, 73% and 56% of COD, 67% and 57% of NH4+-N, respectively. Statistical analysis showed that effluent colour, COD and NH4+-N values in HCWs were significantly different ($p<0.05$), and planted HCW exhibited superior pollutant removal performance.

Keywords: Constructed Wetlands; Plants; Textile Dyeing Wastewater; Colour

Paper ID: 127

Performance Evaluation of Different Carriers for Wastewater Treatment in a Sequencing Batch Moving Bed Biofilm Reactor

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Abstract

There are different biological wastewater treatment options are available. Biological processes are two types i.e., suspended growth process and attached growth process. A recent innovation in this realm is the sequencing batch moving-bed biofilm reactor (SBMBBR), which combines moving bed biofilm reactor (MBBR) and sequencing batch reactor (SBR) processes. This system harnesses the benefits of attached growth, suspended growth, and SBR systems, offering advantages such as operational simplicity, flexibility, stable performance, absence of sludge return, resistance to impacts, and reduced reactor volume. In this study, the efficacy of carriers i.e., ceramic rings and K1 biofilter in removing nitrate in anoxic and anaerobic conditions. Ceramic rings have a structure of dense holes where can live a lot of good vital bacteria, such as nitro-bacteria. A K1 biofilter is a type of biological filtration system used in environmental engineering to treat wastewater and remove organic and inorganic pollutants from water. Under anoxic conditions, the maximum nitrate removal was 93.9% at contact time of 90 min for Ceramic rings and 78.9% at contact time of 75 min for K1 Biofilter. Similarly under anaerobic conditions, the maximum nitrate removal was 72.4% at contact time of 105 min for Ceramic rings and 66.7% at contact time of 120 min for K1 Biofilter.

Keywords: Sequencing Batch Moving Bed Biofilm Reactor (SBMBBR), Nitrate, Ceramic Rings, K1 biofilter

Paper ID: 128

Comparative Assessment of Softwood Biochar via Various Thermochemical Conversion Technologies: A Physicochemical Characterization Study

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Abstract

Biomass-derived carbon holds immense potential not only for environmental applications but also as an energy storage material. This study investigates and compares the physicochemical properties of softwood biochar produced through three distinct heat treatment methods: Thermocatalytic Reforming (TCR), Tube Furnace Pyrolysis (TFP), and a combination of Hydrothermal processing and Tube Furnace Pyrolysis. The primary objective of this work is to provide a fundamental reaction mechanism of char by adopting appropriate methodologies for biomass heat treatment to maximize the versatility of char produced. Using locally sourced softwood, the physicochemical properties of the resulting hydrochars and biochars we observed through Scanning Electron Microscopy (SEM) for surface morphology, Brunauer-Emmett-Teller (BET) analysis for surface area determination, Fourier-Transform Infrared Spectroscopy (FTIR) for functional group identification, and X-Ray Diffraction (XRD) for crystalline structure analysis. As biomass resources vary globally, and regional conditions affect the quality of char production, this investigation focuses on a specific region (Edmonton-Canada), offering valuable insights into the selection of suitable biomass heat treatment techniques. The significance of this study lies in its potential to elucidate the impact of heat treatment methodologies on char properties and, subsequently, identify how it can serve as a multifaceted material, addressing both environmental and energy-related challenges. The findings of this study also have the potential to drive innovations in the field of energy storage, soil and wastewater remediation, solid fuel applications, etc. promoting the adoption of biomass-derived hydrochar and biochar as versatile and eco-friendly resources for intended applications.

Keywords: Biochar; Heat treatment methods; physicochemical characteristics; sustainable materials

Paper ID: 129

Assessment of Surface and Ground Water Quality of Bhawanipatna Town Using Water Quality Index

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Abstract

The present paper deals with assessment of physico-chemical parameters of surface and ground water of Bhawanipatna town of Kalahandi district, Odisha. Seasonal changes in physical and chemical parameters such as pH, hardness, iron, total dissolved solid, turbidity, fluoride, chloride were observed and the WQI (Water Quality Index) was calculated for assessing the quality of water. Some of the parameters fall within the limits of IS: 10500-2012 guidelines. But few parameters i.e. turbidity and iron exceeded the permissible limits. The values of Water quality index indicated that the quality of water was very poor for the ground water and was unsuitable in case of surface water for drinking and domestic purposes in monsoon and post monsoon period. But the quality of both surface and ground water were observed to be better in winter and summer season than monsoon and post monsoon in the study area. The present study suggests that necessary treatment is required for getting good quality water for consumption.

Keywords: physico-chemical parameters, surface water, ground water, Water Quality Index, IS: 10500

Paper ID: 130

Smart Green Data Center for Harnessing IoT with Sustainable Operations

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Abstract

Data centers (DCs) have emerged as the cornerstone of modern information infrastructure, driven by the continuous global surge in data generation and consumption. These facilities grapple with significant challenges related to energy consumption, operational efficiency, and environmental sustainability as their operational scale continues to expand. Due to its complexity and rapid evolution, traditional data center management solutions need help to keep pace with the dynamic demands of the digital transformation era. Given the urgency of these issues, we propose an innovative and comprehensive research project incorporating the Scheduling Control Engine (SCE) and Intelligent Refrigerating Engine (IRE). This initiative seeks to address current challenges while ushering in a new era of data center sustainability. Leveraging the transformative potential of the Internet of Things (IoT) and artificial intelligence (AI), two cutting-edge technologies form our strategy's bedrock. By synergizing these realms of technological innovation, we aspire to create a groundbreaking solution poised to revolutionize the data center industry, setting new benchmarks for operational excellence, environmental responsibility, and energy efficiency. Through this monumental endeavor, we envision redefining data center management and laying the groundwork for a more dependable and sustainable digital future.

Keywords: Green Data Center (GDCs); Internet of Things (IoT); Artificial Intelligence (AI); Scheduling Control Engine (SCE); Intelligent Refrigerating Engine (IRE); Machine learning (ML).

Paper ID: 131

Investigation of Electrolysis with Macrophyte Assisted Verm filter (E-MAVF) for Different Effective Electrodes for Domestic Wastewater Treatment

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Abstract

Electrolysis has been used to improve the nutrient removal in biofilter system. However, the insufficient electron donor formed with the help of electrode limits the process of phosphorus and nitrogen removal. In this study, electrolysis with macrophyte assisted Verm filter system (E-MAVF) was developed for the treatment of domestic wastewater. To address the issue of insufficient electron, different electrodes used for investigating made of scrap iron, graphite and carbon felt. Vertical E-MAVF systems were constructed using PVC material, featuring Canna Indica as the macrophyte and Eisenia fetida earthworms to treat synthetic domestic wastewater at a hydraulic loading rate of 0.6 m3/m2/d. The electrode of scrap iron showed highest removal efficiency of COD of around 91.1% as compared to 82.4% graphite plate and 86.7% carbon felt foam. The improvement in removal of total nitrogen (TN) and total phosphorus (TP) also observed in scrap iron due to the formation Fe3+ and trapping FePO4 respectively. The order of TN and TP removal in different electrode was as Scrap iron > Carbon felt foam > Graphite plate. Thus, this study provides optimal electrode material for treatment of domestic waste in decentralized form.

Keywords: Verm filter; *Canna indica;* Electrolysis; *Eisenia fetida*; Macrophyte assisted Verm filter (MAVF).

Paper ID: 132

Influence of Curing Conditions on Self-Compacting Geopolymer Concrete Properties

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Abstract

Geopolymer concrete (GPC) is an alternative to conventional hydration-based concrete produced using waste materials. Nowadays, research on self-compacting geopolymer concrete (SCGC) has attained global concern as it carries both the aspect of GPC and self-compacting concrete (SCC), without involving mechanical compaction to improve concrete density. The curing process of the freshly prepared GPC significantly affects the geopolymerisation mechanism, influencing hardened concrete characteristics. Hence, the current manuscript contains a thorough study on the effect of varying curing conditions like ambient, heat, and external exposure (summer and winter) on the mechanical and water transportation SCGC characteristics. Thus, eight mixes, four ground granulated blast furnace slag (GGBFS)-based and four GGBFS-fly ash (FA)-based mixes were prepared. All SCGC mix designs are prepared with four given mix parameters like 12M concentration of sodium hydroxide, the sodium silicate to sodium hydroxide ratio of 2.5, superplasticizer (SP) dosage of 6%, and extra water of 24%. The fresh property investigation includes filling ability, passing ability, and segregation resistance tests. The hardened concrete property evaluation includes both ultrasonic pulse velocity (UPV) and rebound hammer (RH) tests under non-destructive (NDT) mechanical assessment, compressive strength, and split-tensile strength under destructive (DT) mechanical and water absorption test under durability characteristics estimations. The test results confirm that the GGBFS-FA-based SCGC is noticed to be less workable than the GGBFS-based SCGC. Compared to ambient curing, heat curing in GGBFS-FA-based mixes shows greater strength development than sole GGBFS-based mixes. Heat curing and winter external exposure curing exhibit the highest and lowest strength development among all the adopted curing methods. Both ambient and heat curing are feasible to resist water absorption in SCGC mixes. The durability test results support the mechanical characteristics observations.

Paper ID: 133

Experimental Prediction of Air Pollutants dispersion in an Simplified Built Environment.

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Abstract

In a urban built environment numerous issues occur due to air pollution. The wind hazard mitigation, air contamination and transportation near and far from buildings, wind flow direction. The above-highlighted problems and their solution are evident in a sustainable societal structure. The investigation of the abovementioned issues lies with one of the extremely promising technologies, that is, experimental aerodynamics and wind tunnel technology. Such a investigations may bring new insight to understand the effects of polluted wind flow coming from different directions towards a building and the response of the building in an urban built environment. In this study the experimental prediction of air pollutions dispersion effects on a simplified built environment where studied. The target building which is kept at the Centre of the built environment has been oriented at different wind directions (00, 22.50, 450) and Three different wind speeds such as 10 m/s, 15 m/s and 20 m/s considered for the study of air pollutant dispersion. The experiment has been conducted in a subsonic wind tunnel to verify the numerically obtained pressure coefficients (Cp) over a target building. Results revealed that the target buildings are under a severely adverse pressure gradient which might lead to the hazardous situation and the higher turbulence is present in the wake zone than near the wall. In case of 450 orientations, due to symmetric nature of flow behind the rear surface, the Cp variations are negative because of the pure suction effect of wind. These results shows the air pollutants are concentrated more near the building wall of the wake zone which is leads very uncomfortable situation in the built environment.

Keywords: Aerodynamics, computational fluid dynamics, turbulence flow, built environment, pollutant dispersion.

Paper ID: 134

Comprehensive Evaluation of Groundwater Quality Status Using GIS Based Multivariate Statistical Techniques Approaches: A Case Study of the Anugul District, Odisha

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Abstract

This research presents a comprehensive evaluation of groundwater quality status in the Angul district of Odisha, India, utilizing Geographic Information System (GIS)-based multivariate statistical techniques. Groundwater is a vital resource for drinking and agricultural purposes in the region, and its quality is critical for sustaining human health and agricultural productivity. The study employs various statistical methods, including Principal Component Analysis (PCA), Cluster Analysis (CA), and Geostatistical Analysis, to assess the spatial distribution and quality of groundwater parameters such as pH, electrical conductivity (EC), total dissolved solids (TDS), major ions, and trace elements. The data, collected from multiple groundwater sources, are integrated into a GIS platform to create spatial maps and identify the potential zone of contamination. The results reveal spatial heterogeneity in groundwater quality, highlighting areas of concern with elevated levels of specific contaminants. PCA identifies dominant factors influencing groundwater quality, while CA categorizes sampling sites into distinct quality clusters. Geostatistical analysis provides insights into spatial patterns and potential areas at higher risk. This research contributes to a better understanding of the groundwater quality dynamics in the Angul district, enabling informed decision-making for sustainable water resource management. The GIS-based approach offers a powerful tool for policymakers, water resource authorities, and researchers to identify priority areas for intervention and formulate strategies to improve groundwater quality, ensuring the health and well-being of the local population and the sustainability of agriculture in the region.

Keywords: Groundwater; GIS Interpolation; Spatial Variations; Water Quality Index; Multivariate analysis.

Paper ID: 137

Cadmium (II) Removal in a Electrocoagulation Reactor: Parametric Optimization by Response Surface Methodology

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Abstract

In this study, the process of electrocoagulation was opted for to optimize for higher removal efficiency of cadmium from wastewater with low energy consumption. In this experiment, the process of electrocoagulation was employed using iron electrodes in a cylindrical reactor for the removal of cadmium from an aqueous solution. Response surface methodology (RSM) for a four-factorial central design (CCD) was applied to study the effects of process parameters on removal efficiency and energy consumption. Maximum removal efficiency of 96.2% was attained on optimization at an applied current of 0.35 A, an initial cadmium concentration of 35.5 ppm, an application time of 9 min, as 0.78 W-hour per gram of Cd (II) removed. With the help of the obtained 3-D plots, the interaction between the process variables was evaluated. By analyzing the variance (ANOVA), the generated models were validated. The study shows that electrocoagulation can be used as a low-cost, efficient, and promising alternative to conventional technologies used for the removal of Cd (II).

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Keywords: cadmium removal; central composite design; heavy metals; energy consumption; electrocoagulation

Paper ID: 138

Development of Alkali Activated Mortar Using Alternate Alkali Activator

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Abstract

In a Geopolymer is a novel binding material produced from the reaction of fly ash with an alkaline solution. Geopolymers, an alternative binder based on fly ash (a fine waste collected from the emissions liberated by coal burning power stations) that is activated by alkaline activators plays a fundamental role in geopolymerisation. Sugarcane bagasse is an agricultural waste that can be potentially used as natural silica resources. Natural silica claimed to be safe in handing, cheap and can be generate from cheap resource. Sugarcane bagasse ash is also rich sin aluminosilicate source, which is a primary requirement for the geopolymer concrete. This study represents an alternate activator solution sugarcane bagasse ash (SCBA) instead of commercially available sodium silicate solutions.

Keywords: GGBS, SCBA, alternate alkali activator, alkali activated mortar

Paper ID: 139

Study the Behaviour of Corrosion and Microstructural Properties of AAC and OPC

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Abstract

Alkali Activated Concrete (AAC) has a lot of potential as a more long-term alternative to ordinary Portland cement (OPC). The AAC was prepared from fly ash, ground granulated blast furnace slag (GGBS) with Sodium hydroxide (NaOH) and Sodium Silicate (Na2SiO3) solutions. The concentration of NaOH varies to 10M, 12M, and 14M, and all the specimens were subjected to accelerated corrosion, to perform the non-destructive test after the corrosion of the steel rebars, and to compare the strength and corrosion properties with AAC and OPC. The ratio of sodium silicate to sodium hydroxide was taken as 2.5 and the solution-to-binder ratio was taken as 0.5 and 0.45 and grade of OPC as M30 and M35. Half-cell potential measurements were conducted on G30 and G35 AAC specimens with different molarities and solution to binder ratio and compare with M30 and M35 grade of concrete. Under the experimental circumstances of this study, reinforced fly ash GGBS-based AAC samples show polarisation resistance values equivalent to Portland cement-based corroding systems. The mass loss of corrode steel rebars was 10%. The probability of corrosion of OPC and AAC is almost identical but due to environmental concern and low cost we can use AAC instead of OPC.

Keywords: Alkali-Activated Concrete; Ordinary Portland Cement; Sodium Hydroxide; Sodium Silicate; Half-Cell potential.

Paper ID: 140

Assessment of Personal Exposures to Fine, Ultrafine and Black Carbon Particles to Highway Toll Plaza Workers in India

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Abstract

Air pollutant emissions at toll plazas are expected to be different than at a normal free flowing traffic environment because of stop and go movement of the vehicles. This study therefore aimed at investigating the personal exposure of workers at a toll plaza on a busy national highway in India. Higher mean concentrations were observed inside the toll booth compared to outside for BC (30.82 µg m^{-3} vs. 12.30 µg m^{-3}), $PM_{2.5}$ (152.26 µg m^{-3} vs. 136.65 µg m^{-3}) and UFP (11312.8 pt cm^{-3} vs 6182.98 pt cm^{-3}). All pollutant concentrations were higher during evening hours than in the morning hours. Positive associations were found between traffic volume and all pollutant concentrations and negative associations were observed for solar radiation and boundary layer height with pollutant concentrations. Additionally, it was found that the health risk of toll workers was higher (RQ range: ~0.4-7.6) than the prescribed limit (RQ<1). The present study demonstrates that there is a need to control personal exposure to pollutants in the workplaces, especially with traffic proximity.

Keywords: BC; PM2.5; UFPs; Spearman correlation; health risk assessment

Paper ID: 141

Demand Side Management (DSM) by Energy Efficiency in Operation and New Technology to Reduce GHG Emission under the Climate Change Mitigation in Pharmaceutical Industries- Case Study

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Abstract

India is the production center of generic medicine and ranked third in pharmaceutical production and supplies over 50% of global demand. This pharma market expected to raise in next decade and because of expansion, de-bottlenecking and supply demand looking for opportunity to reduce production cost without affecting yield or quality of finish product. Pharmaceutical industries are energy intensive and around 60% energy need is fulfill by importing electricity from grid and balance energy for process heating is supplied by oil or natural gas. The challenge of maintaining high product quality while reducing carbon footprint and operating cost can be met through demand side management (DSM) by energy-efficient technologies and energy-efficiency operation practices which may offer various benefits, such as reduction in utility operation cost, effective utilization of equipment for current production and also for future expansion, minimization in losses and increased production due to reliable supply of utilities. In this paper will discuss various opportunities to conserve electrical energy and reduce GHG emissions in pharmaceutical industries through practically feasible operation practices, products and concepts.

Keywords: de-bottlenecking; carbon footprint; refrigeration cycle; CO_2 emission; Set-point.

Paper ID: 142

Inconsistent Air Pollution Data, Haphazard Industrial Growth, a Challenge for Healthier Air Purity Index for Jaipur City

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Abstract

As urban population is increasing in cities and towns due to rapid urbanization, migration, higher employment opportunities it has also increased the number of vehicles in cities along with haphazard industrial growth. Post covid trend of having individual vehicles rather using mass transportation has also aggravated the problem of air pollution. As per macrotrends estimate Jaipur city has more than 4.1 million population in 2023. The city is further divided into 8 zones which are densely populated. Lancet study 2020 about Jaipur air pollution situation is very alarming. On the other side only 9 air pollution monitoring stations out of 931 operating stations throughout India are available under National Air Quality Monitoring Programme by Central Pollution Control Board. In the present study monthly data for all 9 stations was collected for the year 2020 to 2022. Inconsistent data was difficult to address the higher concentration zones. Air Purity Index (API) a composite indicator of air pollution concentration of NO2, PM etc was calculated which fluctuated from 2.4 to 3.6. The lower the value of API the better the area was. The hospital data of asthma and bronchial diseases substantiated the API. The study will help urban planners for future development.

Keywords: Air Pollution, Air Purity Index, NO2, Suspended Particulate Matter, PM2.5

Paper ID: 144

Evaluation of the Efficiency of Dosage for Different Coagulant in Greywater for Local Reuse

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Abstract

Coagulation is an economical and preferable treatment of waste water. In this presented study a comparison between conventional coagulant alum and dried banana peel powder has been carried out. The experiments were conducted on greywater sample collected from inlet sample of Manipal University Jaipur (MUJ) Sewage Treatment Plant (STP). The STP treats the greywater generated from academic building which includes wastewater from toilets, cleaning of floor, drainage of labs and effluent of water coolers. The study aims to examine the banana peel and alum at functional group to predict the functional groups responsible for settling of suspended solid. Also, It has been observed that a dosage of 30ml/l is showing good results than dosage of alum in same sample.

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Keywords: Jar test, Coagulation, Natural Coagulants, Turbidity, NTU, Banana peel powder, Sewage Treatment, Flocculation

Paper ID: 146

Performance Evaluation of Sequencing Batch Reactor for Treatment of Rice Mill Wastewater using Aerobic Granulation

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Abstract

The effect of organic loading rate (OLR) on the aerobic granulation process was investigated using lab-scale column type sequential batch reactor. The cultivation, performance and granular characteristics have been observed. Three reactors, namely R1, R2, and R3 operated on OLR 3, 6, and 9 kg COD/m^3.d. During 60 days of operation COD removal efficiency was stabilized around 95% for all reactors, but it was observed that at higher OLR values disintegration of granules were occurred resulting failure of reactors. Granular characteristics were improved at moderate OLR value.

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Keywords: Aerobic granulation; Rice mill wastewater; Organic loading rate (OLR).

Paper ID: 147

Domestic Wastewater Treatment by Integrating UASB and Anammox-MBBR Technology

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Abstract

This study has been carried out to treat domestic wastewater through the combination of anaerobic treatment and deammonification in a pilot plant of 0.1 MLD in IIT Bhubaneswar campus. The pilot plant showed significant improvements in the removal of organic pollutants, particularly in terms of reducing chemical oxygen demand (COD) and total suspended solids (TSS), as well as effective nitrogen removal. The treated effluent from the pilot can be used for a variety of applications such as gardening and toilet flushing. Furthermore, the biogas produced during the treatment process will be a significant fuel source, and the sludge produced during the procedure showed promise as nutrient-rich manure. The pilot plant, which included a UASB, demethanization, and MBBR-anammox processes, had specific objectives for wastewater treatment: organic matter removal, biogas production, nitrogen removal, and minimizing the environmental impact of wastewater discharge. Over a span of four months in operation, the integration of anaerobic treatment and deammonification technology notably improved removal efficiencies, achieving 93% for COD, 94% for TSS, 95% for TN, and 91% for TP. The sludge production from the plant amounted to 100 kg per year, serving as a valuable resource like fertilizer or soil amendment. Furthermore, the pilot plant yielded 0.07 MLD of treated water, representing the volume of clean and treated water obtained from the treatment process.

Keywords: Domestic wastewater, Anammox, Nutrient removal, Anammox, Wastewater treatment

Paper ID: 148

Treatment of Domestic Wastewater using Constructed Wetland Coupled Microbial Fuel Cell (CW-MFC)

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Abstract

Constructed Wetland (CW) is a proven technology to remove organic load efficiently using macrophytes. Microbial fuel cells (MFCs) are bio-electrochemical devices that use microorganisms to break down organic materials to produce power. The electricity generation in MFCs increases as the substrate is microbially degraded more. A hybrid strategy known as CW-MFC was developed as a result of the fact that both CW and MFC function with varying redox potentials. CW-MFC is a newly developed method for producing energy while simultaneously treating wastewater. In this study employing synthetic high-strength domestic wastewater, influent chemical oxygen demand (COD) concentrations ranged from 200 to 800 mg/L, while hydraulic retention time (HRT) ranged from 12 to 24 hours. Results showed a COD removal efficiency of 86.9% on average, peaking at 94 %. Three techniques were used to analyze the electrochemical behavior: electrochemical impedance spectroscopy, cyclic voltammetry, and linear sweep voltammetry. A polarization analysis found a maximum power density of 84.12 W/m^3. This study demonstrates how changes in COD and HRT affect system performance, demonstrating the promise of CW-MFC for effective wastewater treatment and environmentally friendly energy generation.

Keywords: Microbial fuel cell; constructed wetland; Nutrient removal; adsorption.

Paper ID: 149

Sustainability in Foundry Industry by Greenhouse Gas Reduction Through Energy Efficiency and Optimization - Case Study

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Abstract

Energy is one of the key factors in human life and is used in residences, transportation, commercial buildings, and manufacturing industries. Humans use energy to convert various raw materials and resources into usable articles and items to meet their daily needs. The foundry industries are energy intensive to produces iron castings by melting pig iron and cast-iron scraps. These pig iron and cast-iron scraps are melted in a high-temperature furnace to produce molten iron, which is then poured into moulds of the desired shape to produce castings. The castings form the primary components for a variety of engineering industries. foundries are majorly categorised into two types, namely a coke-based melting furnace known as a cupola and an induction furnace. Cupola furnaces use coke as a fuel, while induction furnaces use electricity. This paper examines the foundry industry as an energy-intensive industry in the sense that it necessitates energy in various forms such as electrical, heat, and mechanical to carry out various engineering processes to produce the necessary castings. It also reviews the different methods that are currently being employed to make the manufacturing process more efficient and how each of them has led to an increase in energy demand. It is affirmed that the new methods involved in foundries and their energy management policies can led to more efficient energy consumption for casted products.

Keywords: Induction furnace; cupola furnace; carbon footprint; CO_2 emission; energy efficiency

Paper ID: 151

Experimental Impact of COVID-19 on Tropospheric ozone over Jharkhand state, India

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Abstract

Impact of COVID-19 has been widely studied to assess the air quality worldwide. In this paper air quality of Jharkhand has been studied to check the impact on ozone concentration due to COVID-19 lockdown. The horizontal and vertical ozone concentration of ozone over Jharkhand has been assessed for the period of 2019, 2020 and 2021. Aqua/ARIS tropospheric ozone data was processed using Giovanni platform. The horizontal ozone concentration of 42.88 DU was observed during 2020 which is less than the values obtained for 2019 (44.12 DU) and 2020 (43.20 DU). A very good agreement was noticed for monthly tropospheric ozone data with R2 = 0.89 to 0.96. Seasonal analysis showed a high ozone value of 51.18 DU during pre-monsoon season and lowest value of 39.44 DU during monsoon in Jharkhand. An increment of 1.46% in ozone level was observed at 1000 hPa, in 2020 whereas, a decrement of 1.01% noticed in 2021 in comparison to 2019 and 2020 over Jharkhand. Current study establishes the existence and variation of tropospheric ozone over the Jharkhand state, focusing temporal duration 2019-2021, that would be helpful in further research and its precursors present in the air.

Keywords: Tropospheric-ozone, COVID-19 lockdown, Giovanni, landlocked, Vertical assessment.

Paper ID: 153

A Comprehensive Review on Sustainable Development of Lightweight Geopolymer Concrete using Different Environmental Wastes

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Abstract

The construction industry is increasingly focusing on sustainable practices to reduce its environmental impact. Geopolymer concrete, a sustainable alternative to traditional Portland cement based concrete, is being explored for its potential to reduce carbon emissions and usage on waste. This eco-friendly concrete uses industrial by-products like fly ash, slag, and other aluminosilicate materials, and lightweight aggregates like expanded clay, shale, or recycled materials. The review highlights the environmental benefits of lightweight geopolymer concrete (LWGC), including reduced carbon footprint, energy consumption, and waste minimization. It also examines the mechanical properties of lightweight geopolymer concrete, including compressive strength, flexural strength, and splitting tensile strength. This helps the sustainable development of lightweight geopolymer concrete utilizing different environmental wastes presents a viable solution for reducing the environmental pollution.

Keywords: Environmental Wastes; Geopolymer Concrete; Lightweight Aggregate; Mechanical Properties

Paper ID: 155

Coagulation of Dye Wastewater: Statistical Optimization using Response Surface Methodology

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Abstract

The discharge of dye effluent resulting from textile manufacturing has the potential to induce detrimental impacts on both the microbial community and the surrounding environment. The removal of dye is a crucial environmental concern prior to the discharge of wastewater. The primary aim of this research was to optimize the removal of Congo red (CR) dye through response surface methodology (RSM) using polyaluminum chloride (PAC) and ferric chloride ($FeCl_3$) coagulants. The evaluation of the impact of pH and coagulant dose on dye removal was conducted to determine the appropriate range of parameters for use in RSM for the purpose of optimising the process. Applying RSM in the optimization of the coagulation process resulted in the determination of optimal conditions. These conditions include a dosage of 39.4 mg/L of PAC at an initial pH of 6.3, as well as a dosage of 46.8 mg/L of $FeCl_3$ at an initial pH of 8.4. The implementation of RSM facilitated the identification of the true optimal condition, leading to a significant reduction in the amount of chemical coagulants required for colour removal.

Keywords: dye wastewater; coagulation; response surface methodology; process optimization.

Paper ID: 156

Enhancement of NOx Removal Efficiency from Real Diesel Engine Exhaust using Cascaded Voltage-Efficient DBD Reactor and Adsorbent Reactor

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Abstract

The pollution caused by vehicle exhaust is a serious environmental issue that affects public health. Policymakers have implemented several regulatory measures, such as clean fuel legislation and catalytic converters, to reduce automobile exhaust emissions. However, these strategies may have negative effects like increased fuel consumption and decreased engine performance. Researchers are looking into cutting-edge technologies like non-thermal plasma (NTP) to reduce nitrogen oxide (NO_X) emissions from vehicle exhaust. An affordable and energy-efficient method of eliminating NO_X is to use NTP, a type of plasma that functions at room temperature and pressure. A multitude of factors, such as the type of plasma reactor and operating conditions, affect how well NTP removes NO_X. The electrode layout we are suggesting in this study exhibits a notable increase in injected power when compared to the traditional cylindrical electrode shape. Furthermore, the NO_x removal is enhanced by use of cascaded adsorbent reactor containing MS13x/Alumina. In our study, Alumina is used as adsorbent at room temperature.

Keywords: High Voltage Power Supply, Plasma Reactor, Non-Thermal Plasma, NO_X Treatment

Paper ID: 157

Assessment of Groundwater Quality using Risk Analysis

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Abstract

The coal mining sector is vital to the economic success of many countries, but it also causes a serious environmental problem known as Acid Mine Drainage (AMD). AMD is distinguished by excessive acidity and a higher concentration of sulfate and metals, which can have serious implications for soil quality and groundwater. This study aimed to analyze the possible health concerns provided by metals such as iron (Fe), manganese (Mn), nickel (Ni), zinc (Zn), copper (Cu), cobalt (Co), lead (Pb), cadmium (Cd), arsenic (As), and chromium (Cr). The groundwater quality examination revealed that Fe, Mn, and Cr concentrations surpassed the recommended drinking water levels, but all other metals remained below safe ranges. The presence of these metals in high concentrations in groundwater raises concerns about potential detrimental health consequences from different exposure. The Heavy Metal Pollution Index (HPI) demonstrated that the water is unsafe to drink, and the Health Risk study revealed that both adults and children are vulnerable to non-carcinogenic health concerns. These findings highlight the critical need of establishing effective treatment and long-term remediation solutions to alleviate AMD's environmental and health consequences.

Keywords: AMD; Human Health Risk; Groundwater; Toxic metals; HPI.

Paper ID: 158

Temporal Water Quality Optimization of Single Reservoir Operation

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Abstract

Reservoirs are operated for stakeholders' requirements based on the inflow and initial storage volume/level. Operation rule curves are determined to resolve the conflict interesting of the stakeholders, in terms of the quantity of water discharged. In the current scenario of urbanization, the upstream scenarios can be used to dilute the downstream water quality with a controlled operation. Few research works addressed the operation of the reservoir to achieve the desired water quality in a particular space. In real life scenario, the reservoir downstream river passing through an urban environment may have multiple effluent discharge points, whether it is possible to maintain the river water quality. To understand the behavior of the river for regulated release from the reservoir, a simulation-optimization algorithm is proposed. In this study, three major assumptions are considered to develop the framework, i) the reservoir water is pure/water quality parameters are within acceptable limits of drinking standard, and ii) the downstream river receives domestic load with organic pollutants at assumed points. The simulation-optimization framework simulates the downstream dissolved oxygen and efficacy of the Genetic Algorithm (GA), Bat algorithm (BA), and Whale algorithm (WA) with a minimum penalty on the water quantity requirements. From the results two key inferences are made; i) irrespective of the algorithm, stringent water quality constraints penalize the convergence of the algorithm towards achieving optimality, and ii) release from the reservoir increases by 150 % to maintain the downstream river water quality and thereby increasing the no release months during low inflow months.

Keywords: water quality, reservoir operation, optimization, dissolved oxygen

Paper ID: 159

Assessment of Groundwater Quality in Parts of Sarda-Ghaghara Interfluve, Lakhimpur District, Uttar Pradesh

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Abstract

The present study has been carried out in parts of the Sarda-Ghaghara interfluve, Lakhimpur District, Uttar Pradesh. Groundwater samples (n=68) were collected from three different depths for pre-monsoon 2023 and were further analyzed for physicochemical parameters. Groundwater of the region is alkaline in nature, which may be due to the interaction between rainwater and alluvial soil. Ca-Mg-HCO3 is the dominant hydrochemical facies identified from the Piper trilinear diagram. The scatter plots of HCO_3^-/Na^+ vs Ca^{2+}/Na^+ and Mg^{2+}/Na^+ vs. Ca^{2+}/Na^+ show that silicate weathering is responsible for a high concentration of Mg^{2+}.

Keywords: Groundwater; hydrochemical facies; Silicate weathering

Paper ID: 160

Monitoring the Local Environmental Impacts of 2023 Summer Heat Wave using Remote Sensing Datasets

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Abstract

The focus of this study is to assess the local environmental impacts of the disastrous heat wave episode of 2023 that affected India during April to June months, using remote sensing (RS)-based high resolution datasets. The Summer 2023 heat wave has caused severe vegetation stress and soil water stress in the cropped lands in our study area lying in the state of Odisha in India. Analysis of vegetation condition of this area during the heat wave days may aid efforts of adaptation to heat stress in the future years. This work employs multi-temporal RS satellite datasets to identify regions that are exposed to impacts of heat stress, by analyzing the fluctuations in land surface temperatures (LST), vegetation health/vigor, and surface soil moisture levels. In this regard, two popular spectral indices: The Enhanced Vegetative Index (EVI) and Normalized Difference Vegetation Index (NDVI) are adopted to assess impacts of heat wave (HW) exposure. The findings reveal that in the composite study domain, notably higher LST are seen in HW days when compared to normal days. Agricultural region experienced a significant decline in soil moisture content and vegetation health, that could cause a detrimental impact on the overall crop productivity of the region.

Keywords: Heat Wave; Remote Sensing; Land Surface Temperature; Spectral Indices; Vegetation Stress

Paper ID: 161

Insights from CMIP6 for Pollution Potential over IGP

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Abstract

Indo-Gangetic Plain (IGP) is a well-known global hotspot for particulate pollution which can be partly attributed to its unfavourable meteorology. Its strategic location in the Indian sub-continent does not favour atmospheric dispersion during the cold seasons. The pollution potential is modulated by the meteorology over a region, which can primarily be explained by the planetary boundary layer height (PBLH) and near-surface wind speed (NSWS). The anthropogenic climate change might influence the assimilative capacity of the atmosphere due to the changes in these meteorological variables. The model projections provide crucial insights into these changes in past and future scenarios. In this regard, this study aims to understand the futuristic changes in the meteorological parameters over the IGP using the Coupled Model Intercomparison Project (CMIP) phase 6, for the SSP 245 scenario during the period of 2015-2050. The ERA5 reanalysis data are used for the model validation for the period of 2015-2021. Out of the seven models used in the study, the Canadian Earth System Model (CanESM5) shows good agreement with the ERA5. Importantly, a discernible increasing trend in the PBLH and NSWS was found until the first decade of the analysis and then no significant trend was observed in the later part. Importantly, it indicates a potential increase in favourable meteorology in the near future which might be conducive for the atmospheric dispersion of pollutants

Keywords: Ventilation Coefficient; CMIP6; Planetary Boundary Layer Height, Wind Speed, Projection

Paper ID: 162

Sustainable Remediation Strategies for Petroleum Refinery Wastewater: An In-Depth Analysis of Constructed Wetlands - A Review

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Abstract

The environmental challenges posed by petroleum refinery wastewater are examined. These industries release toxic and recalcitrant organic pollutants, raising significant concerns in environmental engineering. Conventional biological treatments, while achieving 60-90% COD removal, struggle with petroleum hydrocarbons and generate oily sludge. Advanced oxidation methods offer effective solutions but come with a high cost. Constructed wetlands (CWs) have emerged as promising alternatives due to their inherent mechanisms as phytodegradation, rhizo-filtration, and microbial degradation. Our review underscores the effectiveness of Constructed Wetlands (CWs) in managing high-strength PRPP wastewater, achieving an impressive 80% average COD removal rate. Particularly, horizontal subsurface flow CWs showcased exceptional performance, removing heavy oil and recalcitrant compounds with efficiency rates exceeding 80% and 90%, respectively. System enhancements, including varied aeration and purposeful hybridization, further enhance CW performance. This review underscores CWs as cost-effective and efficient solutions for mitigating PRPP wastewater pollution.

Keywords: Petroleum refinery waste water; Constructed wetlands; Phytoremediation; Bibliometric analysis; Biological treatment.

Paper ID: 163

A Laboratory Scale Anaerobic Filter Study for Treatment of Fish Market Wastewater

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Abstract

Fish market wastewater (FMWW) releases a high amount of organic and nutrient load to the water environment. A necessary bacterial culture has been acclimated in the laboratory to investigate biological treatment for the reduction of the pollution load up to a satisfactory level from wastewater collected from the nearby retail fish market. FMWW has been collected quite a few times and its qualitative characterization is done. The average value of total dissolved solids (TDS), pH, total suspended solids (TSS), biochemical oxygen demand (BOD), chemical oxygen demand (COD), PO_4^{3-}, NO^{3-}-N and NH_4^{+}-N which are found to be 4100 mg/l, 5200 mg/l, 6.43, 3000 mg/l, 4200 mg/l, 120 mg/l, 55 mg/l and 450 mg/l respectively. A combined removal of COD and NO^{3-}-N was studied in a laboratory scale packed bed-up flow anaerobic fixed film reactor (AFFR). For the necessary attachment of microorganisms, earthen potter's clay of 12mm inner diameter annual rings were utilized as packing. Potassium and ammonium nitrate (KNO_3 and NH_4NO_3) solution were used in varied proportions to prepare a synthetic substrate as nitrate source whereas sucrose was used as organic carbon. Experimental results revealed that the highest nitrate removal of about 85% was obtained for an influent nitrate concentration of 30 mg/l in the presence of an initial COD concentration of 3500 mg/l for 4 l/d of hydraulic loading, whereas maximum COD removal of 82% was achieved for 3500 mg/l of initial COD concentration, at 2 days hydraulic retention time (HRT). Methane generation in the reactor was also observed and found to be low in the presence of a high NO^{3-}-N level.

Keywords: Fish market wastewater; Anaerobic fixed film reactor; COD & nitrate removal

Paper ID: 164

Membrane Fouling and Performance Study for Salt Removal Using Membrane Distillation

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Abstract

Since a few years ago, membrane technology has advanced quickly due to the demand for water of high quality. Salt and dark water desalination often use the thermally driven membrane distillation process, which is one of the several membrane separation methods. This paper's primary goal is to evaluate the effectiveness of $MgSO_4$ salt separation from water using Direct contact membrane distillation (DCMD). The phase inversion approach is used in this study to create a membrane with a set composition of PVDF (20 wt%), sodium alginate (SA) (0.5 wt%), carboxylated multiwall coated carbon nanotubes (MWCNT-COOH) (0.06 wt%), solvent N, N dimethyl formaldehyde (DMF). This optimum value of membrane composition is decided by the Taguchi method of design of experiment. On this membrane, the experiment was conducted using an aqueous feed solution of $MgSO_4$ salt for 80 hours. The flow was monitored and the rejection was also calculated at a specific time interval. Flux was measured at the beginning of the experiment and was highest for a fresh membrane; after the 80-hour experiment, it decreased. Atomic force microscopy (AFM) and Fourier transform infrared spectroscopy (FTIR), respectively, were used to characterize the membrane surface before the experiment and after fouling. After 80 hours of operation, there was a very slight decrease in permeate flux of this PVDF membrane, which may have been caused by modest scaling on the membrane surface.

Keywords: Direct contact membrane distillation; PVDF; carbon nanotube; MWCNT-COOH

Paper ID: 165

Comprehensive Approaches for PM2.5 Concentration Prediction in Urbanized and Industrialized Regions: Machine Learning and Deep Learning Solutions

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Abstract

An extensive range of IoT devices are integrating Artificial Intelligence (AI) to enhance, profitability, dependability, and automation. These IoT sensors gather data, enabling the management of industrial smokestack air pollution control systems. To address the environmental and health concerns linked to emissions like particulate matter (PM), sulfur dioxide, and nitrogen oxides, we propose an inventive research project that combines AI-driven hardware with a control-focused data classification technique (CDCT). AI-powered sensors within manufacturing units collect data on air pollution levels, emission rates, and composition. Subsequently, a Deep Neural Network is employed to formulate and execute precise air pollution control strategies. Our research holds the potential to significantly reduce air pollution within manufacturing facilities, ultimately improving public health.

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Keywords: Artificial intelligence (AI); Air pollution control; Industrial smokestacks; Deep neural network (DNN); Control-centric data classification technique (CDCT).

Paper ID: 166

Recent Developments in Removal of Heavy Metals from Wastewater by Nanoadsorbents – A Mini Review

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Abstract

The heavy metals contaminate the water and they are considered as most harmful water pollutants. They severely affect the human health and environment even at very low concentrations. In this work, a thorough literature review has been done on the water pollution with respect to presence of heavy metals and their removal from wastewater. Adsorption is found to be an efficient, simple and cost effective wastewater treatment technique where nanoparticles are highly efficient in mitigating the pollution of water with respect to heavy metals and act as great adsorbents as they have a massive surface area and high adsorption capacity. It has been found from the literature that among the metal-based nanoparticles, iron-based nanoparticles are most preferable for eliminating the contaminants from the wastewater as they are cheap in cost and widely available on earth.

Keywords: Adsorption capacity; Adsorbent dose; pH; Temperature; Surface area

Paper ID: 168

Earthen Cation Exchange Membrane Modification with Sugarcane Bagasse Ash for Enhancing Performance of Microbial Fuel Cells

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Abstract

In microbial fuel cells (MFCs), ceramic membranes are frequently employed as an inexpensive cation exchange membrane. In order to create low-cost ceramic membranes for MFCs, sugarcane bagasse ash (SBA) and soil are blended together in this study. The 15% SBA ceramic membrane showed increased proton mass transfer and decreased oxygen diffusion. Silica and alumina in SBA improved the membrane's ability to retain moisture and facilitated proton movement from the anode to the cathode chamber. The efficacy of the MFCs for the continuous mode operation of the treatment of synthetic wastewater influent was evaluated using modified (with SBA, MFC_M) and unmodified (without SBA, MFC_U) membranes. The MFC_M showed higher volumetric power density than MFC_U while the COD removal efficiencies were 90.7% and 84.4%, respectively. Using the results of the electrochemical impedance spectroscopy (EIS) investigation, ohmic resistance (R_Ω) of MFC_M was found to be lower than MFC_U.

Keywords: Cation exchange membrane; microbial fuel cell; sugarcane bagasse ash; waste to energy, wastewater treatment

Paper ID: 171

Montmorillonite Clay Based Solar Photocatalytic Differential Reactors for Dye Degradation: Rate Estimation

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Abstract

Montmorillonite clay in Rajasthan is believed to be an effective photocatalyst as it is consist of decent amount of photocatalytic minerals like ZnO and TiO2. The abundantly available montmorillonite clay of Rajasthan is exploited for photocatalytic degradation of dye wastewater which is commonly generated in the rural artisan communities of Rajasthan that are involved in textile dyeing. An immobilized photocatalytic pristine montmorillonite clay based differential reactor was designed and experiments are carried out under direct sunlight for degradation of dye waste water sample. The aim of this study is to estimate the rate of the reaction and to check the usability of untreated montmorillonite clay for direct application in treatment of dye wastewater in the rural artisan communities of Rajasthan, India. The experimental results are corroborated with an empirical model and a comprehensive CFD model using ANSYS Fluent 2022 software.

Keywords: Solar photocatalysis; dye wastewater; montmorillonite clay; modeling and simulation

Paper ID: 173

Causes, Effects and Remedies of Air pollution in Metro Cities of India: A Case Study

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Abstract

In a In India's major cities, air pollution is becoming an increasingly serious problem due to a complex web of interrelated issues. Vehicle emissions, industrial activity, construction work, and poor waste management techniques are the main reasons. Due to the growing number of automobiles on the road, which generate pollutants such particulate matter (PM), nitrogen oxides (NOx), sulphur dioxide (SO_2), and carbon monoxide (CO), vehicular pollution is a significant contributor. Industrial operations worsen the problem by releasing a concoction of dangerous gases and particulates into the atmosphere. The amount of particulate matter in the air is also increased by poor trash disposal and construction activities. Public health is severely harmed by air pollution, which can lead to early death, cardiovascular illness, and respiratory conditions. Risks are increased for vulnerable groups like children, the elderly, and people with pre-existing medical issues. Additionally, air pollution has a negative impact on the environment, contributing to climate change, the extinction of species, and the destruction of ecosystems. The fight against air pollution calls for a multifaceted strategy. As part of this, strict emission standards must be put in place, sustainable transportation options must be promoted, waste management systems must be improved, renewable energy sources must be supported, and public awareness must be increased. To reduce air pollution and build healthier and more sustainable urban environments in India's major cities, sustainable urban design, effective policy interventions, and community involvement are crucial. We have collected data from Kaggle source for a certain period of time to prepare a case study and focus the causes, effects and remedies of air pollution in metro cities of India.
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Keywords: Pollutants; Public health; Climate change; Remedies; Kaggle data source

Paper ID: 174

Pseudophormidium at DRI Based Steel Manufacturing Industry via Sequestration and Bioenergy

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Abstract

Steel production in reduction reactors uses reducing gas derived from the reformation of hydrocarbon containing gas, which contains H2, CO, CO2, and H2O in various proportions. During this process which is widely known as Direct Reduced Iron - DRI process, CO2 is selectively removed from a portion of the gas stream effluent of the reduction reactor and the resultant gas stream is used as fuel in the reformer. This process inherently facilitates a source of highly purified CO2 and is a suitable target for sequestration at source to significantly reduce carbon footprint of the steel production by this route. Native blue—green algae from Angul region were successfully adopted at the flue gas fed carbon sequestration plant of NALCO, Angul, India, in a modified open raceway pond system. The isolated stabilized cultures were identified to be of Leptolyngbya/ Pseudophormidium sp. with 16S/18S rRNA analysis and were further monitored routinely by optical and biomass characterization. The biomass recovery rate of 23 ton/acre/year achieved initially by the pilot plant and was accepted as the yield of the system for further calculation purpose. Photo synthetically Active Radiation (PAR) varies with latitude, seasonality, and geographical factors. Photosynthetic organisms use eight photons to capture or fix one molecule of CO to carbohydrate (CHO) n (Raven 2013). Odisha receives an average solar radiation of 5.5 kWh m−2 and around 300 clear sunny days every year (Tarai 2016). Therefore, Odisha with its existing solar radiation conditions offers rich potential for microalgae production (Lakshmi 2015). This study evaluates the potential of using the established microalgae Leptolyngbya /Pseudophormidium sp that was established for carbon sequestration at NALCO located at Angul and adopting it at the DRI plant of Jindal Steel and Power located at Angul for evaluating its impact on the carbon footprint using a LCA approach with biomass conversion paths. Theoretical estimations were derived for the possible end-uses of potential biomass quantity generated for further conversions to biochar and bioenergy as the sequestration measure and overall decarbonization in the steel production.

Paper ID: 175

Potential of Capturing CO2 from Oxygen Plant

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Abstract

Global warming and climate change concerns have triggered global efforts to reduce the concentration of atmospheric carbon dioxide (CO2). Carbon Capture and Storage (CCS) is considered a crucial strategy for meeting CO2 emission reduction targets. To greatly diminish world-wide carbon emissions from industries, particularly from the industries, Carbon Capture, Utilization and Storage (CCUS) is required. This review paper appraises various scientific options for reducing CO2 emissions in industries by capturing and using the available technologies. Additionally, most articles on CO2 capture over the globe are devoted to integrating new skills in the power and steel industries, which is accountable for around 79% of the universal CO2 discharge from significant sources. Capturing CO2 from oxygen plants is mainly focused on in this review article. Oxygen plants are industrial systems designed to produce oxygen. They commonly employ air as a feedstock and use membrane separation or pressure swing absorption techniques to extract it from other air constituents. The selection of specific CO2 capture technology heavily depends on the type of CO2 generating plant and fuel used. Direct Air Capture (DAC), technique is mainly focused on this article, it represents negative emission technology, is a technique to capture CO2 from the environment and diminish global CO2 concentrations. Different methods and techniques of CO2 capture and separation have been discussed. The use of DAC in industry will reduce costs and provide better information to researchers about specific areas that need improvement. The advancement of all these choices, represented by DAC technologies, is essential for achieving the climate goals in coming days.

Paper ID: 176

Application of Environmental Indicators by FPO

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Abstract

Farmer Producer Organizations (FPOs) can play an important role in promoting environmental stability and sustainability in agriculture. FPO includes many farmers for the purpose of production and business activities. There is a vast scope and possibility for the contribution of FPO in the application of Environmental Indicators such as tracking progress, supporting policy evaluation, communicating information, assessing conditions and trends, educating stakeholders, raising awareness, and prioritizing environmental issues.

They accomplish this by promoting organic and integrated farming techniques, efficient resource management, and biodiversity conservation. FPOs advocate for responsible water use, reduce chemical inputs, and facilitate waste management in farming communities. Their initiatives extend to afforestation and agroforestry, aiding carbon sequestration and mitigating soil erosion. Additionally, FPOs engage in policy advocacy for environmentally friendly regulations and collaborate to achieve environmental certifications. Acting as a bridge between agriculture and environmental conservation, FPOs lead efforts to ensure sustainable, resilient, and ecologically responsible agriculture. This article underscores the multifaceted role of FPOs, highlighting their contribution beyond economic benefits to include the preservation and enhancement of the environment, fostering a more sustainable and resilient agricultural sector through diverse processes and management strategies.

Paper ID: 177

Bioretention Technology: A Nature-based Solution (NbS) for Management and Treatment of Stormwater in Cities

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Abstract

Water scarcity is one of the major environmental challenges in many countries including Singapore. To alleviate water stress, stormwater (road runoff following rainfall) can be reclaimed and reused for non-potable purposes including irrigation of urban farms, vehicle washing, toilet flushing, etc. However, stormwater generally contains diverse chemical (nutrients, heavy metals and organics) and microbial (e.g., pathogens) pollutants which could pose adverse effects on the environment and human health. In recent years, nature-based solutions (NbS) (e.g., bioretention technology or bioretention systems) are increasingly explored in cities to tackle water security issues. The NbS also provide various ecosystem services (e.g., enhancement of biodiversity, reduction of noise pollution, mitigation of urban heat island effects, etc.), reduce carbon footprints, promote circular economy and contribute to the United Nations Sustainable Development Goals (SDG). The main objective of this study isto design and develop a novel bioretention system (BRS) for stormwater management and treatment in tropical cities like Singapore. Initially, a series of batch-scale phytoremediation experiments were conducted to screen a suitable plant which can grow with minimal water supply and under warm and humid tropical climate and remove diverse stormwater pollutants. A novel bioretention engineered medium was developed using both natural materials namely soil (60%) and sand (25%) and waste materials including construction wastes (CW, 7.5%) and water treatment residues (WTR, 7.5%). The hydrological performance (i.e., hydraulic conductivity or infiltration rate) as well as removal of pollutants in stormwater (mainly total suspended solids (TSS), total nitrogen (TN) and total phosphorus (TP)) of the developed bioretention media was primarily tested in the lab-scale continuous flow-through column experiments. Then, the efficiency of the engineered media was further evaluated in scale-up systems including prototype and pilot-scale modes using the screened plant, Dracaena reflex This plant exhibits high survivability with limited water supply and greater pollutant decontamination efficiency. The overall findings of this study show that the hydraulic conductivity of the engineered media in the column, prototype and pilot-scale systems was within 100 – 300 mm/hr, which is consistent with the BRS design guidelines

provided by the Singapore's National Water Agency (Public Utilities Borad). The engineered soil mix was also very effective for the removal of numerous contaminants in stormwater namely TSS (more than 80%), nitrate (above 82%) and phosphate (> 93%). The chemical characterization work (e.g., Fourier Transform Infrared Spectroscopy (FT-IR), X-ray Powder Diffraction (XRD), etc.) reveals that the chemical components of the soil, sand, CW and WTR were different, and they may synergistically contribute to the removal of pollutants through various physicochemical processes (e.g., adsorption, precipitation, ion-exchange, etc.). The microbial analysis of the engineered media using the advanced molecular techniques (e.g., 16S rRNA amplicon sequencing) reveals that the enrichment of diverse microbial communities with denitrifying bacteria (mainly responsible for nitrogen removal) was dominant. Overall, the findings of this study demonstrate that the developed novel engineered media and screened plant (D. reflexa) were effective for the management and treatment of stormwater in tropical climatic conditions. However, further studies including long-term continuous field-scale investigations are warranted to assess the performance of the newly developed novel BRS under actual field conditions. The results of field-scale tests would be helpful to develop design guidelines for the installation, operation, and maintenance of BRS in cities.

Keywords: Stormwater treatment; Nature-based solutions; Bioretention systems; Circular Economy and Sustainability

Paper ID: 178

Technologies for Treatment of Caprolactam Effluent from Chemical Fertilizer Industries: A Review

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Abstract

The fertilizer industry faces burgeoning demand, with India excelling in nitrogenous and phosphatic fertilizers. However, due to the absence of domestic potash ores, India imports potash-based fertilizers, primarily relying on nitrogen and phosphorus-based varieties. Consequently, effluents from these industries exhibit high Chemical Oxygen Demand (COD) and dissolved solids due to refractory organic compounds. Caprolactam, employed in the production of synthetic fibres, can lead to acute (short-term) effects characterized by eye, nose, throat, and skin irritation in human's Conventional wastewater treatments struggle to meet pollution control board standards, endangering freshwater quality when inadequately treated effluents enter water bodies. The recalcitrant nature of these pollutants makes biological treatments alone insufficient. Advanced Oxidation Processes (AOPs), relying on hydroxyl radicals, become imperative for breaking carbon bonds, and converting organics into simpler compounds. This study reviews technologies for high-strength effluent treatment, including the Fenton process, heterogeneous photocatalysis, hydrogen peroxide-UV-ozonation, and other oxidants. It underscores the challenge of selecting a single technology for specific effluent parameters and advocates for comprehensive treatment chains to maximize removal efficiency. Prospects include systematic monitoring, environmental compliance, and economic analysis to meet discharge standards effectively.

Keywords: Refractory organic compounds; Advanced Oxidation; Hydroxyl Radicals; Heterogenous Photocatalysis; Fenton Process.

Paper ID: 179

Evaluating the Impact of Residence Time on Degree of Carbonization of Microalgal Biomass through Hydrothermal Carbonization

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Abstract

Hydrothermal carbonization (HTC) has emerged as a promising approach for the conversion of wet biomass into carbonaceous material known as hydrochar. The process occurs at elevated temperatures up to about 300 ℃ and under autogenerated pressure (up to about 25 bars). The developed pressure aids in maintaining the water in the liquid phase at high temperatures which also acts as a catalyst. Some of the major chemical reactions involved in this process are hydrolysis, dehydration, and decarboxylation. Among the various types of feedstocks explored for HTC, microalgal biomass has garnered significant attention due to its rapid growth rate and reduced land requirement for cultivation. Moreover, 3G feedstocks demonstrate diminished emissions of greenhouse gases, thereby reinforcing the environmental sustainability of the related procedures. This study investigates the HTC of microalgal biomass (Spirulina sp.) and the application of the synthesized hydrochar as a substitute for sub-bituminous coal. The HTC was performed in 50 mL Teflon-lined autoclave reactor, placed in a muffle furnace at a design temperature of 190 ℃. The feedstock slurry was prepared by mixing the oven-dried microalgae and Milli Q water at a solid-liquid ratio of 0.1, and the residence time was varied from 1 h to 4 h. The fuel characteristics of the as-synthesized hydrochar were evaluated based on its ultimate analysis, high heating value (HHV) and thermo-gravimetric analysis. As compared to the dried microalgae, 30% improvement was observed in the HHV of the hydrochar corresponding to a residence time of 4 h. However, the highest energy yield of 72% was obtained from the hydrochar subjected to a residence time of 1 h. The findings of this study can aid further research to explore the field-scale application of microalgal hydrochar as a substitute for subbituminous coal in coal-fired power plants.

With best complements