About the Editors

Dr. R. Selvakumar, Professor and Head, Department of Nanobiotechnology, PSG Institute of Advanced Studies, Coimbatore, has 13 years of experience and expertise in microbiology, nanobiotechnology, Nanomaterials application in groundwater and wastewater treatment. He did his Ph.D. at Bharathiar University, Coimbatore and Postdoctoral Fellowships at the University of Newcastle, Australia and University of Nebraska, USA. He is the recipient of prestigious awards like the Water Advanced Research and Innovative (WARI) fellowship from IUSSTF, Endeavour Research Fellow from Government of Australia, Blaustein postdoctoral fellowship awarded at Zuckerburg Institute for Water Research, Israel, CSIR-SRF from Govt. of India, etc. He has completed several funded research projects sanctioned by DST-Water Technology Initiative (WTI), DRDO, ICMR, ONGC, IGCAR etc. As on date, he has 92 publications with H index of 26 and 2074 citations, 7 book chapters, 2 patents and 2 technology transfer to industry.

Dr. M. Devasena, Professor, Department of Civil Engineering and Associate Director-Research, PSG Institute of Technology and Applied Research, Coimbatore is an expert in fate and transport of contaminants in the subsurface and subsurface remediation. She has significant experience to design and conduct research in various spheres of water, wastewater and soil. Hands-on experience in designing and performing 1D and 2D experiments in porous media pertaining to transport of contaminants. She completed her MS in Environmental Engineering from Nanyang Technological University, Singapore and her Ph.D. in Environmental Engineering from Indian Institute of Technology Madras, Chennai. She is a recipient of the prestigious, SERB DST- Fast Track Young Scientist award, Chaatra Viswakarma Award from AICTE, New Delhi, Young Professional on Water Research Award from University of Tokyo, Berkner Travel Fellowship Award from American Geophysical Union. Till date, she has 23 international publications, three book chapters, one book on Water Supply Engineering and two patents to her credit.

Dr. Sankarganesh Jeyaraj, Associate Professor, Center for Molecular Medicine and Therapeutics (CMMT), PSG Institute of Medical Sciences and Research (PSGIMSR) is an expert in molecular biology, infectious diseases, Next Generation Sequencing platform, molecular methods such as GeneXpert and line probe assay. He obtained his Bachelor's degree in Industrial Microbiology and Post Graduate degree in Microbiology. He pursued doctoral studies in Eberhard Karls University of Tuebingen, Germany and postdoctoral studies in the University of Massachusetts Medical School, Worcester, USA and Institute of Tropical Medicine, Tuebingen. He has 17 publications in internationally reputed journals and attended several conference. His current research interests include Antimicrobial resistance, Emerging viral infectious diseases, Tuberculosis and Pathogen genomics.

Dr. Kalyani Anathamohan, Assistant Professor, Department of Nanobiotechnology, PSG Institute of Advanced Studies has expertise in non-coding RNAs in metabolic disease pathogenesis. She has an early career research training experience from premier institutes of India such as the Centre for Cellular and Molecular Biology, Hyderabad, Indian Institute of Technology Madras Chennai, Savitribhai Phule Pune Univesity Pune and Indian Institute of Science Education and Research Pune. During her course of research, she has 5 publications in high-impact impact journals and 1 book chapter. She is establishing an environmental molecular biology lab with the future vision to establish the environmental gene interactions in disease development with a special focus on nano-biotechnological interventions for the betterment of environmental remediation and societal health.

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ASSOCIATION OF GLOBAL GROUNDWATER SCIENTISTS AGGS

Proceedings of
2nd International Conference on
Emerging Contaminants in Water and Environment

21st & 22nd February 2023

ECWE 2023

Editors
Dr. R. Selvakumar
Dr. A. Kalyani
Dr. M. Devasena
Dr. Sankarganesh Jeyaraj

ECWE-2023

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PSG INSTITUTE OF ADVANCED STUDIES

PSG Institute of Advanced Studies (PSGIAS), an institution under PSG & Sons' Charities is an approved Research Centre under Anna University, Chennai and Bharathiar University, Coimbatore to do research in Nanoscience and Technology, Material Science, Mechanical engineering, Biotechnology, Nanobiotechnology, Physics and Chemistry. Having world-class infrastructures & facilities, PSGIAS has collaborations with various Universities in the USA, UK, Germany and Australia for joint research and international exchange programs. The institute currently undertakes several sponsored projects from funding agencies like DST, SERB, DBT, DRDO, BRNS, DAE etc., The institute also supports industrial consultancies, testing and startups for product development and validation.

ASSOCIATION OF GLOBAL GROUNDWATER SCIENTISTS

The Association of Global Groundwater Scientists (AGGS) alias International Groundwater Congress (IGWC) is an international NGO that aims to instil human resources for the sustainable growth of groundwater and its allied areas through knowledge sharing, logical thinking, and qualitative & quantitative analysis. AGGS is envisaged as a functional network and collaboration of different organizations including govt. depts., IITs, national institutes/labs, water-related industries NGOs for better sharing, and collaboration on emerging issues in ground water management. Journal of Groundwater Research (JGWR) is an international peer reviewed journal published by AGGS. Apart from this, AGGS has conducted a series of conferences in various parts of India.

PSG INSTITUTE OF TECHNOLOGY & APPLIED RESEARCH

PSG Institute of Technology and Applied Research, the latest initiative of PSG & Sons' Charities is an AICTE-approved institution affiliated to Anna University, Chennai. This institute caters to various engineering disciplines, focusing on learning, industry engagement of students, innovative and inclusive pedagogy, and ethics. PSG i-Tech aims to achieve excellence in education and research and nurture engineers with ethics, who will face global challenges to serve industry and society.

PSG INSTITUTE OF MEDICAL SCIENCE & RESEARCH

PSG Institute of Medical Science & Research is one of the premier Institutions in PSG & Sons' Charities Trust, which remains one of the oldest trust in the country, with over 44 educational institutions under its care. PSG IMSR as att integrated medical education, training, development, research and patient care with affiliated PSG Hospitals. PSG centre for Molecular Medicine & Therapeutics (PSG-CMMT) research centre was initially established in 2009 under PSG IMSR. It fosters to inter- disciplinary approach to biological research, from bench to clinical research.

PSG SCIENCE & TECHNOLOGY ENTREPRENEURIAL PARK (PSG-STEP)

The PSG-STEP: Nanotech Research, Innovation and Incubation Centre (NRIIC) has been established at PSG-STEP with the support from National Science & Technology Entrepreneurship Development Board (NSTEDB), Department of Science & Technology (DST), Government of India, PSG College of Technology and PSG Institute of Advanced Studies. The thrust areas identified under the NRIIC are Smart Textiles, Plastic Electronics, Energy & Health Care. PSG-STEP: NRIIC provide technical services that include R & D activities, product development, re-engineering, calibration, testing facilities, quality assurance and market research to the entrepreneurs.

ABOUT THE CONFERENCE

Emerging contaminants (EC) or contaminants of emerging concern (CEC) are a class of chemicals or microorganisms which are not commonly monitored and are not part of any regulations in environment and water management sector. The major class of EC includes pharmaceuticals and personal care products, fire retardants, pesticides, plasticizers, surfactants, disinfection by-products, microplastics, antibiotic-resistant bacteria and/or genes etc., These contaminants pose a serious threat to health and environment and are in constant rise which makes it a priority area to be focused without delay. EC in the water sector are of prime concern in the view that the EC intoxicate various ecosystems from groundwater to marine. The concept of occurrence of co-contaminants in the same habitat augments the ecosystem imbalance and health impact. Having very keen eyesight on these ecological threats, the global management of EC needs novel analytical, molecular and modelling techniques to quantify, monitor, mitigate and assess its impact on environmental health.

In view of these consequences, this exclusive 2nd International conference on "Emerging Contaminants in Water and Environment 2023 (ECWE-2023)" will be an excellent platform to update, exchange ideas and create awareness among the researchers, innovators, governmental/non-governmental organizations, policy makers and industries in the field of EC research. This program apart from sharing knowledge from professionals around the world, includes a pre-conference workshop on “Techniques for EC quantification and impact assessment in various water sectors”. This exclusive conference will be addressed by international and national scientists from renowned institutions, and technical experts from popular industries in EC sector.

Technical Session

- EC in global and Indian scenario- Screening and identification
- Recent EC in the environmental sector and its distribution
- Advancements in sensing and impact assessment methodologies for EC
- Technological breakthroughs and challenges in EC management
- Analytical methodologies and troubleshooting for EC quantification
- Microbial and biotechnological tools for EC mitigation, and impact assessment
- Technologies (including integrated technologies like nano- biotechnology) and materials for EC mitigation
- Toxicology assessment- tools, techniques and challenges
- Simulation and as attai techniques – EC kinetics
- Regulatory aspects of EC and any other related areas

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Message from the
Managing Trustee

The presence of emerging contaminants in water and environment has been reported to have adverse effect on public health and ecosystem. Recently its significant increase in environment warrants immediate attention from research, treatment and toxicological point of view. In this context, I am happy to know that our PSG team lead by Dr.R.Selvakumar, Dr.Kalyani (PSGIAS), Dr.Devasena (PSGiTech) and Dr.Sankarganesh (PSGIMSR) are carrying out research to find appropriate solution to treat, monitor and manage water containing emerging contaminants.

I am glad to know that they are organisning 2nd International Conference on Emerging Contaminants in Water and Environment (ECWE-2023) along with a Pre-Conference Workshop on "Techniques for Emerging Contaminants Quantification & Impact Assessment" from 20th to 22nd February, 2023. I am sure this conference and workshop will lead to mutual exchange of knowledge and experiences, networking and pave way for collaborative research.

I wish the program and organizers a grand success.

L. Gopalakrishnan
Managing Trustee,
PSG Institutions

Message from the

Director Emeritus,
PSG Institute of Advanced Studies

Emerging contaminants in water and environment has been a serious threat throughout the world and require immediate actions to understand its impact on societal health and environment. Such actions can provide better solutions and knowledge to handle these contaminants in various environment.

I take this opportunity to appreciate the efforts put forth by the interdisciplinary team of PSG lead by Dr. R. Selvakumar, Dr. A. Kalyani (PSGIAS), Dr. M. Devasena (PSGiTech) and Dr.Sankarganesh Jeyaraj (PSGIMSR) to find research based solutions for the abatement of emerging contaminants from various environment. I am also glad to know that the 2nd International Conference on Emerging Contaminants in Water and Environment (ECWE-2023) along with a Pre-Conference Workshop on "Techniques for Emerging Contaminants Quantification & Impact Assessment" from 20th to 22nd February, 2023 is supported by Association of Global groundwater Scientist (AGGS), PSG Science and Entrepreneurial Park (PSG-STEP), PSG Center for Academic Research and Excellence (PSG CARE) and several funding agencies like SERB, CSIR, BRNS etc. I am sure this conference and workshop will facilitate interdisciplinary exchange of ideas, experiences and knowledge.

I wish the conference a grand success.

P. Radhakrishnan
Director Emeritus,
PSG Institute of Advanced Studies, INDIA

Message from the
Principal,
PSG College of Technology

I am very happy to know that PSG Institute of Advanced Studies, is organizing this important 2nd international conference on Emerging Contaminants in Water and Environment (ECWE-2023) jointly with Association of Global groundwater Scientist (AGGS), PSG Institute of Technology and Applied Research, PSG Institute for Medical Science and Research, PSG College of Technology and PSG - STEP during February 20-22, 2023.

The concern on natural resources, especially air and water is to be addressed for a safe living of current generation and future generations. This can be attempted through conferences like this that covers various domains of science and Technology.

I congratulate the team of organizers for successfully organising this event. The interactions and presentations will provide lot of opportunities to understand the issues and build solutions.

I wish the conference a grand success.

K. Prakasan
Principal,
PSG College of Technology, INDIA

Message from the

Director,
PSG Center for Academic Research and Excellence

It's a pleasure to know that PSG Institute of Advanced studies is organizing the 2nd International Conference on Emerging Contaminants in Water and Environment (ECWE-2023) jointly with Association of Global groundwater Scientist (AGGS), PSG Institute of Technology and Applied Research, PSG Institute for Medical Science and Research & PSG - STEP: Nanotech Research Innovation and Incubation Centre (NRIIC) during 20th 21st February 2023. Safe water has been a priority always for healthy world and environment always. I am sure that this conference will enlighten the participants about the advancements in science and technology related to this area and about various emerging contaminants that are becoming a great concern for health and in this field. I appreciate the efforts put forth by the organizing committee to discuss such an important area through this conference. I wish them all success.

R. Rudramoorthy
Director,
PSG Center for Academic Research and Excellence, INDIA

Message from the

President, Association of Global Groundwater Scientist (AGGS)

Dear All,

On behalf of Association of Global groundwater Scientist (AGGS), I wish to submit my heartfelt appreciation to PSG Institutions for conducting this three days 2nd International Conference on "Emerging Contaminants in Water and Environment" (ECWE-2023) and for providing opportunity to be a part of this conference. AGGS has been keen in promoting academic and research interactions with scientists, young researchers and students on the needs for clean water/groundwater and has played vital role in creating platform for various stakeholders to discuss its significance. I am happy to be part of this ECWE-2023 conference. With these few words, I wish the conference a great success.

C. Mayilswami
President,
Association of Global Groundwater Scientist, INDIA

Message from the

Deputy Director,
PSG Institute of Advanced Studies

With immense pleasure, I am happy to inform you that we are organizing this 2nd International Conference on Emerging Contaminants in Water and Environment (ECWE-2023) along with a Pre-Conference Workshop on "Techniques for Emerging Contaminants Quantification & Impact Assessment" from 20th to 22nd February, 2023 jointly with our sister institutes under PSG and Sons' Charities and Association of Global Groundwater Scientist (AGGS). This conference envisages the need for attention on status of emerging contaminants spread in environment, technological readiness to handle them and its immediate and long-term impact on society and environment. I appreciate the efforts put forth by our interdisciplinary team of PSG institutes lead by Dr. R. Selvakumar, Dr. A. Kalyani (PSGIAS), Dr. M. Devasena (PSGiTech) and Dr.Sankarganesh Jeyaraj (PSGIMSR) in bringing together the leading researchers at national and international level to discuss the significance of emerging contaminants through this conference. I am sure that the young researchers and students will gains valuable information and aquire knowledge through the lead lecture delivered at this conference.

I wish this conference a grand success

J. Kanchana
Deputy Director,
PSG Institute of Advanced Studies, INDIA

Message from the
Executive Director, PSG-STEP

It gives us immense pleasure to be a part of this three days 2nd International Conference on "Emerging Contaminants in Water and Environment" (ECWE-2023) along the PSG Team from PSGIAS, PSG-iTech, PSGIMSR and along with Association of Global groundwater Scientist (AGGS). PSG-STEP plays a critical role in creating an enabling eco-system to promote innovation and entrepreneurship to address the social and industrial problems. The conference focuses on addressing important challenges of the society at large. We look forward to the conversion of current research into commercially viable applications. We assure you the necessary support – technical, financial, infrastructure and other facilities for the successful development of the application. This conference is an opportunity for the young researchers, innovators, startups and investors to get to interact with various experts in the field of environment and nanotechnology around the world to build their innovative idea into a successful product. We wish all the participants a great success in all their endeavors.

K. Suresh Kumar
Executive Director,
PSG-Science & Technology Entrepreneurial Park (PSG-STEP), INDIA

LIST OF SPEAKERS

Dr. Xu Li
USA

Dr. S. Stolte
Germany

Dr.Hilmar Börnick
Germany

Dr. Leo Crasti
Australia

Dr. Marta I. Litter
Argentina

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INVITED LECTURES

INVITED LECTURES

IL-1: Recent Developments and Current Trends in Membrane Technologies for Desalination & Water Purification

A. K. Ghosh
Desalination & Membrane Technology Division, Bhabha Atomic Research Centre, Trombay, Mumbai – 400 085, India
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Abstract

The common water treatment technologies to get clean waters from the contaminated water sources are disinfection, decontamination, desalination and reuse & reclamation. Application of membrane technologies for water purification has grown tremendously with the development of novel membranes having better contaminant retention with higher productivity and effective use of hybrid membrane processes to maximize water recovery & attend near zero liquid discharge. With the advancement of nanotechnology applications in several areas, nanocomposite membranes have also motivated the search for alternative approaches to engineered better membranes which offers further opportunities not only to improve the membrane performances but also to mitigates all types of fouling which indirectly increase the membrane life. The use of jammed organized nanoparticles prepared by spray drying, organic functional group grafted inorganic nanoparticles, carbon-based nanomaterials like graphene oxide & functionalized carbon nanotube, metal organic framework-based nanomaterials are explored as some of the future prospective filler materials for preparation of nanocomposite membranes. In this presentation, the current status of development of next generation performance enhanced fouling resistant nanocomposite membranes and recent trends of membrane-based technologies used for desalination and water treatment will be discussed.

IL-2: Comprehensive Assessment of Microplastics Movement through Soil-Water System around an MSW Dumpsite

Brijesh Kumar Yadav, Jaswant Singh
Department of Hydrology, Indian Institute of Technology, Roorkee
Email Id – brijesh.yadav@hy.iitr.ac.in

Abstract

Microplastic pollution is a major concern for our ecosystem and human health as many rivers, lakes, reservoirs, sediments and aquatic biota have been shown polluted with this emerging contaminant. Microplastics have been found in elevated amounts in many commercial fish species, proving their potential introduction into our food chains. Despite the ubiquitous nature of microplastic pollution, their source and movement in soil-water resources have not been understood systematically. Considering the fact that land-based activities are the initial sources of microplastics, studies related to the presence of microplastics in freshwater and terrestrial habitats are very limited as compared to the coastal environments. In terrestrial activities, most plastic trash ends up in landfills/dump-sites which are broken down into different microplastics before moving through the surrounding soil-water system via leachate. Thus, soil water resources act as s transitional sink and pathway for microplastic particles from land to sea or plants and animals. Site characterization along with soil-water sample processing and analysis can play a crucial role in predicting migration and concentration level of microplastics. In this work, an MSW dumpsite in northern India is investigated for spatial variation of microplastics in surrounding soil-water and in a nearby tributary (*Solani*) of river Ganges. Presence of co-contaminants like heavy metal is also considered to understand interactions between heavy metals and microplastics with their potential co-transport through porous medium. The developed framework aimed to approach the multi-analytical strategy based on the characterization and quantification of different forms of microplastics in soil-water for their potential risks on the surrounding environment. In general, it would assist us in taking future initiatives to tackle microplastics pollution effectively.

Keywords: Microplastics, MSW Dumpsite, soil-water resources, Surface water, Groundwater

IL-3: Chemical pollution from durable water repellents in textile industry-the very different perspective from producing and importing countries

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Abstract

Polyfluorinated and perfluorinated alkyl compounds (PFAS) are used in many applications due to their water- and oil-repellent properties, for example in the impregnation of carpets, in fire extinguishing foams, paper finishing, paints, varnishes, the non-stick coating of cookware and in various medical products. In the textile industry, PFAS are used in DWR ("durable water repellent") coatings to provide products with long-term water-, oil- and dirt-repellent properties. Due to inherent stability of PFAS against degradation their use in different products, not only textiles, comes with increasing environmental concentrations. They are detected in various environmental matrices and organisms, including humans, and even in remote areas (Arctic or Antarctic). This can have global consequences for human health and lead to a variety of environmental problems. Due to this, textile industry seeks to find alternatives with less problematic (eco)toxicological and environmental properties (Schellenberger et al. 2017).

In our research we have performed a market research regarding commercial availability of DWR products, analysed 18 different DWR-formulation (silicon-, hydrocarbon- or PFAS- based) in regard of chemical composition and ecotoxicological effects, and compared the hazard of different types of DWRs. Our focus was to assess hazards and risks of used chemicals during the production of textiles and not the emission from ready textiles. In several DWR samples, toxic or carcinogenic components were detected, which were not declared by the producers. The analysis of PFAS-based DWR formulations confirmed presence of numerous (per)fluorinated carboxylic acids, sulfonic acids and alcohols of different chain lengths. Considering the production volume of DWR and the emissions during production, the textile industry is responsible for a significant input of PFAS into the environment.

Generally, DWR formulations mainly contain reactive components that enable chemical (covalent) binding to textile materials. Often such chemicals are *per se*

acutely hazardous to humans and the environment - this also applies to products based on natural waxes, for example. Textile production involving investigated formulations (whether Si-, CH- and FC-based) requires a high standard of occupational safety, well-equipped production facilities, trained personnel and good waste and wastewater management. If these conditions are not met then the hydrophobization of textiles is associated with a considerable direct/immediate (factory workers) and delayed/indirect (general population) as well as the environment. Since large share of textile hydrophobisation occurs in Asia, Asian population is particularly affected, especially considering the often less advanced standards of occupational/environmental protection compared to western countries.

In this talk, the different perspectives of “chemical pollution” of a textile producing country such as India and typical textile importers such Germany are discussed controversially.

Reference: Schellenberger, S., Gillgard, P., Stare, A., Hanning, A., Levenstam, O., Roos, S., Cousins, I.T., 2018. Facing the rain after the phase out: Performance evaluation of alternative fluorinated and non-fluorinated durable water repellents for outdoor fabrics. Chemosphere 193, 675–684. https://doi.org/10.1016/j.chemosphere.2017.11.027

IL-4: Bacteria-laden granules for treating wastewater containingpriority contaminants

Y.V. Nancharaiah[a,b]

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Abstract

Effective wastewater treatment is essential for public health and sanitation, water reclamation, preventing environmental pollution, avoiding water degradation and sustainable development. Biological treatment is a key component of wastewater treatment plants (WWTPs) and removes both oxidized and reduced contaminants like organic matter, reactive nitrogen, phosphorus, and others from wastewaters. Growth of microorganisms as communities like activated sludge is needed for achieving biological treatment as well as separation and retention of microbes in WWTPs. Aerobic granular sludge (AGS) processhas emerged as a replacement for century-old activated sludge and promisessustainable biological wastewater treatment. This new emerging technology promises effective removal of contaminants apart from a significant reduction in land footprint, infrastructure and cost.It relies on development of bacteria-laden granules for removing pollutants through biodegradation and/or biotransformation. This emerging process was evaluated under different process conditions in the presence of priority pollutants like antibiotics, metal(loid) oxyanions and heavy metals. It was observed that the bacteria-laden granules were robust and performs biological treatment even in the presence of toxic concentrations of emerging contaminants. For example, the nitrogen and phosphorus removal capabilities were not impacted by the presence of toxic concentrations of metal(loid) oxyanions and heavy metals. Moreover, bacteria-laden granules were able to efficiently convert metal(loid) oxyanions into insoluble biomass associated forms. This presentation covers advantages of bacteria-laden granules vis a vis existing biological wastewater treatment, biological nutrient removal and effect and fate of priority/emerging contaminants on this emerging wastewater treatment technology.

IL-5: Removal Of Emerging Contaminants Using Engineered Natural Treatment Systems

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Abstract

In recent years, the availability of freshwater resources has been depleting due to increased water consumption by the growing population across the world. In this regard, treatment, and reuse of wastewater aid in achieving water security and environmental protection. However, pharmaceuticals and personal care products (PPCPs) in the treated wastewater abate its reuse potential to a certain extent. The advanced treatment technologies to eliminate PPCPs incur exorbitant costs and energy requirements. In this regard, natural treatment systems like riverbank filtration, bioactive adsorbents, constructed wetland systems (CWs) etc, could be a sustainable treatment alternative. Despite its broad application in removing pollutants (organics, nutrients, and pathogens), the application of constructed wetland systems to attenuate PPCPs is still inconclusive. Besides, the relationship between various factors (pollutant properties, characteristics of substrate materials and plant species, the configuration of CWs, etc.) and removal mechanisms is not fully understood. Further, the efficacy of CWs can be improved largely by enhancing the synergetic actions of its components. However, the information on these factors is limited. Thus, comprehensive studies on the occurrence, fate, and accumulation of PPCPs in wetland systems is essential. Also, the application of riverbank filtration, bioactive biochar, and tailor-made adsorbents for the abatement of emerging contaminants are not explored extensively.

This paper discusses about the removal of three Ecs, namely, atenolol, ciprofloxacin and gemfibrozil possessing diverse physico-chemical properties in different treatments, such as biodegradation, adsorption and riverbank filtration (RBF). This paper also provides information on the occurrence of PPCPs in Indian rural wastewater along with their fate in CWs. The present work gauged the contribution of each component of CWs for the attenuation of PPCPs in bioaugmented CWs.

IL-6: Removal of Radio-Contaminants from Low Level Radioactive Liquid Waste

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Abstract

An efficient and safe waste management practices in congruence with evolving global approaches has been given vital priority in Indian nuclear power program. Effective removal of radio-contaminants from radioactive effluent streams prior to discharge through aquatic route has always been the thrust area for developing scientific concepts and translating the same into innovative technologies. Emphasis has been towards environment friendly green solutions. The primary objective is to isolate the radioactive waste from the biosphere to minimize migration of radionuclide into the geo-environment. Safe and secured management of radioactive effluents plays vital role towards acceptability of nuclear energy by general public. Extensive research & development in this field has resulted in standardization of the treatment methodologies. In addition to conventional chemical treatment, newer technologies like ion exchange and membrane processes have been evaluated and implemented on plant scale for effective containment of radionuclides present in liquid wastes. The use of membrane based reverse osmosis processes has also provided a promising methodology for demonstrating recycling of water recovered from radioactive liquid waste. There have been distinctly visible improvements in treatment and conditioning technologies. The radioactive wastes are gradually turning into the material of resource thereby, realizing the concept of “Wealth from Waste”.

Keywords: radioactive, effluent, discharge, ion exchange, chemical treatment, membrane etc.

IL-7: Technologies for Autonomous Monitoring of Contaminants Present in the Atmosphere

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Abstract

Contaminants of both chemical and Biological origin are emerging as the most critical global threat of the new millennium. The concentration and the nature of chemical contaminants are significantly increasing every day due to industrialization. Similarly, the microbial load in the atmosphere is also increasing due to the heavy population, improper waste disposal systems, and open sewage / industrial wastewater treatment systems, leading to an increase in the load of bioaerosol concentration in the atmosphere. The early Detection of these contaminants in the atmosphere is crucial to contain the dissemination of microbial agents (Bacteria, Viruses, Fungi & Toxins) and toxic chemicals in the population. In a biological attack, the aerosol release of biological agents is the main dissemination route; in this form, these agents will spread and stay for a long time in the air and cause maximum mortality. Generic biological detectors have been developed using various principles to monitor biological agents in the air around the clock. In this lecture, I will discuss the recent technologies used for the autonomous Detection and identification of chemical and biological contaminants in the atmosphere.

Only a few technologies of autonomous monitoring devices will be used in field conditions., Most of them are instruments based and free from consumables. I will be discussing the following technologies listed below for their advantages and disadvantages and their possible applications for detecting both chemical and biological contaminants in the atmosphere.

- Laser-induced fluorescence
- Flame photometry
- Raman Spectroscopy

IL-8: Electro-Spun Nano-Fiber For Effective Photocatalytic Decontamination Chemical Warfare Agents

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Abstract

Organophosphorous (OPs) and Organochlorine (OCs) based chemical warfare agents (CWA) always pose severe threats to environment. There are lots of treatment methods available and it is crucial to find out technical feasible and economical viable methods for the safe disposal of organic contaminants. In the view of this issue, electrospun nanofibers were successfully developed and chemically modified to address the problem. The ZnO nanomaterials and rare earth-doping compounds enhance the photocatalytic activity by decreasing the band gap. In the recent study, La-doped ZnO nanocrystals were directly grown on electrospun PAN nanofiber sheets using hydrothermal method. The prepared La-doped ZnO/PAN nanofibers were properly characterized by using advanced techniques. The prepared catalyst was applied as heterogeneous photocatalyst for the degradation of toxins under UV light. The mineralization of the toxicants was analyzed and the by-products were confirmed by HPLC and GC-MS techniques. From the studies, it concludes that the developed materials were productive for wider range of compounds, completely degraded, and the catalyst was recycled for more than three cycles.

IL-9: Legislative Requirement For the Industrial Hazardous Waste Disposal And an overview of Hazardous waste disposal in India.

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Abstract

Industries involved in the manufacturing, uses raw materials and subject it into various processes. This results in the output of final pProducts, Bye Products. Additionally, the solid, air and liquid wastes are also generated in the process. Liquid wastes can be separated, 36as attaine and subjected to physical, chemical, biological processes to treat the waste water to minimize the adverse effects on the environment and also to reuse the treated waste water for appropriate uses. This will ensure adhering to the Sustainable Development Goals (SDGs). Certain specific Standards are prescribed depending upon the type of the effluent or the type of discharge place such as stream, pond, and irrigation land or into land or oceans etc. Air pollutants can be dissolved or can be collected using adsorption, absorption or density based techniques and can be disposed of using scrubber, or cyclone or electrostatic precipitators.

Hazardous waste needs a specialized method of collection, analysis, storage, transportation and disposal methods. Specific regulations apply for generation, handling, collection, reception, treatment, transport, storage, reuse, recycling, recovery, pre-processing, utilization including co-processing and disposal of hazardous wastes. The regulation takes into account prevention, minimization of environmental damages, possible reuse, recycling, recovery, and utilization of hazardous waste including co-processing. This will ensure adherence to a numbers of SDGs for the industries. If any material and substances are not used or recovered in any of the above techniques then those are subjected to safe disposal in a scientifically developed treatment, storage and Disposal facility (TSDF). In all States, such TSDF facilities are commonly available for the disposal of Hazardous wastes generated from Industries. Big industries can develop their own dedicated disposal sites as well with strict adherence to standards.

Where as, handing of hazardous substances needs preparedness while handling and transportation, storage and using in processes etc. These are governed by another set of legislations. According to this legislation specific safe guards are to be put in place while handling these chemicals. This include off site and on site emergency plans, periodic training to all stake holder, officials involved, conducting periodic mock drills etc.

Besides, a number of contaminants like Bio- medical wastes, E wastes, Battery waste/ Used batteries, Plastic wastes. Construction & Demolition Wastes etc are also need to be tackled. The objectives of all these legislations are to separate, establish a dedicated system of collection at the generation points itself and then scientifically treat and dispose them off with minimal or no damage to any of the environmental components. This can be done either in situ or it can be done through a common operator. This paper will give an over view of the legislative requirements to handle these wastes and chemical substances.

Key words : Hazardous wastes handling, disposal, legislative requirement, Hazardous substances management, handling of specialized/ specific wastes.

IL- 10: Uranium in groundwaters of India

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Abstract

Uranium is a naturally occurring radioactive element in the groundwaters of India. This study aims to assess the impact of the occurrence of uranium in the groundwaters of different regions of India. Groundwater samples were collected in Nalgonda district, Telangana (2008 to 2012); Gogi region, Karnataka (2013 to 2016); Preambular, Dharmapuri, Krishnagiri, Erode, Trichy, Karur, Salem districts of Tamil Nadu (2016-2020). Uranium occurs as an important constituent in igneous, metamorphic rocks and in some sedimentary rocks. Low to medium-grade uranium ore deposits are occurring in the states of Jharkhand, Rajasthan, Meghalaya, Chhattisgarh, Andhra Pradesh, Telangana and Karnataka of India. The uranium

concentration in groundwater is relatively high in massive rock regions, especially granites. Uranium was found to be higher than the prescribed values of 30 µg/l in several granitic regions of southern India. Evaluation of toxicological effects on humans due to consumption of groundwater with uranium confirms that people in several parts of south India are exposed to the lowest observed adverse effect level dosage greater than 0.06 mg/kg/day. People living in granitic regions near the uranium mineralised zones are at higher risk, whereas the other regions also possess low to moderate risks. Thus, it is necessary to include this radioactive element in Indian water quality standards and effective water treatment to minimize the risks posed to humans.

IL-11: Environmental Biofilms, Water Quality and Microbial Corrosion: Impact on Public Establishments and its Mitigation Strategies

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Abstract

Severe biofouling and microbiologically influenced corrosion (MIC) issues pose threats to the process water, fire water and cooling water systems of several power plants and structural components of public establishments. Failure analysis on the pipelines and damaged structures showed an accelerated under deposit corrosion and pinhole leaks caused by slime formers, manganese and iron oxidizing bacteria. Besides microorganisms, water quality parameters including turbidity, chlorides, total dissolved solids and the dissolved oxygen content play the significant roles in MIC of different establishments. The present talk encompasses on the impact of biofilms and MIC in various water systems of nuclear power reactors and in the public sector units. Some non-conventional biofilm mitigation strategies including novel non-oxidizing biocides, ionic liquids and graphene based coatings are also discussed.

IL-12: Mitigating the Dissemination of Antibiotic Resistance Genes in Urban and Agricultural Environment

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Abstract

The spread of antibiotic resistance genes (ARGs) in the environment poses a potential threat to public health. Surface water is often considered a major environmental medium contributing to the transmission of ARGs to the general public, as it is used as a source of drinking water, irrigation water, and recreational water. Experimental and modeling approaches were used to investigate the fate and transport of ARGs, originated from urban wastewater and livestock wastes, in the environment. Data obtained from the investigation were used to design strategies for urban stormwater management and livestock manure management with the goal to minimize the spread of ARGs to surface water and food crops.

IL-13: Reduction of Micro-Pollutants in Drinking Water by Domestic Water Purifiers

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Abstract

Micro-pollutants (MPs) are biological or chemical contaminants that make their way into ground and surface waters in trace quantities (at or below the microgram levels) as a result of anthropogenic activities. These include pharmaceuticals and personal care products (PPCPs), industrial chemicals (including per- and polyfluoroalkyl substances (PFAS)), cleaning detergents, steroid hormones, heavy metals and pesticides. Reverse osmosis (RO) is the most promising technology for MPs removal from drinking water. Almost 80 % of domestic drinking water market use RO technology for the effective treatment of water.

With their low concentrations and diversity in nature, MP removal encounters numerous challenges. Although some MPs are effectively eliminated via conventional treatment methods, most of them can easily escape and are retained in the treated water. Therefore, advanced technologies like adsorption, oxidation and advanced oxidation processes, nano-filtration, and advanced membrane processes are very effective for removal of specific MPs. However, regardless of what technology is employed, the removal of micropollutants depends on physico-chemical properties of micropollutants and treatment conditions.

After the release of micropollutants in surface and ground water, a better understanding of their fate in surface water is essential for effectively predicting their impacts on the receiving environment.

IL- 14: Effect of temporal variation in ionic strength on colloid retention and remobilization in saturated porous media

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Abstract

Temporal variations in the chemistry of infiltrating water into the subsurface are known to cause remobilization of colloids from the grain surfaces, thereby increasing the travel distance of the colloidal contaminants. Hence, it is essential to thoroughly understand the transport, deposition, and release mechanisms of colloids in the subsurface, through laboratory experiments and modeling. This study systematically investigated the effect of temporal variations in ionic strength on the remobilization of deposited colloids in saturated porous media through laboratory column experiments and numerical modeling. Four sets of column experiments were performed, in which carboxylate-modified latex colloids were injected at a given ionic strength for a specified period. After breakthrough of colloids, the ionic strength of inflowing water was decreased in a stepwise manner to 0 mM. The initial ionic strength values of the four experiments were 100, 50, 25, and 10 mM. Partial release of deposited colloids was observed after several steps of ionic strength decrease with significant release observed only when the ionic strength was reduced to below 10

mM. Also, the fraction of released colloids was found to decrease with increasing value of initial ionic strength of inflow water. A mathematical model incorporating a novel formulation for ionic strength-dependent deposition and release is developed. The model is found to capture the colloid breakthrough curves reasonably well for all experiments with the same set of parameter values, except the one at the initial ionic strength of 25 mM.

IL- 15: Improving water quality through bank filtration in India with respect to organic micropollutants

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Abstract

Besides pathogens, heavy metals or excessive nutrient loads, organic micropollutants (OMPs) caused by humans represent a considerable problem for water quality as well as for a safe drinking water supply. For example, the occurrence of higher concentrations of chloroaromatics, PAHs or pesticides in major Indian rivers has been reported several times.[1,2] Regarding the occurrence of other OMPs, such as antibiotics and other pharmaceuticals, UV filters, or polar industrial chemicals, there is insufficient knowledge so far.[3] However, it can be assumed that considerable amounts also occur here, mainly from municipal and industrial wastewater. Even if these are treated by wastewater treatment plants, the removal is known to be insufficient for many OMPs. If the receiving water is used for irrigation or as a source of drinking water, there is a potential risk to human health. Conventional water treatment with flocculation/filtration usually does not provide a sufficient barrier for many OMPs. More efficient processes such as activated carbon adsorption, oxidation methods or membrane processes are expensive and complex. In different industrialized countries, including Germany, it has been investigated that bank filtration (BF) is an effective and low-cost first step to improve raw water quality also in view of OMPs. However, a simple transferability of corresponding results and experiences to other regions is often limited due to different boundary conditions (including climatic factors, water

composition, operation of BF schemes). Within the Indo-German BMBF-funded CCRBF project, water samples were collected from five BF demonstration sites across India in 2021/2022 to investigate the removal of OMPs. The sites differ considerably with respect to regional boundary conditions, e.g., diverse sources of contamination, such as industrial or municipal wastewater, agriculture, or mining. Previous studies using high-sensitivity LC-MS/MS show, for example, that the concentration of various OMPs such as benzophenones, ibuprofen, DEET or bisphenol A, which occur in the Yamuna River, are significantly reduced by BF at the demonstration site in Agra. There, a high mean removal rate of 70% was also observed for dissolved organic carbon (DOC) and for sulfamethoxazole (~100%). Other OMPs like naproxen, triclosan, diclofenac, atrazine, atenolol and diuron also showed good removal during BF. Of all the investigated sites, the highest concentration of most OMPs was detected in the Yamuna River in Agra. The presentation will include monitoring results, current field and laboratory studies on OMP removal by BF in India.

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IL-16: Tunable 2D Nanomaterials (Nanocomposites) for Efficient Water Treatment and Remediation

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Abstract

Water sources globally are heavily contaminated with pollutants, including heavy metals and hazardous materials from industries, which requires proper control to protect water bodies. Pollutants introduced into the water from hazardous waste

and incidental spills like organic dyes, volatile compounds, pharmaceutical waste gives rise to significant threats to the environment and human health. The conventional removal strategies are time consuming and not effectively removing the contaminants. In response to the need for water remediation, the advancement of nanotechnology has led to the development of new technologies using nanomaterials over the past few decades. The exceptional characteristics of nanomaterials, such as a high surface-to- volume ratio, strong thermal and electrical conductivity, and affordability, have boosted the effectiveness of removing pollutants from water bodies. The removal of pollutants by nanomaterials should be complimented by the degradation of pollutants into non-toxic metabolites. Among the nanomaterials the 2D materials are gaining attention for their potential to replace current water purification method due to its unique property with removal and degradation of pollutants. The 2D materials like graphene, MoS 2 , Mxene, layered double hydroxides are potentially used in removal and degradation of pollutants. Despite all the potential benefits of nanomaterials in water remediation, the unwanted and uncontrolled release of nanomaterials in the environment may significantly affect the environment, human, animal and plant health. It is crucial to consider the development of safer nanomaterials formulation in the field of pollutant remediation.

IL-17: The Decontamination of Urban Run-off, Importance and Methods

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Abstract

Urbanisation and other anthropogenic activities have become the source of contaminants which have now infiltrated groundwater, land-based water bodies and oceans. Based on UN data and our own research, the load being discharged could well exceed 30 million tonnes per annum and growing. The recent COP15 agreement focuses on removal of plastics and nutrients which are regarded as major contributors to loss of biodiversity. However, the full spectrum of contaminants must be addressed. That spectrum must include the synthetic molecular compounds that are associated

with many human activities. Unfortunately, a biproduct of improvements in lifestyle and standards of living is a growing array of toxic materials that are threatening sustainability of water at a Global level. This paper seeks to present research and solutions for the removal of toxic materials transported by runoff which are recognised as compromising the sustainability of global water bodies. As we know, sediments from impervious surfaces and processes carry a range of contaminants and heavy metals. Research of fine particles clearly shows that a complex process of surface attraction, mechanical entrapment and chemical bonding occurs at micro particle level (refer fig 1). These micro particles conglomerate to form sediment beds and retain chemicals for extended periods of time. This complex process of attraction and entrapment explains the phenomenon whereby heavily toxic sediment beds may exist whilst the aquatic environment above may support transient, healthy life forms. The research further concludes that a major reduction in the presence of synthetic contaminants can occur by focusing on the removal of fine particulate matter rather than seeking to remove those compounds utilising further chemical action, which in turn may have detrimental consequences. The follow-on challenge is developing technology which can be easily applied to the various applications that vary in both concentration and flow volume. For example, groundwater remediation and recharge requires a different level of technology when compared with the discharge from a major drain or waterway. The research conducted demonstrates that conventional filtration methods are either limited or impractical. The resultant solution from research is to broaden the use of hydraulic separation which is capable of removing fine sediment without the inherent clogging and blinding of filter screens and media. The presentation will provide examples of systems which can process a broad range of influent concentrations and flow rates from 10 to 10,000 litres/second. The presentation will also invite interested parties to participate in further research and implementation of the technology with a focus on sustainable water for future generations.

IL-18: Per- and poly-fluoroalkyl substances (PFAS); Human exposure pathways

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Abstract

Per- and poly-fluoroalkyl substances (PFAS) are related to a family of synthetic products and are widely used in different industries and consumables due to their special molecular characteristics. Their special characteristics are related to their dual hydrophobic and hydrophilic properties and their extremely resistant carbon-fluorine bonds. These facts consequence their ubiquitous in our surrounding environment. PFAS are everywhere and they can contaminate water and soil to enter the food chain. Exposure to a high level of PFAS can cause different adverse effects on human health. Human exposure to PFAS can occur through ingestion, inhalation, or dermal contact. Ingestion has a higher contribution among other sources. PFAS accumulates in food through bioaccumulation in food products or migration from food contact material. Application of PFAS in food contact materials makes them non-stick and water and oil resistant. This presentation aims to focus on human exposure to PFAS through ingestion, especially food contact materials. PFAS is used in the coating agents in various food contact materials (FCM) such as fast-food and take-away containers, baking papers, muffin cups, French fries, and microwave popcorn packaging.

IL-19: Impacts and Challenges of Climate Change on Groundwater Availability and Utilization

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Abstract

Climate change poses uncertainties to the management of water resources. In several parts of India particularly in Gujarat, Punjab and Tamil Nadu states, the pumping of the groundwater is nearly double the rate of natural groundwater recharge. In these states, the problems of overdraft and associated groundwater quality parameters have emerged. Further, the issue of climate change adds a new dimension to the ongoing dynamics of water supply and demand. The number of over-exploited areas are continually increasing. This poses a challenge to the researchers 46as atta on water related issues towards sustainability. Both in energy and water sectors, India's high emission growth pathways need to be checked. Energy sector reforms are quantitatively defined by way of changed energy reforms and efficiency. In water sector, as most pathways for less carbon emissions/GHGs are based on probabilistic estimates of climate change like precipitation patterns, temperature patterns, river flows, reservoir storages, crop evapo-transpiration, water evaporation, groundwater movement the complexities are high. Landuse Landcover change due to urbanization, industrialization and habitat conversion causes more stress on water resources due to pollution. Strategies are to be developed for management of risks comprising demand and supply, devising infrastructure projects that will enhance the number of beneficiaries and that will also provide appropriate opportunities to manage water resources. The advent of technologies like remote sensing, GIS, artificial intelligence etc. play a crucial role in these developmental activities.

Keywords: Climate change, impact, issues, challenges in water resource management and adaptation

IL- 20: Risk Assessment of plastic additives in the Ganges and Sundarban wetland: Implications on sustainable development approaches

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Abstract

The expeditious growth in the global industry has led to an increase in the pollution of freshwater systems particularly in Asian and African countries. It is noteworthy that wastewater discharge into the riverine environment has been identified as the primary source for the deterioration in river quality as nearly 80% of all wastewater is discharged directly into rivers and lakes without treatment in these countries. The transboundary River Ganga serves as a conduit for meltwater from the Himalayas and is a major freshwater source for two-thirds of the Indian population before emptying into the Sundarbans Delta, the largest estuary in the Bay of Bengal. River Ganga in its total length of 2525 km receives industrial effluents of 501 million litres per day (MLD) from 764 grossly polluting industries (GPI). Owing to the huge quantity of wastewater released into River Ganga, it ranked among the top three rivers globally with Indus and the Brahmaputra carrying 90% of plastic waste. Out of the numerous contaminants that are carried by wastewater into the receiving riverine environment, organic plastic additives in particular phthalic acid esters (PAEs) and bisphenol A (BPA) have emerged as the most prominent chemicals. In addition, the practice of burning manmade plastic products in open dumpsites and unregulated electronic waste (e-waste) recycling in Indian cities have also been identified to pollute the ambient riverine environment with these chemicals. The linkages between plastic-borne chemicals and key sustainable development goals are not well articulated. Hence, an attempt was made to elucidate these chemicals in water samples from Ganga and Sundarban wetland of India. Since these compounds exhibit estrogenic potential we have further measured steroids and evaluated the estrogenic activity using an in-vitro bioassay (E-Screen). Caffeine was measured as a marker for anthropogenic wastewater discharge. Further, based on the results, sustainable development approaches were discussed. Results showed that the highest *estrogenic*

activity was associated with sites having sewer outfalls in the middle stretch of the river, and concomitantly coinciding with high elevated concentrations of caffeine. The highest estimated ecotoxicological risk to aquatic insect and fish stemmed from BPA. A secondary effect, and a potential impact on human health could be reflected via fish consumption from the productive fisheries region along the lower stretch of River Ganga.

Based on the identified areas of elevated estrogenicity, plasticizer and steroid concentrations in River Ganga it was evident that there is an urgent need for the drafting of sustainable use strategies to address the gradual decrease in water quality.

IL-21: Use of iron nanomaterials for the treatment of emergent contaminants in water

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Abstract

Iron-based nanomaterials are increasingly used in environmental applications. Different types of iron-based nanomaterials, namely, zerovalent iron nanoparticles, nanoparticles of iron oxides, and nanoparticles prepared from iron salts and natural extracts by green procedures, are briefly indicated in this presentation, together with their preparation, characterization, and applications in the treatment of pollutants in water, with emphasis on the works performed in the last 10 years. In terms of preparation, top-down procedures such as mechanical milling, nanolithography, laser ablation, sputtering, and thermal decomposition, and bottom-up methods such as chemical synthesis, sol-gel, spinning, chemical vapor deposition (CVD), pyrolysis, and biosynthesis are indicated for nanoparticle production. The most commonly used nanomaterials are inorganic nanoparticles based on metal and metal oxides and, among them, iron-based materials have been widely used in the removal of pollutants in water. Among pollutants, halogenated organics, nitroaromatics, pesticides, dyes, antibiotics, halogenated aromatics, phenolic compounds, PCBs, inorganic anions such as nitrate and heavy metals and metalloids (e.g., Hg, Pb, Cr, Cu, As, Ni, Zn, Cd, and Ag); radioisotopes of Ba, TcO_4, and U, and antibacterial activity against Gram-positive

and negative bacteria have been successfully treated. In some cases, iron-based nanoparticles have been combined with H_2O_2 in Fenton processes. In this presentation, examples of emergent contaminants are specially discussed. The advantages of using these materials and the need for their improvement to extend their deployment are remarked.

Keywords: Iron-based nanomaterials, Removal of pollutants, Emergent pollutants, Water

Invited Lectures in Preconference Workshop

WIL-1 : Transport and Entrapment of Organic Contaminants in the Subsurface

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Abstract

Toxic organic contaminants such as slightly soluble volatile liquids enter the subsurface resulting in spread of contaminant plumes. Challenges are high whenthese immiscible liquids get entrapped in the subsurface. Immiscible fluids migrate under the influence of capillary, gravity and viscous forces, spreads vertically displacing water and air from pores of the subsurface and gets trapped as discontinuous residual blobs due to the effect of capillary forces.van Genuchtenequation and Brooks and Corey equation serve as useful inputs to the models developed for two phase flow migration and entrapment.The empirical equation proposed by van Genuchten is robust and has gained favorable acceptance. It is given by

$$S_e = (1 + (\alpha h_c)^n)^{-m} \quad (1)$$

$$m = 1 - \frac{1}{n} \quad (2)$$

Effective Water saturation is expressed as S_e, the constants n and m are dimensionless. α value is a fitting parameter associated with both drainage and imbibition of water and are represented as α_d and α_i respectively. α_d is the measure of the pore throat size and α_i is the measure of the pore body size. They both have the dimensions of 1/L. The parameter n is also a fitting parameter associated with both drainage and imbibition as n_d and n_i respectively. n is related to pore size distribution index and it controls the shape of the curve. h_c is the capillary pressure head corresponding to degree of saturationwhere α, n and m are constants.

The VG equation parameters are indirectly estimated from basic soil properties such as sand, silt and clay fractions, bulk density, or water content at field capacity. The computer program RETC is widely used to forecast the VG model. The nonlinear least square method is adopted in RETC and the initial values of VG equation parameters

need to be set. Having obtained van Genuchten's parameter 'α_d' from RETC model for air-water system, α_d value was used to predict water saturation PCE-water systems.Similarly, with the $\alpha_i$values obtained for air-water system, residual PCE saturations were predicted. The predicted values of water content of RETC can be compared with experimental results immiscible liquid flow in the subsurface.

Having known the estimated parameters from Retention Curve model, the entrapment and residual saturation of immiscible fluids in the pore spaces of the subsurface can be found. These values would be helpful in gauging entrapment of such fluids at field level and design a proper remediation technology.

WIL-2: Impact of emerging contaminants in cardiovascular and renal diseases-a biomarker based detection technologies

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Abstract

Bioassay including in vivo and in vitro assays help as a bioanalytical tool in water quality assessment. The biomarkers are class of biomolecules that determines the activity of endogenous function upon exposure to the toxic or contaminant. Biomarker can be a protein or its associated nucleic acid or a metabolite. An adverse outcome pathway in a toxicokinetics study includes the understanding of cellular toxicity, organ response, organism response and population response. The initial cellular toxicity analysis includes toxicodynamics (cellular toxicity pathway) in which the molecular intiating kinetics, intermediate effect, cellular stress response and cytotoxicity will be evaluated. the establishment of toxicodynamic requires a potential cell-based bioassays utilizing viable and dead cell count based assays or toxicity pathways related enzymatic assays and biomarker quantitation. Biomarkers can be

nucleic acids, proteins and metabolites secreted from the affected organs discovered using high throughput approaches. Any detectable biomarker relies on the gene responsible for its synthesis and secretion. The gene is transcribed into mRNA and is translated into a protein. Quantitation of mRNA is a versatile tool to define its response with respect to the contaminant exposure. The quantitation of mRNA levels

of biomarker genes directly predicts the cellular response. The various steps involved in detecting this response includes, treatment of in vitro grown tissue specific cell lines (native cell line or primary cell line) with contaminant to be tested, RNA isolation, cDNA conversion followed by quantitation of mRNA levels with respect to untreated controls. The techniques for RNA isolation, cDNA conversion and quantitative Polymerase Chain Reaction are attached.

WIL-3: Molecular tools and techniques for determining antimicrobial resistance genes and bacterial community in water environment

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Abstract

Anti Microbial Resistance is emerging as a global threat in human health estimated to become the leading cause of death worldwide by 2050. It is considered as a huge social and economical problem where water environment significantly contribute to the evolution of AMR in microbial organisms and its transmission. Environmental water monitoring will provide vital information related to the burden and emergence of antimicrobial resistant micro organisms, hotspots for the transmission of AMR organisms, efficiency of waste water treatment plants in removal of potential micro organisms. Microbiological culture based methods and molecular techniques such as qPCR provide insights related to the identification and load of micro organisms. Metagenomics based NGS approaches provides an excellent platform to profile all the antimicrobial resistant genes, toxic and virulent genes and bacterial community of environmental water samples. Bioinformatics pipeline analysis includes FastQC to determine the quality of the raw reads, spades assembling the raw reads to contigs and scaffolds, Kaiju for taxonomical classification and phylogeny analysis, Prokka for genome annotation, Staramr and Abricate to identify AMR genes, Barrnap to map 16rRNA sequences in BLAST and MLST sequencing to identify sequence type of the organism..

ORAL PRESENTATIONS

OP-1: Theoretical insights into the role of catalyst in enhancing the degradation kinetics of acetaminophen in photocatalytic and photocatalytic ozonation systems

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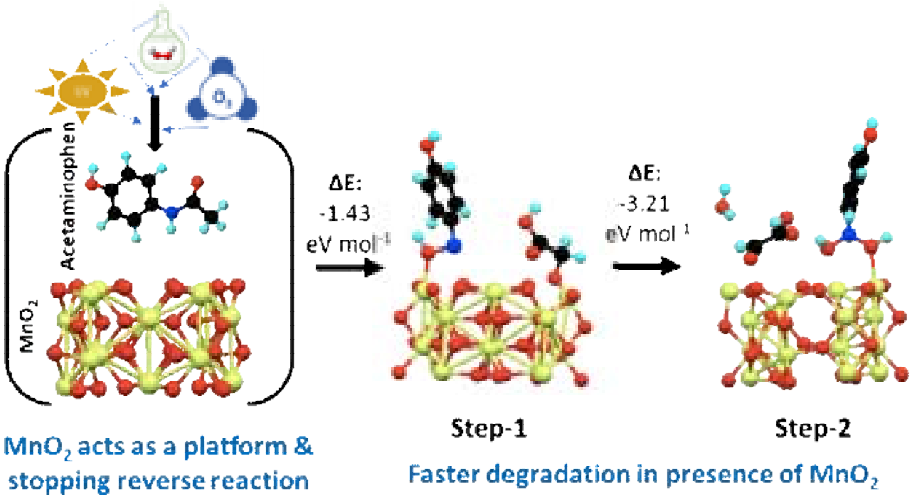
Abstract

Emerging contaminants (ECs) are pervasive organic pollutants, and their removal is beneficial to safeguard humans and the environment. The concentrations of pharmaceutically active compounds (PhACs) showing a significant upward trend in recent years. Acetaminophen is commonly reported PhACs in wastewater systems with a detection frequency of 80-100% and 50% for below and above 100 μL^{-1}, and its removal through conventional treatment is scarce[1]. Tertiary treatments like advanced oxidation processes (AOPs) help degrade acetaminophen. In such cases, a catalyst (e.g., MnO_2) can further enhance the reaction rate of the degradation processes, while the mechanism is poorly understood. On the other hand, generating an experimental dataset to identify the function of a catalyst is a complex and cost-intensive process. In such a way, computational models are mathematical models having the potency to verify the significance of catalysts in degradation reactions via computer-based simulations. So, here the role of MnO_2 for degrading acetaminophen via photocatalytic (MnO_2+UV) and photocatalytic ozonation (MnO_2+UV+O_3) systems were calculated using density functional theory (DFT) studies. To develop the baseline dataset, UV and UV+O_3 systems were also studied. As hydrogen peroxide (H_2O_2) is known to enhance reactive radical production in AOP-based processes, its efficiency in such a system is also calculated. The difference in energy of the reaction (ΔE eV mol^{-1}) at each degradation level of acetaminophen was calculated using the formula $\Delta E = E(A) + E(MnO_2\text{-}B) - E(MnO_2) - E(AB)$, where AB is target compound. The negative value of ΔE indicates the exothermic reactions, and such conditions are thermodynamically favorable i.e. feasible reaction. Contrastingly, a positive value indicates an

endothermic process, and to induce favorable reactions additional energy needs to be supplied. From the results, photolysis (UV) is not effective in degrading acetaminophen, the reaction is not favorable, and it is reversible. The presence of H_2O_2 in the UV+O_3 system enhanced the ΔE value as -0.77 eV mol^{-1} and initiated the degradation of acetaminophen. However, the presence of MnO_2 further increases the degradation rate of the reaction by serving as a platform (room) for acetaminophen and its degraded by-products. The achieved ΔE value for MnO_2+UV+O_3 was -1.43 eV mol^{-1}, which enhanced the acetaminophen degradation. In subsequent reaction steps, the rate of ΔE values increased to -3.21 eV mol^{-1}, which indicates the essential role of MnO_2 in degrading the acetaminophen to low molecular weight aliphatic compounds (e.g., CH_3COOH). Therefore, the theoretical simulation may act as pioneering research to select the best degradation technologies for the most recalcitrant pollutants like acetaminophen.

Keywords: Acetaminophen, MnO_2, Density functional theory, Photocatalysis, Degradation

Reference: Vo, et al. *Chemosphere* 236 (2019): 124391,



Graphical abstract

OP-2: Numerical Modelling as a decision tool for water quality

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Abstract

Groundwater is the world's most extracted raw material and is significantly used for agriculture and provides almost half of all drinking water supply. With the important role of groundwater in different industry sectors (mining, agriculture, civil engineering, etc.), there is always a potential risk of affecting its quality. Emerging contaminants like pharmaceutics, are life-threatening and they reach the drinking water sources through agricultural runoff, leaching of contaminants through waste disposal sites, mining etc and they can have a variable temporal-spatial scale. Therefore, we require necessary tools and methodologies to mitigate quality problems and evaluate different sanitation measurements easily and rapidly. In this study we use groundwater modelling as a decision support system for the assessment of water quality. The finite-element method behind the software FEFLOW is used to solve water quality issues at different scales and different complexity levels. FEFLOW is widely recognized as a comprehensive software package for subsurface flow and transport simulation. In this study we present a practical case, where FEFLOW was used to model the fate of pharmaceutics in groundwater. This study investigates in detail the transport mechanisms (mass and heat transport) associated to riverbank filtration. With a detailed controlled system, we validate numerical simulations of the fate and transport of trace organic compounds in a field site in Germany. Using FEFLOW reactive transport engine, the fate of multiple species transport was simulated. In the present study, we focus only on the transport of dissolved Oxygen and N-Formyl-4-Aminophenazone (4FAA) through bank filtration into groundwater. 4FAA is a common persistent marker and a product of pharmaceutics. Numerical modelling is used to demonstrate the importance of addressing the relevant hydro-geochemical processes like different complexity levels of reactions, temperature-dependent processes, sorption/desorption among others.

Keywords: Emerging contaminants, pharmaceutics,4FAA, FEFLOW

OP-3: Effect of microplastics on anaerobic digestion of domestic sewage sludge

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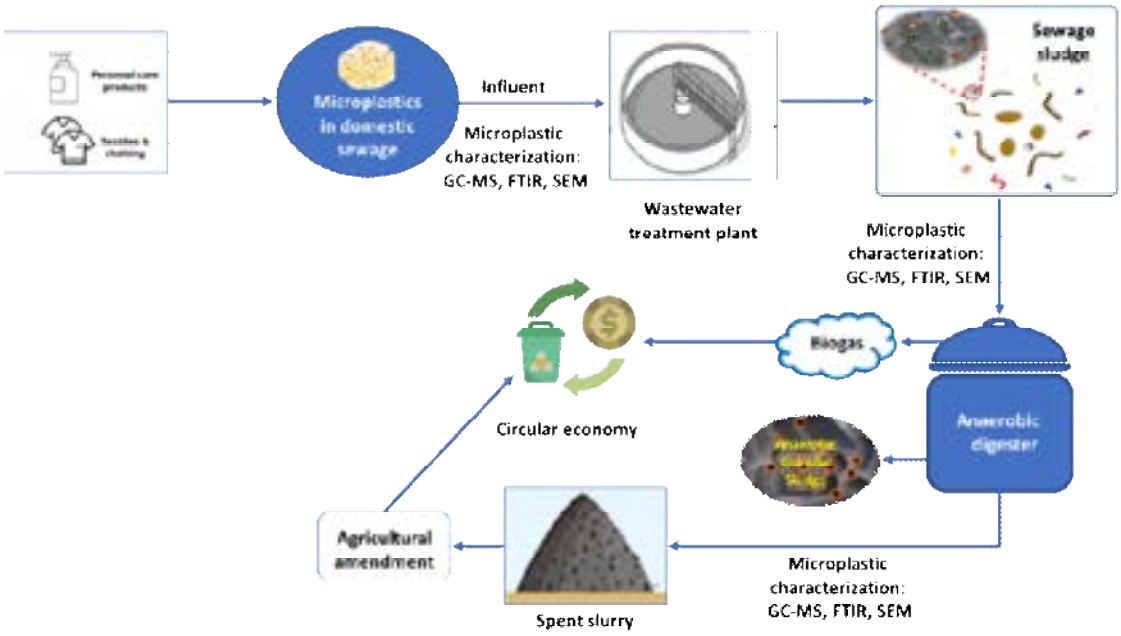
Abstract

Plastics have become an integral part of our life because of their characteristic properties. However, plastics disintegrate after their applications, creating microplastics (MP), a new environmental pollutant. Due to the excessive use of plastics in various products, MPs enter wastewater treatment plants (WWTPs). Due to their tiny size and varied physiochemical features, separating MPs is difficult. Although more than 90% of MPs may be removed from wastewater entering the WWTPs, they end up in the sludge because of their "hydrophobic" properties. Hence removal of microplastics from domestic sewage sludge is a prime necessity. Characterization of microplastics is the first step for their efficient removal. Due to the production of biogas from organic-rich sewage sludge, anaerobic digestion (AD) is considered one of the most effective treatment methods. AD can eliminate pathogens and odour, reduce the sludge volume and generate renewable energy. Many studies revealed that MPs show positive and negative impacts on AD, but their effects are still unclear. Hence, the present study aims to characterize MPs in domestic sewage sludge samples collected from aerobic treatment-based WWTPs. The MP-laden sewage sludge will be anaerobically digested, and the effect of microplastics during the process and the impacting mechanisms will be studied. Further anaerobic microbial granule formation with microplastics as a media and the selection of microorganisms during AD will be investigated. The above approaches will eventually lead to a better understanding of the fate of microplastics during anaerobic digestion for better treatment and resource recovery, as biogas and ensuring a circular economy in domestic sewage treatment.

Keywords: Microplastics; Domestic sewage sludge; Anaerobic digestion; Biogas; Granule

Source, fate, and effects of microplastics during domestic wastewater treatment



Graphical abstract

OP-4: Presence of antibiotics in surface waters and wastewater of a sub-tropical urban area in India

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Abstract

Antibiotics enter the surface water primarily through urban runoff, untreated/partially treated wastewater, and residues that may persist in the treated effluent. They enter the environment and pose a selective pressure resulting into altering the microbial structure and proliferation of resistant bacterial strains. Therefore, major concerns are the magnitude of the concentration of antibiotics and the modality of their release in the environment. The present study investigates the concentration of various antibiotics in the surface water sources (River, Canal and Stormwater drains) and also in the wastewater in a sub-tropical urban setting, and its potential impact on the environment. Liquid Chromatography Mass Spectrometer (LCMS) has been employed for analysis of samples. The Upper Ganga canal water displayed occurrence of trimethoprim, tetracycline and enrofloxacin in the range of 5.03-384.95 ng/L, even though the canal water is not supposed to receive any

municipal or industrial discharge. In drain waters, trimethoprim, sulfamethoxazole, enrofloxacin and tetracycline, widely used by the community for urinary tract/chest infection, acne, pneumonia, and bacterial diseases, were detected with 100% frequency displaying high concentration of 5.22- 6402 ng/L. It is expected that these drains receive grey water discharge from households and some other effluents through cross-connections containing unmetabolized and residual antibiotics. Out of these, the highest level was displayed by trimethoprim (6402 ng/L). Erythromycin, however, was detected only in one drain. Water of river Solani showed the presence of trimethoprim, enrofloxacin, and tetracycline in the range of 4.29-1647.11 ng/L in both the upstream and downstream locations, with the maximum value of trimethoprim (1647.11 ng/L) occurring at the downstream location of the river. Sulfamethoxazole was not detected at any location, but Erythromycin was detected at the downstream location only. Ciprofloxacin was absent in all the samples collected. The raw and treated sewage collected from sewage treatment plant (SBR based) receiving mixture of municipal and hospital wastewater of the IIT campus showed the presence of several antibiotics. The concentration levels in raw sewage were observed as 12.51 ng/L for enrofloxacin, 57.72 ng/l for sulfamethoxazole, 212 µg/L for tetracycline, 2532 µg/L for trimethoprim and 7420 µg/L for ciprofloxacin respectively in a rising order. Enrofloxacin indicated a negative removal whereas the dominance of trimethoprim and ciprofloxacin was demonstrated. The removal efficiency of the STP for reduction of most of the antibiotics was in the range of 11.18-50.44% with a maximum of 99% for trimethoprim. For the present study, hazard quotient (HQ) approach was employed for determining the risk associated with the discharge of concerned antibiotics to water/soil environment. The concentration of specific antibiotics was taken into consideration against the predicted no effect concentration (PNEC) either from literature or calculated experimental values for understanding the effect of antibiotics. It was observed that for erythromycin, enrofloxacin and tetracycline, the values were below 1, indicating no potential threat to the receiving water/soil compartment. High HQ was observed for sulfamethoxazole and trimethoprim in the range of 2.46 to 9.16 indicating a serious threat to the aquatic environment. Though the samples were limited in number, yet the findings indicate the potential risk of antibiotics to the environment.

Keywords: Surface water, STP, antibiotics, environmental impact, aquatic environment, sewage.

OP-5: A nano-technology-based method to detect heavy metal ions in aquifers and to selectively identify the nano-tracer in presence of high humic acid content present in the soil sample

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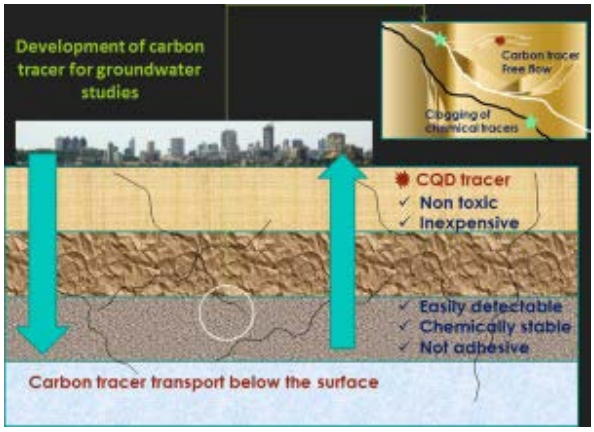
Abstract

There are certain factors that limit the use of conventional radioactive elements and molecular tracers. The use of radioactive elements as tracers has potential hazardous effects on the environment especially on human beings and other animals, for which it is currently replaced by non radioactive elements. The issue with non- radioactive molecular tracers is their dimension and hence diffusion coefficient the value of which is very high for molecular dimensions. Hence when these tracers are injected in to bore-wells, they diffuse into the rock strata and hence take long time to eventually come out of the bore-wells. The analysis of ground water flow and contaminant detection becomes time consuming and more expensive. Molecular contaminants due to their size, penetrates and diffuse very fast and hence retrieving the sample and their analysis becomes difficult.

Despite the extensive activities over the years and the existence of several approaches commercially, there is still a real need for more effective and more convenient tracer systems. In addition, the new systems need to be environmentally friendly as well as cost-effective.

In this abstract we report the synthesis and testing of PSS-coated carbon quantum dots which can bring out hidden information from underground water and aquifers. It has been observed that these PSS-CQDs can selectively get attached with heavy metal ions like Cd and Pb and helped to retrieve the information from water collected from the underground samples. We have also recently shown that addition of a specific metal ion can reduce the fluorescence signal of humic acids but do not affect the emission properties of the PSS-CQDs thereby supporting the nano tracer applications of the PSS-CQDs.



Graphical abstract

References: 1. https://doi.org/10.1016/j.diamond.2020.107701
2. United States Patent Application No. 17/146,346; Title: Robust Carbon Dots (Cd) As An Artificial Tracer For Groundwater Studies

OP-6: Simulation optimization technique for identification of groundwater contaminant sources

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Abstract

Remediation of contaminated aquifers needs the knowledge of the sources (location and leak rate) accurately. Correct identification of sources is very important to optimize the cost and time involved in remediation measures. In this study, a simulation-optimization model is developed for identification of groundwater contaminant sources. This method consists of two steps namely, simulation and optimization. The simulation step is a groundwater contaminant transport model which is technically a forward problem that predicts the unknown state of the system (concentration) by solving the advectiondispersion-reaction equation (ADRE) using the system parameters & control variables (pumping, recharge). In this study,

the ADRE equation is solved by using a meshless method, known as Local radial point interpolation method (LRPIM) to find the distribution of contaminant concentration in the model domain. For optimization, Particle swarm optimization (PSO), which is swarm intelligence based optimization algorithm, is used. The objective function is the deviation of the predicted concentrations from 63as attaon model with the observed concentrations. The optimization model minimizes this objective function with respect to the unknown source characteristics (source location, leak rates and release history). The applicability of the developed simulation-optimization (source identification) model is demonstrated with the hypothetical aquifer to identify the groundwater contaminant sources. The model was able to identify the sources location, leak rates and release history correctly.

Keywords: Simulation, Optimization, Source identification, Meshless method, Local radial point interpolation method (LRPIM), Particle swarm optimization (PSO).

OP-7: Understanding Emerging Contaminants interactions in surface-groundwater systems under changing environmental conditions

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Abstract

The presence of emerging contaminants (EC) in surface and groundwater resources is a major cause of concern in recent years. EC include pharmaceuticals, endocrine disrupting compounds, personal care products, micro plastics, and nanomaterials, can lead to adverse health effects for both humans and wildlife. To better understand the potential impacts of these contaminants, a research framework has been developed here to evaluate their fate and transport in soil-water resources under changing environmental conditions. A comprehensive literature survey has been conducted first to understand the movement of these pollutants from surface water to the underlying variably saturated zones and vice versa. Based on the available field/observed data, a metanalysis is performed to finalize the crucial soil water parameters for investigating their role on fate and transport of EC. A numerical framework is finally developed to investigate the individual and integrated impacts of

the identified soil-water parameters. The framework is wide-ranging and may be modified to solve various issues by focusing just on the components required to solve a given problem. Advection-dispersion equation coupled with soil water flow equation is proposed for simulating the spatiotemporal behavior of the representative EC under varying density of water, pH, temperature, soils, groundwater location and surface water head. Practical experiments under controlled conditions are planned to compare the simulated data in future. The proposed numerical framework of this study would help the policymakers in managing surface water, soil and groundwater pollution due to EC under site prevailing conditions.

Keywords: Emerging contaminants, Contaminant transport, physical, chemical and biological processes & treatment technologies.

OP-8: Rapid one-pot synthesis of PAM-GO-Ag nanocomposite hydrogel by gamma-ray irradiation for remediation of emerging pharmaceutical pollutants and pathogen inactivation

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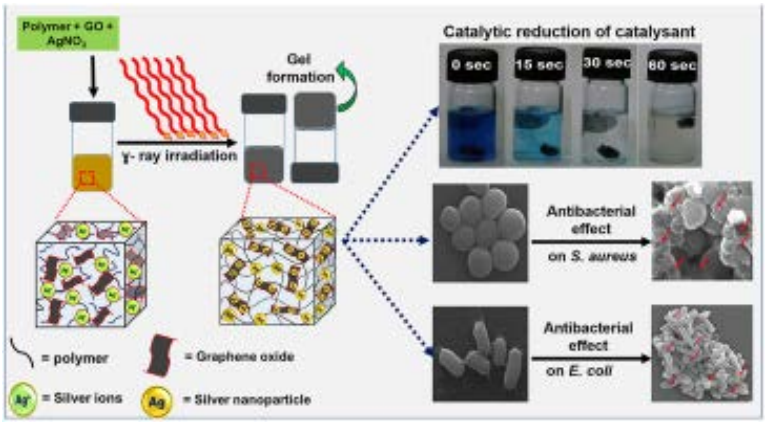
Abstract

Designing a cost-effective, high potential and recyclable catalyst remains a challenge. In the present work, a monolithic PAM-GO-Ag hydrogel is prepared by a facile, eco-friendly method using gamma-ray irradiation. The formation of GO-Ag composite by gamma radiation is also investigated and it is authenticated by XRD, FTIR, Raman, XPS and TEM analysis. The PAM-GO-Ag hydrogel exhibits excellent catalytic activity to different catalysant like methylene blue, Rhodamine-B, and pharmaceutical compound ciprofloxacin. The high catalyst carrying capacity and rapid electron shuttling ability of GO plays a significant role in the high performance of PAM-GO-Ag hydrogel. The PAM-GO-Ag hydrogel also exhibits excellent antibacterial activity. The damaged cell membrane, protein leakage, and increased ROS level contribute to the antibacterial activity of PAM-GO-Ag. The monolithic structure of PAM-GO-Ag hydrogel makes it easy to handle, recover, and reuse for several runs without significant loss of

catalytic and antibacterial activity. All these results showed the possible application of PAM-GO-Ag hydrogel as a promising catalyst for the reduction of different pollutants and antibacterial agents on a large scale with good reusability.



Graphical abstract

OP-9: Studies on the effect of polyethylene microplastics on blackgram (*Vigna mungo*) and its associated rhizosphere

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Abstract

Microplastics enter into various ecosystems, like soil and alter its physico-chemical and biological properties thereby influencing the plant growth and development. Hence, the current study was formulated with an aim to understand how PE-MPs at different concentrations (0, 0.25, 0.50, 0.75 and 1.00% w/w) affect the (i) seed germination, (ii) seedling growth and (iii) plant growth and yield attributes. The preliminary study conducted to evaluate the effect of PE – MPs on seed germination reveals that after 24 hours of incubation with different doses of PE-MPs (0.25, 0.5, 0.75 and 1%), a reduction in germination up to 20% was observed. Furthermore, the maximum reduction in germination index (15 %), root length (25 %), relative root length (25 %) and vigour index (10 %) was recorded with the application of 1 % PE – MPs.The influence of soil type in the presence of PE- MPs on seedling growth reveals that the maximum reduction in the germination rate (16 and 4%), shoot length (35 and

23 %), vigour index (39 and 31 %), root weight (13 and 14 %), shoot weight (11 and 5 %) in loam and clay loam soil was recorded with the application of 1 % PE – MPs. While considering the soil properties, in loam and clay loam soil, application of 1 % PE – MPs increased the pH (8.7 and 6.6%), EC (21 and 18%), organic carbon (24 and 34%) and available nitrogen (22 and 18.5 %); while the available phosphorus (17 and 19 %) and potassium (10 and 7 %) had declined.Similarly, in the pot experiment with loam soil, a maximum reduction in physiological traits like photosynthetic rate, chlorophyll a, b and total chlorophyll by 5, 14, 10 and 13 % at flowering stage; and an increase in biochemical traits like ascorbic acid, malondialdehyde, proline, superoxide dismutase and catalase by 11, 29.7, 16, 22 and 30 % during vegetative stage was observed with the application of 1 % PE – MPs. Moreover, a reduction in growth and yield attributes were also observed with increasing concentration of microplastics. Additionally, application of microplastics decreased the soil bulk density up to 7% and as a consequence, the pore space percentage increased up to 15%. Subsequently, application of 1 % PE – MPs significantly increased the pH (2 %), EC (11%), organic carbon (26 %), microbial biomass carbon (8 %), NO_3 – N (22 %), NH_4 – N (23 %); while the available phosphorus and potassium declined. Moreover, the presence of PE-MPs in soil had also significant influence on the soil enzyme activities. 16s metagenomic analysis reveals that at genus level, the beta-diversity (measured by Sorenson's co-efficient) was 0.867 which suggests that the communities overlap by more than 80% with slight differences.

Keywords: Microplastics, Blackgram, physiological and biochemical traits, yield, metagenomics; seed germination

OP-10: Sustainable Robust Synthesis of Amine-functionalized Nano-Cellulosic Membrane (NH_2/CA/EC) for the Effective Removal of Arsenic from the Effluent

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Abstract

Water is a preponderant resource in the environment which is being polluted by industrialization and urbanization. Heavy metal like Arsenic causes extreme impact even at a low concentration in water. *Eichhornia crassipes* is an aquatic weed that readily removes heavy metal ions from water. Herein, amine-functionalized 67as attaine nano fibrous cellulose membranes (NH_2/CA/EC) were synthesized and employed to adsorb the arsenic contaminants. Fourier transform infrared spectroscopy (FTIR), Scanning electron microscopy (SEM) and Energy dispersive X-ray (EDX) analysis were carried out to analyse the characteristic nature of NH_2/CA/EC. FTIR results reveals that NH_2/CA/EC possess -NH_2, -OH, and C=O functional groups. SEM images confirms the nano-fibrous structure. The adsorption of arsenic by NH_2/CA/EC was carried by varying parameters such pH, contact time, adsorbent dosage and concentration. The maximum percentage removal of arsenic was found to be 86.3%. Adsorption isotherm and kinetics were studied. Adsorption isotherm fitted well with Langmuir isotherm model and the maximum monolayer adsorption capacity was found to be 24.88 mg/g. Adsorption kinetics followed Pseudo second order and Intra particle diffusion model. Overall, nanofibrous membranes offer economically potential towards developing adsorbents for arsenic removal from contaminated water.

Keywords: Pollution, Nano membranes, Arsenic contaminants, Adsorption, Isotherm, Kinetics

POSTER PRESENTATIONS

PP-1: Novel -decorated Inner transition metal @Bi_2O_3 Nanoflakes with enhanced visible-light photocatalytic performance

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Abstract

Photocatalytic technique has versatile used for remove pollutants in environmental for aquatic. A new heterogeneous photocatalytic like Lanthanide family exhibits a series of physicochemical properties, which favour its application both oxidation and reduction to complete remove hazardous material in industrial waste water. Nanoflakes Novel-decorated inner transition metal @Bi_2O_3 nanoparticles were synthesized by hydrothermal method using autoclave. Inner transition metal has coupled with narrow bandgap semiconductor and form heterojunction. As a result, good photo-charge separation and charge transformation it should be has good performance photocatalytic mechanism. The synthesized sample were characterized by various spectroscopic techniques such as XRD, BET, XPS, UV-visible absorption, Electrochemical Impedance (EIS) studies and microscopic analysis (SEM, TEM and EDAX). Bismuth based photocatalysts has proven to be excellent photocatalyst and photo anode for dye-sensitive solar cells. This is attributed to the wide band gap between 2.0 to 3.96 eV.

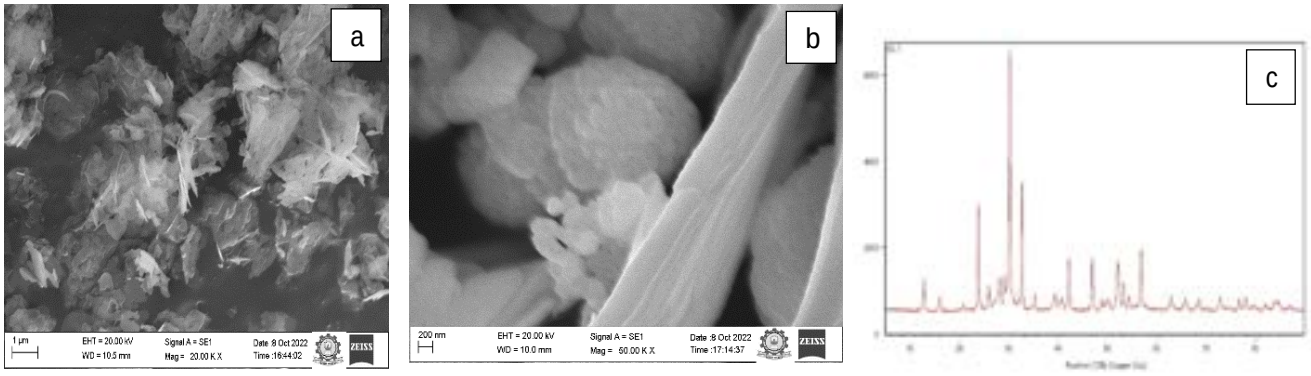

Fig.a. SEM image of Bi2O3, b). Inner transition metal oxide and c). XRD image of Novel-decorated Inner transition metal @Bi_2O_3 nanoflakes

PP-2: A Review on Potentiality of Microbial-based Nanoparticles for the Removal of Emerging Contaminants

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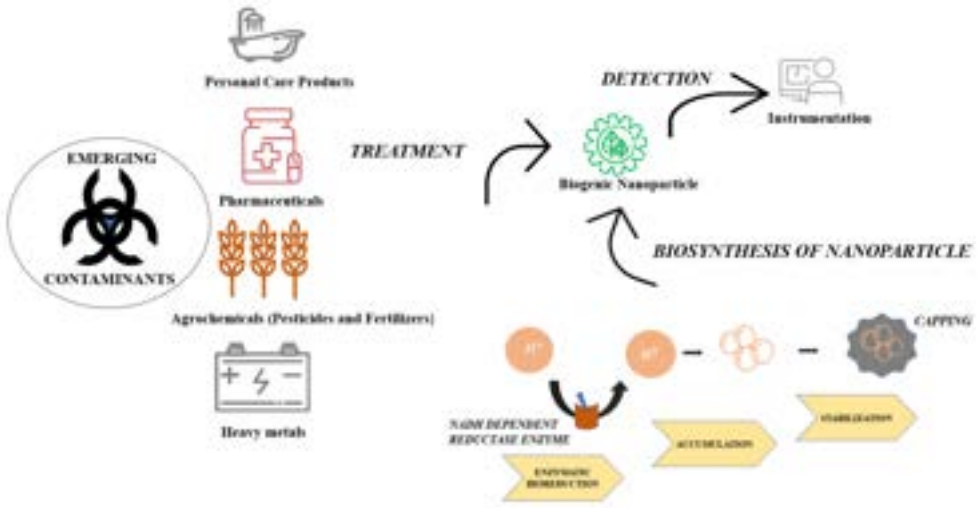
Abstract

Chemicals or substances that pose an actual, potential, or perceived risk to public health, the environment, or that do not meet established safety criteria are referred to as “emerging contaminants” (EC). Such substances, which mostly exist in municipal wastewater discharges and receiving waters for industrial facilities, agricultural, or urban contamination-prone areas, appear as trace components. With the introduction of new industrial chemicals like those already in-use pharmaceuticals, commercial and personal care products, agrochemicals, heavy metals, etc., the list of developing contaminants is incredibly long and keeps growing. This situation necessitates the creation of innovative wastewater and soil treatment technology. For the elimination of such contaminants, conventional treatment methods continue to be inefficient, expensive, and environmentally hazardous, and they may even result in secondary pollution. Today, the use of nanotechnology has enabled a number of shortcomings of traditional remediation procedures to be overcome, and the integration of a few techniques aids in achieving positive outcomes. Biogenic nanoparticles, or nanoscale materials derived from biological sources, present an environmentally friendly and cost-effective alternative to chemically and physically 70as attaine nanoparticles. Biosynthesis of nanoparticles from microbial enzymes with reducing characteristics is how microbial-based nanoparticles are created, where metal compounds are often reduced into their corresponding nanoparticles by a simple redox reaction. The objective of the present review is to shed light on the significant microbes and compatible metal ions for the synthesis of biogenic nanoparticles and their great potential as an alternative pollution abatement tool for the removal of Ecs from wastewater effluents and contaminated soil sediments.

Keywords: Microbial-based Nanoparticles, Emerging Contaminants, Bio-Synthesis, Nano-bioremediation.



Graphical abstract

PP-3: A Review of the Occurrence and Pathway of Emerging Contaminants to Waterbodies

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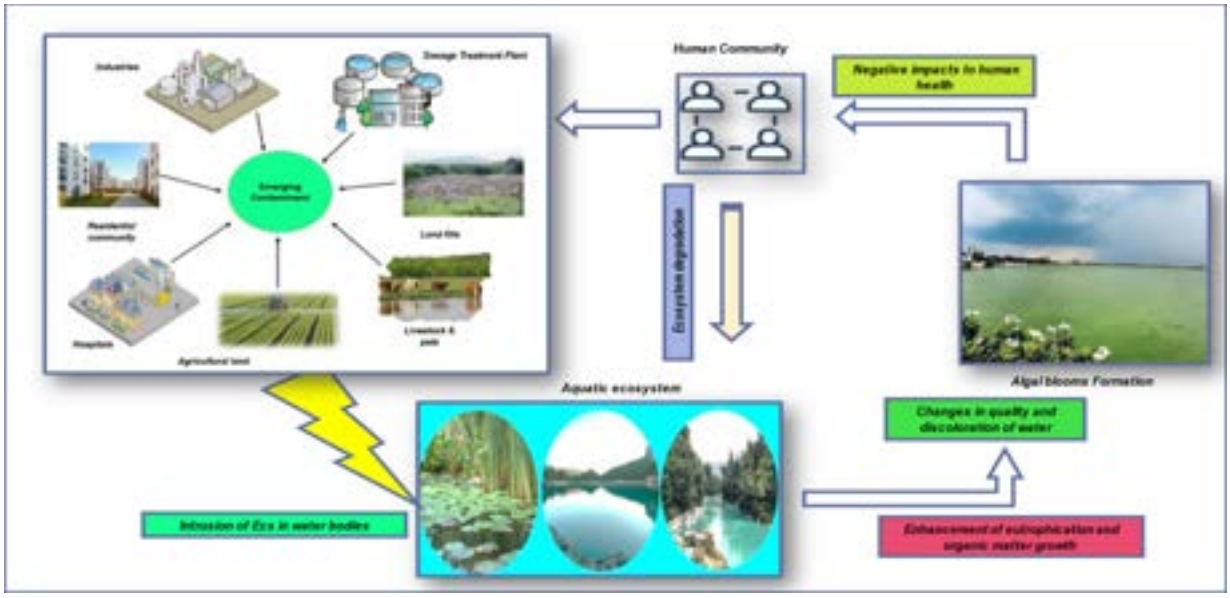
Abstract

Emerging pollutants are a new source of concern for India's surface water quality. These contaminants are part of a recently identified group of water contaminants that have been discovered in a number of water bodies across the country in recent years. Emerging contaminants, or ECs, are any manmade or naturally occurring chemicals or microbes that are not routinely monitored in the environment but have the potential to enter the ecosystem and harm human health or the environment. Emerging pollutants might be man-made or natural. Pharmaceuticals and personal care products (PPCPs), plasticizers, surfactants, fire retardants, nanomaterials, and pesticides are the most frequent environmental pollutants. Nanomaterials are a form of EC. This paper provides an outline of the incidence of emerging pollutants as well as the pathway by which they infiltrate surface waters such as rivers, lakes, ponds, and wetlands for the purpose of analysing these water bodies. These excess nutrient

loadings are causing soil and water quality deterioration, which could have severe impacts on human health, aquatic ecosystems, and environmental sustainability.

Keywords: Surface water, Emerging Contaminants (ECs), Personal care products (PPCP)s, Nanomaterials & ecosystem.



Pathway for ECs into environment and water quality degradation

PP-4: Enhancement Of *Eucalyptus* Bark Pellets On Pretreatment By *Trichoderma atroviride*

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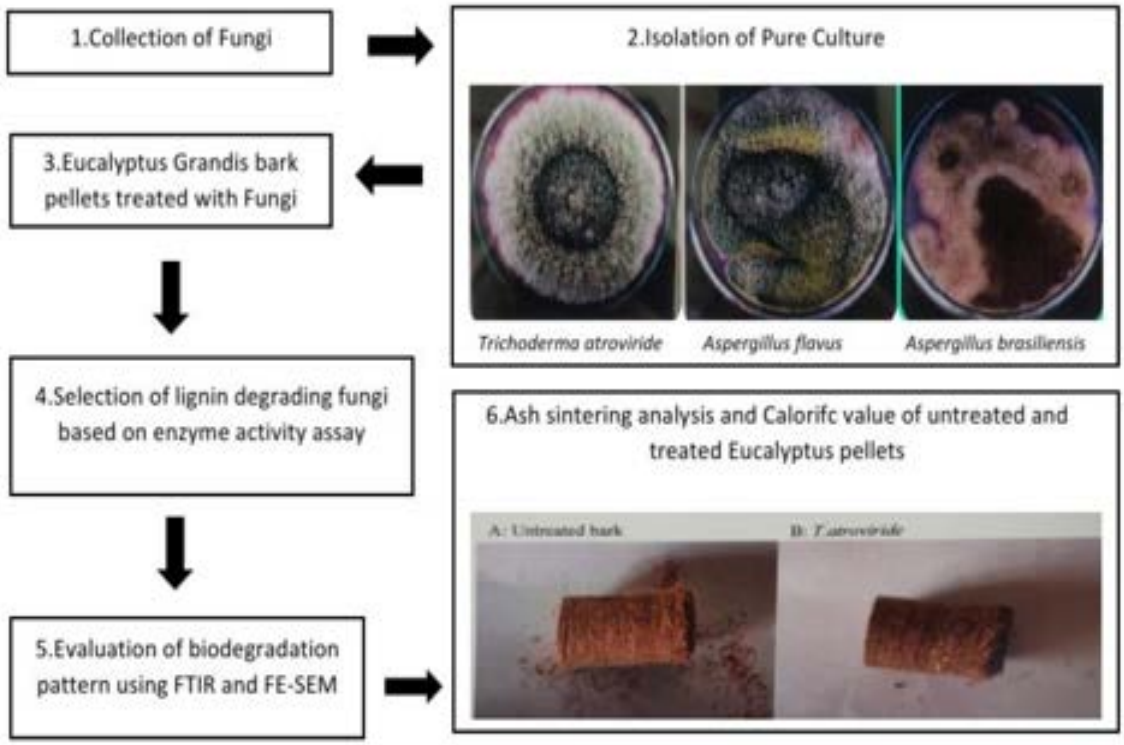
Abstract

The calorific value of bark is usually higher than that of wood but due to the abundance of ash content its sintering tendency, bark combustion can lead to fouling which would damage the combustors. The objective of this study was focused on lignin degradation of Eucalyptus grandis bark by Trichoderma atroviride that would potentially beneficiate it into combustion fuel. The indigenous fungi T.atroviride had an efficient delignification capability on E.grandis bark. The ash content was reduced to 65% in biotreated bark with lower sintering tendency thus enhancing the pellet quality and also mitigating fouling problems in combustors. Results from this work

can provide valuable information regarding selection of the appropriate strain and degradation conditions for pretreatment of bark for producing biomass pellets with a minimum ash sintering potential.



Keywords: *Eucalyptus grandis, Trichoderma*, Lignin degradation, Ash sintering, Bark pellets

PP-5: Phytoremediation-A sustainable approach to clean the contaminated water

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Abstract

Sustainable remediation of environmental pollution has led to the search in many countries. Contaminant can spread in the environment via air, water and soil. Specially, water resources facing a major challenge in current situation. Water is an indispensable part of the all living ecosystem. Water contamination occurs mainly due to 73as attained73ion73, 73as attained, intensive agriculture, heavy metals and house

hold waste water. A definite need to develop a economic and green technology to remediate polluted water. Phytoremediation is an eco-friendly and green remediation technology to clean the pollutant. The phytoremediation is a natural process of plants through translocation, evapotranspiration and bio accumulation thus degrading pollutant to clean the contaminated water. The plants used for phytoremediation process are selected based on the growth rate, biomass, their ability to tolerant in contaminated environment. Plants like ornamental plant, artimoney plant, giant cane, broadleaf cattail, vetiver, water hyacinth, water lettuce, duck weed etc., were clean the contaminant like nitrate, arcenic, lead and other pollutant from contaminated water. The uptake, accumulation and degradation of contaminants vary from plant to plant. This mini review of phytoremediation process achieves the goal of remediation of contaminated water. To know , Phyto remediation metabolic process methods need further research. Plants especially different species of wild aquatic weeds are found more tolerant and they can used for phytoremediation process and to stop the entry of contaminants in to the food web.

Keywords: Phytoremediation, Tollerance, uptake, aquatic weed, Eco-friendly

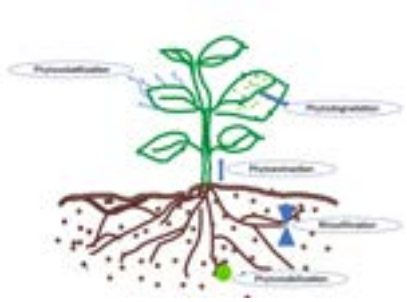

Fig.1.Phytoremediation Process Methods

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PP-6: Biogenic synthesis of silver nanoparticles using *Mangifera indica* (L). leaf extract: characterization, antibacterial and anticancer activities

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Abstract

Green Nanotechnology became an interesting field where functional NPs of iron, silver and gold has been prepared without using hazardous/toxic chemicals. It is considered as more economic, significant and cost-effective. Silver (Ag) is found to be the safe inorganic antibacterial agent. AgNPs have been used as an Antibacterial agent against bacteria. Cancer is one of the leading causes of death worldwide. *Mangifera indica L.* is one of the tropical fruits of the world which is rich in source of polyphenolic compound called Mangiferin is now proven for its anticancer, anti-inflammatory and anti-diabetic properties too. The AgNPs produced by the reduction of silver ions are expected to retain mangiferin as a capping agent thus, producing additional therapeutic benefits to the NPs. An effort has been made in the present study to demonstrate the utilization of M. indica leaves to produce silver nanoparticles (AgNPs). The Antibacterial and anticancer activity of the biosynthesized AgNPs has been evaluated. The first indication of the formation of Silver Nanoparticles is the visual colour change and in addition of M. indica leaf aqueous extract to the silver nitrate solution, colour change occurred in reaction mixture. The shift in colour from Light yellow to reddish brown indicated the Rapid synthesis of Silver Nanoparticles. The Silver nanoparticles solution (AgNPs) turned to Dark brownish black colour at 48 hours and finally it turned to Grey colour at 72 hours. Formation of AgNPs was further confirmed by recording the UV – Visible spectra of synthesized colloidal AgNPs solution.

Keywords: Green Nanotechnology, mangiferin, anticancer and antidiabetic.

PP-7: CELLULOSE ACETATE -TiO_2 – (g-C_3N_4) FOR PHOTOCATALYTIC DEGRADATION OF 2,4 DICHLORO PHENOXY ACETIC ACID

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Abstract

Semiconductor photocatalytic membrane is a potential pollution abatement strategy that has received much attention in recent decades. Many semiconductors have been researched and used in the field of environmental cleanup up to this point. In that hybrid photocatalyst made of graphite-like carbon nitride (g-C_3N_4, which primarily responds to visible light) and TiO_2 (which primarily responds to UV light) and Cellulose Acetate as a membrane. It uses both visible and UV light and improves the photogenerated charge separation capability. This type of photocatalytic membrane has the potential to degrade 2,4- dichlorophenoxyacetic acid. This type of membrane is prepared by the phase impregnation method and conducted under UV and natural sunlight. Further, the overview of the morphological and physiological features will be compared and evaluated.

Keywords: 2,4- dichlorophenoxyacetic acid, Cellulose Acetate, g-C_3N_4, TiO_2, Photocatalyst, and UV light

PP-8: Synthesis and dye adsorption study of host guest complexes of thallium with cucurbit[7]uril and ionic liquid

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Abstract

Supramolecular complexes offer a new efficient way of monitoring and removal of noxious substances emanating from various sources. Such pollutants range from toxic or radioactive metal ions to chemical side products, herbicides and drugs including steroids. It has wide range of applicability such as chemotherapy, supramolecular solvents, drug delivery and adsorption of contaminants in pollution. Therefore, Cucurbituril has been suggested as a sorbent for removal of aromatic compounds from contaminated water sources followed by its decolourization for the reuse. In the

current work host (I) CB[7], (II) the inclusion complex of Ionic liquid with CB[7], (III) ionic liquid with CB[7] and thallium, (IV) CB[7] with thallium were synthesized and analysed structurally using spectroscopic tools and its dye adsorption property is also studied. Water soluble cationic dye present in tannery effluent water can be encapsulated into the inner cavity of CB. This dye molecule enters into the precipitate forming inclusion complex with CB and the allowing the filtrate to remain clear. The solubility of CB increases with the presence of salts in the medium. This observation is confirmed via calorimetric studies that with increases in time adsorption also increases. The spectroscopic studies reveal that UV-Visible spectra of mixed ligand complexes show increases in absorbance at 247nm and IR spectra shows characteristic peak at 3403cm^{-1} which indicate the presence of intramolecular hydrogen bonding. Powder XRD pattern of free CB[7] shows two characteristic peaks at 11^0 and 21^0 indicating that CB[7] moieties can favour the crystallinity. Ionic liquid due to their efficiencies, non-toxicities and recyclability proved to be a convenient and environmental guest for the host. As ionic liquid is highly soluble it makes 77as attained77ion process easier and also increases the solubility of complex. This study illustrates how dye bearing waste water can be treated by adsorption with CB as an adsorbent that contribute to solve some of the biggest issues of environment.

Keywords: Cucurbituril, Ionic liquid, Dye adsorption, Inclusion complexes

References: 1.Deng, S.Q.; Mo, X.J.; Zheng, S.R.; Jin, X.; Gao, Y.; Cai, S.L.; Fan, J.; Zhang, W.G. Hydrolytically Stable Nanotubular Cationic Metal–Organic Framework for Rapid and Efficient Removal of Toxic Oxo-Anions and Dyes from Water. Inorg. Chem. 2019, 58, 2899–2909. 2.Assaf, Khaleel I, et al. "*Encapsulation of ionic liquids inside cucurbiturils*". Organic and bimolecular chemistry 18.11(2020): 2120-2128 3.H.J. Schneider and A.Yatsimirsky, "*Principles and methods in supramolecular chemistry*". (2000)

PP-9: Investigation of microplastic contamination in an urban drainage network of Delhi megacity, India

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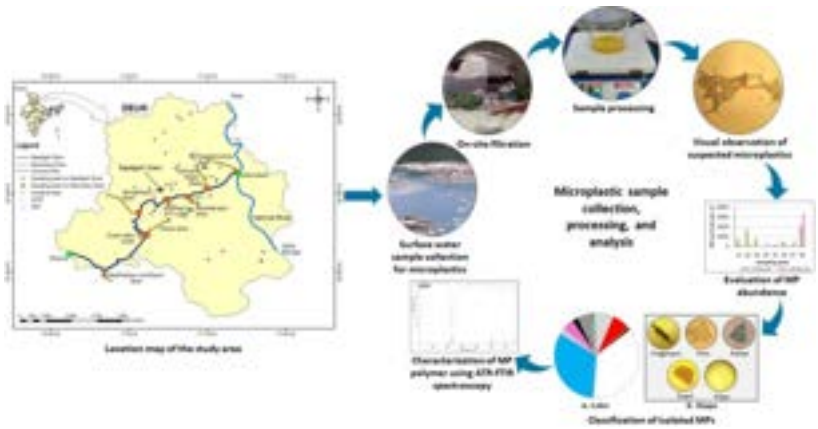
Abstract

Microplastics (MPs) are emerging contaminants in the global aquatic systems. Urban drainage channels are an important transporter of terrestrial MPs to aquatic bodies.

Delhi megacity is situated in Northern India and has a huge consumption of plastic materials owing to the enormous generation of plastic litter that goes unregulated into the drainage network. The present study investigates one such important network, namely the Najafgarh, and its associated secondary drains in this city. Najafgarh drain enters Delhi from the southwestern side, near Dhansa, and travels 57 km till its final outfall at Wazirabad in the Yamuna River. Through its passage, the drain receives continuous discharges of wastewater from various secondary drains in the city. The present study investigates ten sampling locations in Najafgarh and its associated secondary drains. The collection of surface water samples was done bi-annually in 2019. The study revealed an abundance of 100-4300 MPs/m^3 (pre-monsoon) and 100-6700 MPs/m^3 (post-monsoon) in the secondary drains. Due to the consistent discharges of MP-laden wastewater from these secondary drains, their abundance increased significantly in the Najafgarh drain from Dhansa to Wazirabad from 300 to 2900 MPs/m^3 (pre-monsoon) and 0 to 700 MPs/m^3 (post-monsoon). Fragmented shape and white color were detected as the predominant MP types. Characterization using ATR-FTIR spectroscopy showed ten types of MP polymers and out of these, high-density polyethylene (HDPE) polymer was in maximum abundance. The study, thus, highlights the capacity of secondary drains in channelizing MPs to the Najafgarh drain and ultimately Yamuna River. Considering the gap areas present in the literature regarding sources, occurrence, and distribution of MPs in the urban drainage networks of the Delhi megacity, this study will provide baseline information to the concerned stakeholders for necessary interventions.

Keywords: Microplastics, Emerging water pollutant, Najafgarh drain, Secondary drains, Characterization



PP-10: Analysing the efficiency and crude oil degradation potential of indigenous microbes through bioremediation

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Abstract
Oil pollution originated from both natural and anthropogenic sources can have dramatic detrimental effects to the environment. Large amount of crude oil entering marine, groundwater, soil and other environment could cause significant damages to resident organisms. Oil on ocean surface is harmful to aquatic life, because it prevents sufficient amount of sunlight from penetrating the surface and reduces the level of dissolved oxygen. The longer the crude oil spilled is left in the environment, the more damage it can do. In recent years the Bioremediation, known as microbial remediation process by utilizing microbes or their enzymes to remove or neutralize contaminants within the environment (soil and water) to their original conditions. Considering this environmental problem, the perspective of my work will be studied by collecting the soil sample from the oil rich environment such as oil spill areas or oil reservoirs. By undergoing bio-stimulation process the indigenous microbes from the contaminated sample will be enriched with selective medium and the crude oil degrading microbes were analyzed using DNA sequencing and quantitative methods. By analysing the indigenous crude oil degrading microbes in invitro conditions, may result in recovery of oil spill in the polluted environment.

Keywords: Oil spill, Crude oil, Microbes, Bioremediation.

PP-11: Aqueous Coralene Rubine dye solution removal with less energy consumption in the electrocoagulation method

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Abstract
Electrocoagulation is a simple and easy process, but suffers in consuming more energy, thus cost of the process is high, in limiting its implementation in the treatment of textile wastewater in the industry. An attempt has been made to reduce the cost in this study with the synthetic Coralene Rubine dye solution treated using

titanium metal sheet as anode and copper as cathode. Ti being high corrosion resistant metal, copper undergoes uniform dissolution, so this dissimilar pair are used in the electrolysis. The operational parameters like pH, current density, contact time, addition of electrolyte and initial concentration of dye and the economical parameters like energy consumption, electrode consumption and the operating cost were optimized. From the optimized conditions, the colour removal efficiency (CRE%) and the COD removal was calculated. Maximum CRE% and COD removal was obtained with initial concentration of dye at 110 mg/L at pH 5, voltage 20 V and at 35 mins. For these optimized conditions, the energy consumption of the electrode was 10.49 kWh/m^3, electrode consumption was 0.004 kg/$m^3$and the operational cost was ₹ 63.1 for 200 ml solution. The ICP-OES studies were done to know whether the metal ion was present in the treated water which showed that only 0.010 mg/L of copper and 0.001 mg/L of titanium. Further phytotoxicity and ecotoxicity studies were done using *Trigonella foenum-graecum* and *Oreochromis mossambicus*. The results of percentage of germination, shoot and root lengths grown in the treated water were similar to the results obtained for the control also the survival rate of *Oreochromis mossambicus* was also in accordance with the control.

Keywords: Synthetic dye solution; titanium electrodes; operational; economical parameters.

PP-12: Treatment Of Tannery Industry Wastewater Disposal At Dindigul District

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Abstract

The production of leather is one of India's oldest manufacturing sectors, and there is a high demand for its goods on a global scale. The study's primary goal is to identify the production and marketing strategies used by leather businesses in Dindigul. The global ecosystems, as well as human health, depend most heavily on water and soil. The tanning industry is a potential industry that poses a serious threat to the environment since it has the potential to pollute soil, water, and air in India. The goal of the current inquiry was to analyses the physical and chemical characteristics of the tannery wastewater in Dindigul. For the study of a number of chemical parameters, including pH, TDS (total dissolved solids), DO (dissolved oxygen), and turbidity, the sludge from the tannery industry is collected. Reverse osmosis, sedimentation, and coagulation are all used to treat the sludge. As a result, an effort has been undertaken to discover the parameters and purify the water using the reverse osmosis procedure.

Keywords: Sludge, BOD, COD, Sedimentation, Coagulation, Reverse Osmosis

PP-13: Removing harmful algae by use of bioflocculant produced from Bacillus to coated with iron oxide nanoparticle

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Abstract

In all types of water bodies, algae are the primary producers and play an important role in water pollution in many ways. Organic waste selectively enhances the growth of certain types of algae by enriching the algal nutrients of the water, resulting in massive surface growths or “blooms” that reduce water quality and limit its use. In contaminated water, some polluting algae can be dangerous to humans, animals and fish. In addition, algae can significantly affect the food chain of aquatic organisms, meaning that changing the amount and variety of algae significantly

impacts fish and all other species in the chain. Flocculants are used to remove toxin-producing algae in water bodies. Flocculants are divided into three categories, such as organic, inorganic and natural. The bioflocculants are extracellular polymers produced by microorganisms during the growth of biodegradable and environmentally friendly cells. Compared to commercially available chemical flocculants, bio flocculants exhibit significant advantages of being biodegradable, non-toxic and safe for the ecosystem. In this study, bioflocculant-producing bacteria were isolated from a water sample of Kurichi Lake, Coimbatore, Tamil Nadu, India. The isolated bacterial strains were screened for their bioflocculant ability. Among the eight bioflocculant-producing bacteria, the one strain exhibiting maximum bioflocculant activity (62.52%) was selected as *Bacillus subtilis* OL818309. The optimization of parameters for enhanced bioflocculant production was evaluated. Production medium containing pH 7, 35^{o}C temperature, 84 hours incubation time with 165 rpm shaking speed, 3% dosage concentration and guar gum and yeast extract as carbon and nitrogen source exhibited maximum yield. 4.651 g/L. Then, iron oxide nanoparticles were synthesized by the co-precipitation method, and the boflocculant was coated on the iron oxide nanoparticle surface to recover and reuse multiple times to reduce the cost of bioflocculant production. Also, the bioflocculant-coated iron oxide nanoparticle was characterized using FTIR, XRD, HR-TEM, SEM and TGA-DSC. Also, bioflocculant has been tested for treating wastewater with algae, thereby improving COD, BOD Total Dissolved Solids (TDS) and Total Suspended Solids (TSS). All these results revealed that the bioflocculant derived from *B. subtilis* OL818309 coated with iron oxide nanoparticles has a promising future for replacing chemical flocculants in water treatment.

Keywords: Algae polluted wastewater, iron oxide nanoparticle, bioflocculant, *Bacillus subtilis.*

PP-14: Impact Of Microplastics On The Floating Freshwater Plant – *Lemna Minor*

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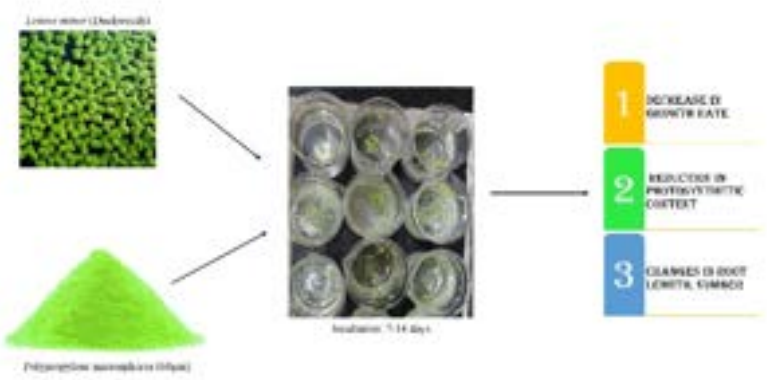
Abstract

Surface or ground waters are heavily contaminated with numerous toxic substances. One of the emerging contaminants are the Microplastics (MP). MPs are polymers with a size less than 5mm in diameter, which are toxic in nature. Plants are affected in terms of the growth inhibition and photosynthetic pigment reduction. Duckweeds (*Lemna minor)* are the freshwater floating plants, which are considered as a good source of protein for humans as well as fishes due to its high protein content and environmental friendly production properties. The aim of the study was to investigate the effect of the polypropylene (PP) microspheres of size 60µm on duckweeds. The effects of different concentration of microspheres on the leaf growth rate, chlorophyll *a* and b content, root length, number and root cell viability were assessed. Duckweeds were grown in the Steinberg medium for 30 days. Later, duckweeds were exposed to different concentrations of microspheres of PP (50mg, 100mg and 200mg) for 7-14 days. Leaf growth rate, content of photosynthetic pigments, root length and root growth were adversely affected. Decolouration in duckweed leaves were found in all the test samples from day 5. Disintegration of roots were highly observed in 3rd test sample. It can be concluded that the PP microspheres can have negative impacts on floating plants of freshwater ecosystems.

Keywords: Microplastics, Duckweeds, microspheres, Growth rate, photosynthetic activity



Graphical Abstract: Effects of Microplastics on *Lemna minor*

PP-15: Assessment of usage and disposal patterns of sanitizer in Urban Environment

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Abstract

Hand hygiene is of utmost importance as it may be contaminated easily from direct contact with microorganism droplets through coughs, sneezes, foodstuffs, and drinks. Particularly in situations like pandemic outbreak, it is crucial to interrupt the transmission chain of the virus by the practice of proper hand sanitization. The emergence of the novel virus, SARS-CoV-2, has posed unprecedented challenges to public health around the globe, the World Health Organization recommended that, in the absence of soap and water, alcohol-based hand sanitizer can be used to prevent the transmission of corona viruses. However, these practices have an impact on the environment and ecosystems. Several studies have demonstrated the ecotoxic effects of alcohol-based sanitizers leading to adverse effects. In addition, several cases of alcohol poisoning have been reported from direct and indirect consumption of sanitizers. In order to have a preliminary analysis to know the different hand cleansing means, usage, preference and the frequency of using hand sanitizers especially during the pandemic period, the disposal methods of the expired and unused sanitizers, a questionnaire based-survey was conducted in both online and offline mode. From the

study it was observed that people aren't following the appropriate disposal means for the empty and expired sanitizer bottles, most of them discarded them along with household wastes or flushed down the drains. The study recommends proper guidelines for disposal of used hand sanitizer and expired sanitizers and to consider the disposal as hazardous waste disposal.

Keywords: Hand hygiene, SARS-CoV-2, sanitizers, ecotoxic effects**.**

PP-16: Effects of Pharmaceutical Pollutants (PPs) on aquatic organisms: A focused review of Indian Rivers.

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Abstract

Wastewaters from hospitals, pharmaceutical manufacturing units, and domestic sewage containing excretal matters of medicine users are the major sources of pharmaceutical pollutants (PPs) in river water. This paper provides an overview of the existing occurrence data for four classes of PPs, namely, Antibiotics, Non-steroidal anti-Inflammatory Drugs (NSAIDs), Anticonvulsants, and Stimulants in Indian rivers. Based on the reported predicted no-effect concentration (PNEC) values for the three distinct levels of aquatic organisms, such as algae, macroinvertebrates, and fish, the increasing risk levels and Threshold Risk Quotient (RQ_T) have been defined. RQ_T = 10 has been considered as the threshold for fatally high-risk conditions. Broadly three classes of PPs- Antibiotics (e.g., azithromycin, naproxen, norfloxacin, and sulfamethoxazole), Stimulants (e.g., caffeine), and NSAIDs (e.g., diclofenac) are found at moderately high risk (RQ_T =1-3) to fatally high risk (RQ_T > 10) concentrations for different organisms in aquatic environments of Indian rivers. While the presence of norfloxacin has been reported as most fatal for fishes in the Isakavagu-Nakkavagu stream reaching river Godavari near Hyderabad, caffeine is found to be putting algae at the highest risks in river Ahar near Udaipur, river Brahmaputra near Guwahati and river Ganga near Patna.

Keywords: Pharmaceutical Pollutants, Aquatic Organisms, Predicted no-effect Concentration (PNEC), and Threshold Risk Quotient (RQ_T).

PP-17: Water Quality Index of flood affected Mannar panchayath, Kerala and their management using the Vetiver grass (*Vetiveria zizanioides*)

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Abstract

Floods are one of the major natural diasasters which directly affect the drinking water quality and water borne diseases. Kerala, which is the southern most state, experienced an abnormally high rainfall from 1 June 2018 to 19 August 2018. This resulted in severe flooding in 13 out of 14 districts in the State. As per IMD data, Kerala received 2346.6 mm of rainfall from 1 June 2018 to 19 August 2018, that is about 42% above the normal. It was the worst flood in Kerala in nearly a century. Over 483 people died, and 14 are missing. About a million people were evacuated, mainly from Chengannur Taluk of Alapuzha District. Mannar which is the study area is a Panchayat in Chengannur Taluk in Alappuzha District of Kerala state, India, located on the banks of the river Pamba with a geographical coordinate of 9.3171° N, 76.5344° E. Flood resulted in slushy water entering the wells and other sources of drinking water and made it not potable. We carried out a detailed investigation about drinking water quality in the study area during October – November, 2018. A total of 30 water samples were collected from the ground water sources. The water quality of households affected due to flood were subjected to various physico-chemical and microbiological analysis and based on standard procedures. The parameters selected for analysis were temp (^{o}C), pH, DO (ppm), BOD_5 (ppm), Turbidity (NTU), MPN, Hardness (mg/l) and Total coliforms, Standard Plate count and Faecal coliforms. The standards are designated based on WHO guidelines for drinking water quality assessment. Based on the results, the quality was selected based on major pollution index - National sanitation foundation water quality index (NSF-WQI). Based on MPN analysis of the water samples, they are not potable since the MPN index values are above the permissible limit as per WHO and ICMR standards (10/100 ml) and some of

the samples are reported to contain faecal contamination. An experiment was also designed to control these water quality parameters with vetiver grass, which is already found to be effective in removing phosphorous and nitrogen from water, and is a good plant in purifying eutrophic water as well as in the treatment of garbage leachates. It has been also shown that vetiver is highly capable of reducing the number of standard Plate counts considerably. Hence the Vetiver grass (*Vetiveria zizanioides*) can be used as a cost-effective, non-toxic, biodegradable, eco-friendly alternate towards the purification of contaminants from groundwater.

Keywords: Kerala Flood, Ground water contamination, Coliforms, *Vetiveria zizanioides* Eco-friendly etc

PP-18: Degradation potential of fungal isolates from contaminated soil: Aspergillus niger and Aspergillus flavus in biodegradation of Microplastic

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Abstract

Over the past few decades, plastic pollution has become a major global problem. Plastic waste that remains in the environmental matrix for an extended period is subjected to mechanical, chemical, or biological factors and is broken down into smaller constituents known as microplastics (MP). Infiltration of MP into the terrestrial ecosystem has a detrimental impact on the health of the soil and its associated fauna and flora. MP bioaccumulates in the body and moves up the food chain, endangering human health. Thus, it is important to remediate the MP present in the ecosystem. Among the various methods adopted for the degradation of MP, biodegradation is reported to be the most efficient, eco- friendly, cost-effective, and natural method. Plastics are predominantly degraded using bacteria whereas only a few studies have shown the ability of fungi isolated from soil to degrade. Hence, in this study ability of fungi to degrade MP has been investigated. The fungi isolated from the soil sample were tested for their efficiency in 87as attain and degrading the MP using Scanning electron Microscope (SEM) and Gas Chromatography and Mass Spectroscopy (GC-MS). A change in surface morphology was revealed in SEM

analysis showing the ability of the fungal species to colonise the MP surface and cause deterioration. Furthermore, GCMS analysis showed the presence of the plasticizers such as benzene and phenol which indicates the initiation of microplastic mineralization. The results obtained prove that the isolated fungus can colonise and mineralize the MP confirming the potential of fungus in the biodegradation of MP.

Keywords: MP, Biodegradation, SEM, GCMS, Fungi

PP-19: Investigations on Microplastics in Surface water from Ennore to Kovalm on Southeast Coast of India.

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Abstract

In the current scenario, microplastic is a growing contaminant that poses an ecological threat to the surface water ecosystem. Our primary goal is to investigate the distribution and abundance of microplastics along India's East Coast from Ennore to Kovalam. NOAA protocol for examining microplastics. Polyethylene (PE), polypropylene (PP) and polystyrene (PS) are the most common polymers found in surface water across all sampling sites. The most common polymers in surface water are polyethylene (43%) and polypropylene (42%). Microplastics identified using a stereo microscope, as well as analytical methods such as SEM and FTIR, were used to investigate microplastic characterization. The major types of microplastic found in surface water are as follows: Fibres (59%) are the most common, followed by films (24%), fragments (10%), and pellets (7%). This study serves as a baseline for microplastic contamination from Ennore to Kovalam.

Keywords: Microplastics, Surface water, NOAA, SEM, FTIR

PP-20: Effect of Cocoa Shell and Jack Fruit Peel Wastes and Their Performance on the Growth and Biochemical Characteristics of Red amaranth (*Amaranthus tricolor* (L.))

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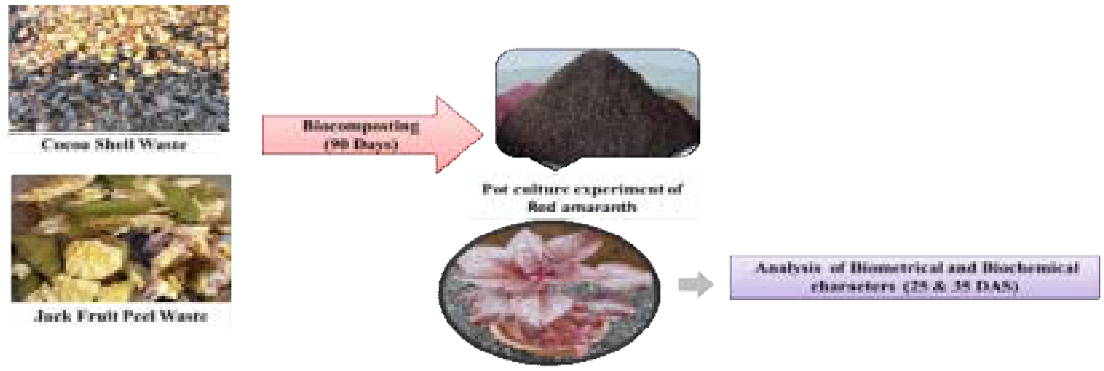
Abstract

Agroindustrial waste dumping is responsible for ecosystem damage and accelerates the destruction of the environment. The present study evaluated the efficiency of cocoa shell waste (CSW) and jack fruit peel waste (JFPW) biocompost impact on the vegetative characters (biometric) and biochemical constituents in leaves of Red amaranth (*Amaranthus tricolor* (L.)). Biocomposting plays a major role in organic farming and it increases the growth of vegetable crops. The experiments were conducted with a control (no manure) and eight treatments (T_1 to T_8). Biometrical characters and biochemical constituents in the leaves of *A. tricolor* (L.). were tested on 25 and 35 DAS. All the treatments (T_1 to T_8) showed a significant increase in the growth attributes and biochemical parameters of Red amaranth. The result showed that maximum increase in the root length (22.87cm, 26.07cm), shoot length (14.07cm, 29.07cm), number of leaves (10.97, 14.03), fresh weight (2.271 g, 8.085 g) and dry weight (0.438 g, 1.122 g) and protein (73.57 mg/g tissue,85.21 mg/g tissue), carbohydrate (67.75 mg/g tissue, 74.27 mg/g tissue), chlorophyll 'a' (0.273 mg/g tissue, 0.527 mg/g tissue), chlorophyll 'b'(0.639 mg/g tissue, 0.844mg/g tissue) and total chlorophyll (3.578 mg/g tissue, 4.630 mg/g tissue) content in test crop was recorded in T_8. The application of cocoa shell and jack fruit peel waste biocompost was recommended to small-scale producers and farmers for the production of healthy vegetable crops and safe food. The experimental work determined that among the treatments "T_8 – Raw Jack fruit peel +10g *Pleurotus eous* + 10g *Pleurotus florida*+ *Eudrilus eugeniae* 5t/ha^{-1} (Biocompost 8) registered maximum improvement in vegetative and biochemical characters of *Amaranthus tricolor* (L.) followed by T_4 - Raw cocoa shell+ 10g *Pleurotus eous* + 10g *Pleurotus florida* + *Eudrilus eugeniae* 5t/ha^{-1} (Biocompost 4)" as compared to the other treatments and control. Thus, it was concluded that the biocomposted agroindustrial waste acts as an

environmentally friendly, less expensive, and highly effective organic manure for the growth of vegetable crops and improves the biological characteristics of the soil.

Keywords: *Amaranthus tricolor,* Biocompost, CSW, JFPW, *Pleurotus florida, Pleurotus eous* and *Eudrilus eugeniae.*



Effect of CSW and JFPW and its impact on Red amaranth

PP-21: Physico-chemical properties of raw and composted Vegetable and Fruit waste of winter season composting

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Abstract

India is one of the agricultural based nation that play an important role in the overall socio-economic process and is one of the largest economic sectors. India has a large number of successful sustainable agricultural practices that are in par with ecological principal. Composting is a biological decomposition process that breaks down organic material into a stable, humus-like substance. It is a safe method for the disposal and recycling of organic waste by converting to organic fertilizer. Vermicomposting is a low-cost technological process of composting where earthworm species were introduced into the compost to generate a better end product. Application of vermicompost in the soil promotes the growth of the plant and helps in protecting the crops from pest and disease. Due to intensive use of inorganic pesticides and fertilizers, depleted soil fertility was observed in soil, which leads to environmental degradation and increase the yield for short duration but harmful to human health. The aim of the study was to recycle Vegetable and Fruit waste in winter season from Nov-January into eco-friendly

manure and analyse its physico-chemical composition of raw and composted sample. The study consists of 8 treatments namely C1 to C8 and Control (no manure). The study reported a significant decrease in lignin, cellulose, EC, organic carbon and C:N ratio in C8- Fruit wastes + cowdung + *Pleurotus eous* + *Trichoderma asperelloides* + *Eudrilus euginiae* (5 t/ha) treatment followed by C4- Vegetable wastes + cowdung + *Pleurotus eous* + *Trichoderma asperelloides* + *Eudrilus euginiae* (5 t/ha) treatment when compared to raw wastes sample. The increasing trend was noted in C8 and C4 treatment for pH, Nitrogen, Potassium, Phosphorus, Calcium and Magnesium. The finding of the experiment revealed that physico-chemical composition and nutrient content of the composted Vegetable and Fruit waste showed higher content when compared to raw vegetable and fruit sample. The success outcome of the study will allow the farmer and consumer to minimize the use of chemical fertilizers and pesticides in crop production and encourage the use of organic manure for healthy environment.

Keywords: Vegetable and Fruit waste, Lignin, compost, Agriculture, manure.

PP-22: From Fiber to Fashion: A Roadmap towards Sustainability in Textile and Apparel Industry

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Abstract

Over the last couple of years, the term 'sustainability' has become the talk of the town around the globe. Sustainability in the textile and apparel industry is merely a debatable concept, as this industry is accused of being unsustainable due to fast production cycles, overuse of resources, enormous waste generation and environmental pollution. The apparel supply chain is diverse and complex, spanning four or more tiers, including design, raw material harvesting, spinning, yarn production, dyeing, weaving, cutting, stitching and final garment construction. However, to counter this negative contribution towards the environment, various sustainable design techniques and eco-friendly processes of extracting natural dyes from identified resources are advancing towards a sustainability roadmap. Presently, new business models, new-age fashion labels and various supply chain methods are being used to address the awareness and demand for sustainable fashion.This paper

highlights the adverse impact of textile waste on our ecosystem as well as a few innovative utilization and recycling practices for converting textile wastes into valuable products for attaining sustainability within the textile and apparel industry.

Keywords: Sustainability, environment-friendly, recycling, fast fashion, handloom

PP-23: Adverse Effects of Textile Coloration on Aquatic Ecosystem and Its Handling

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Abstract

The contamination of the aquatic environment due to textile dye is becoming a significant problem as dyes are examined as micro-pollutants with very low concentrations. The dye used in textile industries pollutes the aquatic domain and shows potentially lethal towards aquatic creatures, which enter the food chain. Different classes of textile dyes such as acidic, basic, direct, disperse, vat and sulfur donot securely cohere to the fabric; their discharge as a pollutant in the aquatic environment could increase the risk of the existence of the aquatic flora and also decreases the quality of water.Therefore, dye-hold wastewater should be effectively handled using eco-friendly technologies to circumvent negative effects on the aquatic environment. This paper focuses on the harmful effects of textile effluents on the aquatic environment and also highlights the recent developments in sustainable dyeing practices in the textile industry along with challenges and future prospects.

Keywords: Wastewater, dyes, contaminants, eco-system, aquatic environment, treatment

PP-24: Determination of the circulating levels of the pathologically relevant environmental pollutants BDE47, and Phthalates (DEHP, DMP, DEP, DBP, DOP) in a pilot population from south India

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Abstract

The abundantly reported environmental pollutants such polybrominated diphenyl ethers (PBDE) and Phthalates have been strongly associated with human pathogenesis. Several developed countries have evidenced very high levels of PBDEs in human specimens and the circulating levels of PBDEs have been reported to reach 1µg/ml. As structural mimics of the thyroid hormones, PBDEs compete with T3, T4 and significantly affect thyroid hormone functions. Similarly, the low volatile, stable pollutants, phthalates are recently associated with endocrine disorders. While several countries have examined in detail the association of such pollutants in human pathologies, such studies are obscure in the Indian population. Therefore, the present study, as the first, aims to determine the circulating levels of the PBDE BDE47, and the Phthalates (DEHP, DMP, DEP, DBP, DOP) in the serum of a pilot population from south India. Determination of the circulating levels of BDE47 was carried out from serum separated from peripheral blood samples(10ml) of 10 healthy/thyroid patients using GC-MS/MS, according to standard protocols. In brief, the samples were sonicated for 15 minutes with 2x formic acid, and preprocessed using Strata X cartridges (Phenomenex, 500mg, 6ml). Cleaned, fractionated analytes were eluted through silica columns (5g silica: 2g Na_2SO_4) preconditioned with hexane. The reduced fractions dried in rotavapor were reconstituted in hexane and analyzed. Similarly, determination of Phthalates was carried out from 5ml of healthy volunteers/patient's peripheral blood samples. In brief, serum samples, standards were extracted using Strata SPE cartridges (30mg, 1 ml) preconditioned using acetonitrile, ultra-pure water and washed with 5% acetonitrile. The analytes eluted in 100% acetonitrile were dried under rotavapor, reconstituted with acetonitrile and then analyzed using GC-MS. The free circulating levels of BDE47 in healthy volunteers, thyroid patients ranged between

533pg/ml and 2700pg/ml. The mean concentration of DEHP, DMP, DEP, DBP, DOP in healthy volunteers was 97.57 ± 112.81 ng/ml, 10.10 ± 13.68 ng/ml, 179.53 ± 173.53 ng/ml, 1157.92 ± 1294.53ng/ml, 32.930 ± 26.21 ng/ml, and was 120.93 ± 75.85 ng/ml, 5.58 ± 3.23 ng/ml, 156.42 ± 49.16 ng/ml, 914.98 ± 407.21, 22.02 ± 12.37 ng/ml in thyroid patients, respectively. Taken together, the present study validates GC based methods, reports circulating levels of the pollutants in the regional pilot population. Further larger scale studies are necessary to reveal the association of these pollutants in thyroid, other endocrine diseases.

Key words: BDE47, Phthalates, human serum, thyroid patients.

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PP-25: Influence of Arecanut Husk Compost Increased the Protein and Carbohydrate Content in Leaves of Fenugreek (*Trigonella foenum-graceum* L.)

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Abstract

Arecanut husk is an agro-industrial by product, which accounts for 60-80% of the arecanut fruit by volume. Agro-industrial waste and byproducts are renewable forms of resources generated all over the world. It acts as an important soil ameliorant to improve the physical condition and moisture status. Thus, it can be used as an effective mulching agent. The present investigation was undertaken to study the effect of composted arecanut husk as a growth promoter on the test crop fenugreek (*Trigonella foenum-graceum* L.). Hence, recycling of arecanut husk would be a good substitute for organic manure produced by *Pleurotus florida*. The treatments were as follows: C – Control, T_1 – Arecanut husk compost (16 g), T_2 – Arecanut husk compost (18 g), T_3 – Arecanut husk compost (20 g), T_4 – Arecanut husk compost (22 g). Among the treatments, T_4 registered a maximum protein content of 39.81 mg/g tissue (25 DAS) and 96.63 mg/g tissue (45 DAS) followed by other treatments and after that, the protein content in the leaves declined gradually 78.90 mg/g tissue on 55 DAS over the control treatment. The carbohydrate content was increased significantly in T_4

treatment which ranged from 51.67 to 90.76 mg/g tissue followed by other treatments on 25 and 45 DAS and declined to 79.48 mg/g tissue on 55 DAS against control. From the results, T_4 treatment showed promising results of superior values obtained for protein and carbohydrate content in leaves than other treatments and control. Hence, organic manure like arecanut husk compost has been proved as an effective biocompost for the enhancement of protein and carbohydrate content in leaves of Fenugreek (*Trigonella foenum-graceum* L.)

Key words: Arecanut husk compost, DAS- Days After Sowing, *Trigonella foenum-graceum, Pleurotus florida*, Protein and Carbohydrate.

PP-26: Bioconversion of banana peel into eco-friendly compost and Its effect on the growth and Yield parameters of Lablab

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Abstract

India is one of the countries with a large agricultural economy and plays a significant part in the whole socio-economic process. Intensive use of inorganic pesticides and fertilizers increased crop production for a short period of time but depleted soil fertility which leads to environmental degradation. Composting is the process of biodegradation of organic matter as manure to improve soil fertility and reduces the use of fertilizers and pesticides which is harmful to environment. Composting provides several benefits to the environment because manure is eco-friendly and cost-effective. The present study was conducted at Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, Tamil Nadu to analyse the growth in the lablab on 15 DAS, 35 DAS, 55 DAS and yield parameters in seeds on 75 DAS after incorporation of banana peel compost. The study consists of 5 treatments namely C- Control (only soil), T_1- Composted Banana peels waste (25g), T_2- Composted Banana peels waste (50g), T_3- Composted Banana peels waste (75g) and T_4- Composted Banana peels waste (100g). The study showed significantly increased in root length, shoot length and number of leaves per plant in T_4 treatment followed by T_3 when compared to the control on 15, 35 and 55 DAS. Fresh weight and dry weight of the plants was noted higher in T_4 treatment when compared to the control on 15, 35 and

55 DAS. The yield parameters (number of pods / plants, number of seeds / pods, pod length, seed weight, pod fresh weight and dry weight) reported maximum in T_4 followed by T_3 over control. The study concluded that T_4- Composted Banana peels waste (100g) treatment is an effective and eco-friendly compost that enhance the growth and yield parameters of lablab plant. The outcome of the study will allow to minimize the use of fertilizer, pesticides that are harmful to crop and encourage the farmer to use organic manure for healthy environment and life.

Keywords: Biocompost, Banana peels, soil fertility, eco-friendly

PP-27: Efficiency of bacteria isolated from sewage water in degrading organic pollutant using Acrylonitrile Butadiene Styrene (ABS) as carrier material

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Abstract

In waste water treatment system, biological way of treating the organic pollutant present in the sewage water can be achieved through the use of effective biofilters in the secondary treatment process. Biofilm carriers with varying sizes, shapes, and materials have been studied to actively influence the proper mixing of microorganisms with nutrients thereby enhancing oxygen transfer process. Usage of biofilm carrier material has been employed successfully in various waste water sectors like municipality, tannery, diary, food industries. Our study focuses, on the growth of bacteria isolated from sewage water on the carrier material Acrylonitrile Butadiene Styrene (ABS). ABS is a thermoplastic polymer and also it is a reusable biofilter which is used as a carrier material. This carrier material was customized in a honeycomb structure with surface area of 49cm^2. This structure provides more surface to volume ratio to promote more biofilm growth. A well grown biofilm on carrier material will be called as biofilter, since it has high efficiency to consume and filter out organic pollutant present in the sewage water and can convert it into by-products which are less toxic to environment. For this study we have grown biofilm on two different media to check the micro-organisms efficiency to degrading the organic pollutants and

thereby decreasing the BOD, COD, TSS, TDS, Sulphate, Chloride, Oil & Grease and Odour. The treatment is carried out for 3 days in triplicates and it is a closed batch system. The result showed that the maximum biofilm growth and effective in treatment of tryptone and yeast extract when compared to peptone and beef extract medium. It is noted that the BOD level was reduced to about 80 to 85% of the amount of sewage water sample. This research work showcases the efficacy of micro-organisms towards decreasing BOD, COD and other parameters as well as strong nature of the carrier material on which the biofilm is grown. In near future, zero waste target will be achieved by employing biofilm enhanced biofilter waste water treatment system.

Keywords: waste water treatment system, carrier material, biofilter, Acrylonitrile Butadiene Styrene, BOD, COD.

PP-28: Design, Spectral Sensing, Molecular docking, and DFT studies of Triazine-based Metal complexes

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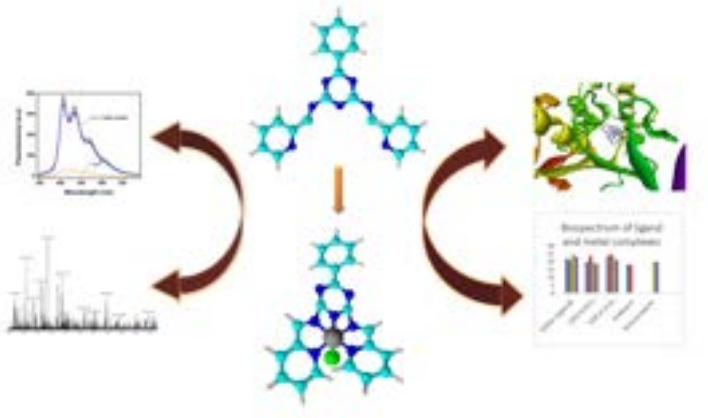
Abstract

Novel Cu (II) complexes of pyridine-2-carboxaldehyde (DPTPC) derived triazine-centered ligand was synthesized and physicochemical characterization was accomplished through elemental analyses, molar conductivity, and spectroscopic techniques (IR, ^{1}H NMR and UV-visible). The selective and sensitive determination of Cu^{2+} was done by colorimetry and Fluorescence sensing. The high selectivity of Copper(II) ions has been investigated through the optical spectral method. The stoichiometric of Cu (DPTPC)Cl_2 has been authenticated by Jobs plot and the stability constants were determined. The optimized geometry of the ligand DPTPC and Cu (DPTPC) Cl_2 complex were found to be octahedral by DFT methods. The ligand showed high selectivity towards copper ion in ethanol with a detection limit of 0.04µM. The interaction of DPTPC and complexes with *Mycobacterium tuberculosis* were analysed by Molecular docking studies and the *invitro* antimicrobial activity of DPTPC and metal complexes were studied against *Escherichia coli*, *Staphylococcus aureus*, and *candida Albicans* and found to possess appreciable activity. The newly 97as attaine can be

used for selective sensing f copper present in environment with high reproducibility ad lng term stability and for the analysis of natural and industrial samples.

Keywords: Triazines, Schiff base complexes, Colorimetric, DFT, Molecular docking.



Graphical abstract

PP-29: Assessment of Microplastics in the Freshwater Fishes of Puducherry

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Abstract

Plastics have become an important part of our everyday life as most of the products we use are made up of plastics due to their light weight, low cost, durable and flexible properties. But improper management of these plastic waste will lead to accumulation of plastic debris in natural habitat, predominantly in aquatic habitats. During decomposition of plastic waste, the disintegrated smaller pieces of plastic debris of size less than 5 mm are termed as “Microplastics” (MP). MPs are easily ingested by the aquatic organisms due to their small size and they are proved to adsorb persistent organic pollutants (POP) from the surrounding water, which ultimately affects the quality of freshwater which is relied by the local livelihood near to the water body. Fishing and sewage activities are the major source of microplastics in water bodies. The most commonly used polymer types in everyday human activities are HDPE, LDPE, PVC, PS, PP and PET. Most of the plastics which are released into the water

bodies are single use plastics. PE is the most common type of polymer followed by PS and PP. The plastic articles like water bottles, food packaging, cosmetics packaging and plastic ropes are much released into the environment everyday which accounts for the microplastics in the water bodies due to stormwater drains. Fragments and films of this articles formed due to incomplete decomposition by sunlight, seawater and UV-radiation persists in the environment as microplastics which are easily ingested by the aquatic organisms as it looks similar like its feed. This ingested microplastic in fish also gets passed on to humans via bio transfer which causes various health impacts in humans. Human exposure of microplastics causes metabolism alteration, oxidative stress, immune system damage, reproductive toxicity, cytotoxicity, neurotoxicity, and much more impacts. So the assessment of microplastics in the edible freshwater fishes consumed by the people will ultimately make them aware of emerging contaminants in freshwater and will make them act responsible in future plastic waste management.

PP-30: Cost and Energy Efficient Wastewater Treatment using Electrocoagulation Process to Remove Textile and Pharmaceutical Contaminants.

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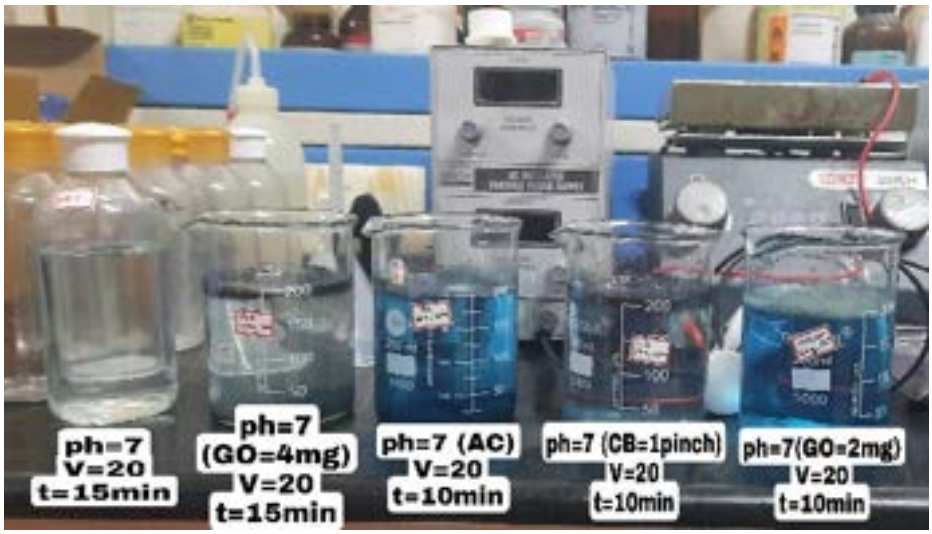
Abstract

No research could develop a commercially feasible effective water treatment yet. Many challenges like emerging pollutants, high toxicity, inorganic contamination, etc. making water treatment difficult. Membrane filtration in RO has made to the commercial level yet it has limitations like pressure maintenance and membrane maintenance. Advance oxidation has been widely expanding field in water treatment yet it is time taking for degrading huge multiple pollutants and not cost effective, plus external adding of oxidants and degrading catalyst further make the water treatment complication. Hence, we are focusing on electrocoagulation (EC) a simple but effective physical field for water treatment. Only issue with EC is Sludge Formation that we had fixed with modified EC. Modified EC has promising output with less sludge formation

and low current consumption. Another advantage of EC being all multiple process are happening at the same time, like electrocoagulation, flocculation, sedimentation, oxidation, reduction, charge neutralization etc. in a single EC system. Since we are adding no external chemical, oxidants, catalyst, etc. this is a friendly way of approach in water treatment which minimize the water treatment complication. Hence this technique has a huge advantage over other methods. We have converted traditional EC system into modified system by converting cheap porous electrode multiple electrodes with very limited anode decay and cathode passivation. This hybrid setup has only limitation when it comes to highly polluted contaminates, but still effective purification is possible after pre-treatments. Hence this technique is possible in commercial level since it minimized challenges in traditional EC system

Keywords: Modified Electrodes; porous electrodes; anode decay; cathode passivation.



PP-31: Nutrient Recovery from Dairy Wastewaters as HAP (HydroxyApatite) and MAP (Magnesium Ammonium Phosphate): PotentialApplication Prospects

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Abstract

Dairy industries engender a huge amount of effluents with high organic load, facing the problems of treatment, disposal and recycling of effluents. Dairy industry generates on anaverage 2.5 – 3.0 litres of wastewaters per litre of milk processed. Discharge of thesewastewaters cause eutrophication and block soil pores resulted in reduced levels of soilinfiltration. Developed treatment systems are insufficient due to the poor operation designwhich creates trickling filter, sludge generation, high labour and maintenance cost. Considering the above stated implications, an attempt is made to extract the nutrients after systematic analysis of physicochemical parameters. Dairy wastewaters procured from industrial sources are subjected to lime/ Magnesium Chloride precipitation methods and the derived materials are tested for their manure property as HAP (Hydroxy Apatite) and MAP (Magnesium Ammonium Phosphate). These nutrients being a slow released fertilizer are impelled to pot trials with household pulses and extended to fodder crop. The results indicate an inclination in the shoot growth of the respective plants against their controls. Subsequently, water quality parameters of the raw dairy wastewaters are determined by standard operating procedures. Maximum reductions of BOD, COD and TSSfrom the wastewatersare achieved through Batch adsorption studies employing eco-based byproducts, at preset conditions, to facilitate further safe disposal. Conversion of the nutrient enriched wastewaters generated from dairy industries into value added HAP/ MAP manures and their utilization in promoting fodder crops growth to feed domesticated cows is a robust approach.

Keywords: dairy wastewaters, nutrient recovery, hydroxy apatite, magnesium ammonium phosphate, water quality parameters, manure

Waste to Value

PP-32: Synthesis of Plant Extract Derived Silver Nanoparticles and their Toxic Dye Degradation Applications

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Abstract

Silver nanoparticles have been of great interest in science for over a century due to their unique size and shape, as well as their physical, chemical and surface properties. Silver nanoparticles are widely used in several applications. Among the different applications, photocatalytic degradation of environmental toxins received great attention. A major problem that threatens human wellbeing, weakens ecosystem services, and impedes economic growth is water pollution. Due to industrialization, water resources have been contaminated with toxic pollutants such as the effluents of organic and inorganic dyes. Therefore, the degradation of dyes are important. Herein, we are focusing on the green synthesis of silver nanoparticles using Crateva magna plant extract. The synthesized CM-AgNPs shows the surface plasma resonance (SPR) band at 425 nm. Further, we have characterized them by UV-visible, FT-IR spectral, XRD and HR-TEM techniques. Then, we used CM-AgNPs as photocatalyst for the degradation of crystal violet dye . The degradation efficiency of CM-AgNPs for the degradation of crystal violet was calculated to be 96.90%. Finally, we have successfully

applied this CM-AgNPs as photocatalyst for the effective degradation of industrial dye wastewater.

Keywords: Silver nanoparticle, Water pollution, Crystal violet, Dye degradation, Industrial waste water.

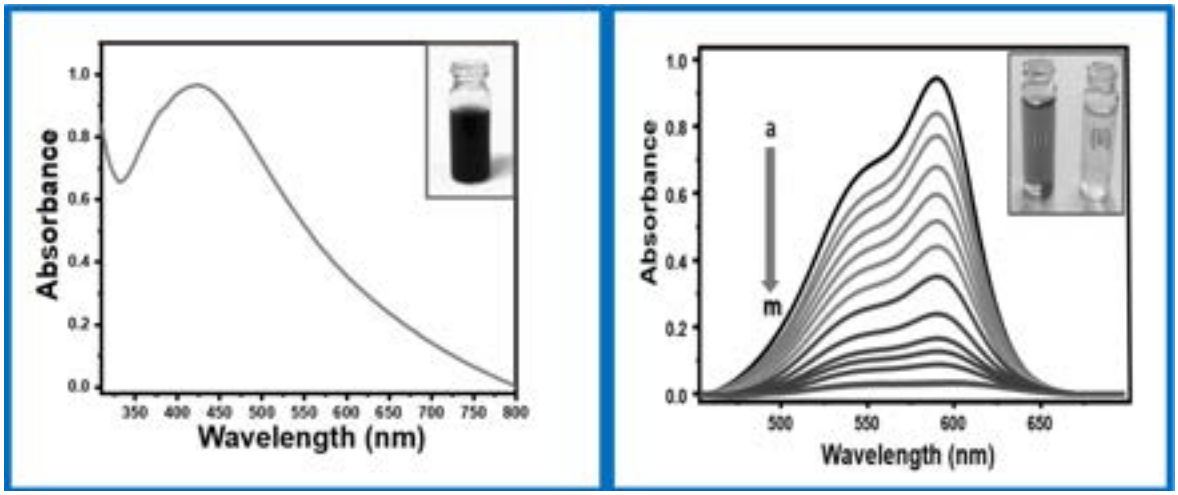

Fig.1. (a) UV-Visible spectrum of CM-AgNPs. (b) Absorption spectra for the formation of MG-AgNPs recorded at different time interval.

PP-33: Bioactive Pigments From Marine Isolated Bacteria And Their Application In Dye Industries

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Abstract

Pigments derived from natural sources have gained interest worldwide in recent years and they offer a promising means for a wide variety of applications in the food, cosmetics, dyeing and pharmaceutical industries. The pigment-producing bacterial isolate TPA01 was isolated and identified as *Serratia marcescens* by 16S rRNA PCR method. The strain *Serratia marcescens* TPA01 produced pigment was characterized by UV-Vis (λ_{max}410 nm), thin layer chromatography (R*f* 0.64 - 0.96) and FTIR analysis. The antimicrobial activity of the extracted pigment exhibited an inhibitory effect significantly against bacterial clinical pathogens viz., *E. coli*, *Bacillus subtilis., Shigella dysenteriae*, *Pseudomonas aeruginosa*., *Staphylococcus aureus* and *Klebsiella*

pneumoniae. It is also evidenced that a strong antioxidant activity (DPPH radical scavenging and metal ion chelating assay) and the existence of anticancer potential with IC_{50} are 28.1 $\mu g\ ml^{-1}$ for the tested HeLa cells. Therefore, *S. marcescens* TPA01 is a potent source that could be a most promising organism for producing marine derived compounds with application in various industries. Predominantly, the strain TPA01 has demonstrated dye activity when utilized in cotton and linen fabric pieces and will make it an alternative to synthetic dyes which are hazardous to the environment and can prevent water pollution.

Keywords: Bacterial pigments, UV, TLC, FTIR, antibacterial activity, antioxidant activity, anticancer activity, dye industries

PP-34: Synthesis of Novel MOF- (Metal Organic Framework) for Various Environmental Applications

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Abstract

The major global and the environmental pollution meeting peaks nowadays. There are many emerging contaminants arise in day to day life. The emerging contaminants are the major threat to the environment and the water. For that so many emerging technologies and ways to reduce the pollutants and to remove it. Some of the biological contaminants also there to pollute the environment. For that we come up with the novel catalyst used in metal organic framework. This presentation will discuss the synthesis and characterisation of copper based metal organic framework using modified Solvothermal method and its wide application in environmental emerging contaminants. Copper based metal organic frameworks have been significant attention in recent years due to the potential in various environmental applications. These porous materials have a highly tuneable pore structure and high surface area, making then suitable for adsorption, catalysis and sensing applications. These study demonstrate the potential of Cu MOFs in various environmental application such as air purification, water purification , carbon dioxide capture, and sensing and also show the effect of different MOF in different application. The synthesized MOF should undergoes various characterization like X-RAY

diffraction(XRD), Fourier Transform Infra-red Spectroscopy (FTIR),Field Emission Scanning Electron Microscopy with Energy Dispersive X-ray(FESEM with EDX), Nitrogen Sorption Studies. The Cu-MOF catalyst has been designed to be highly efficient and effective in catalysing reactions for the treatment of pollution in air and water. The catalyst has also also been tested for its ability to improve the efficiency of fuel of fuel cells and solar cells, showing promising results. The ability of this catalyst to catalyse multiple reactions and its potential to used in various environmental and energy production application makes it a versatile and valuable addition to the field and also used in Waste Water Treatment in Industry. The method of synthesis is feasible ,less time consuming and economically feasible too. It can applied in commercial scale to obtain better results.

Keywords: Cu-MOF, Modified Solvothermal method, Characterization, Application of Cu MOF in emerging contaminants

PP-35: Efficiency of vermicoposted coirpith on growth and biochemical characters of cluster bean (*Cyamopsis tetragonoloba* L. (Taub) Var. Pusa Navbahar)

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Abstract

Organic agriculture is helpful for the production of safe food. Coirpith dumped on road sides pollute air and water which has an impact on environment. Composted coirpith retains moisture and fertility of the soil and thus promotes the plant growth and safeguard environment. Agriculture provide us food and nutritional security which is the backbone of nation. A pot culture experiment was conducted with cluster bean as the test crop to evaluate the efficacy of vermicomposted coirpith. The present study was aimed to understand the effect of vermicomposted coirpith on plant growth and biochemical characters of cluster bean. Seven treatments were given viz. C – control, T_1 – vermicomposted coirpith (15g), T_2 – vermicomposted coirpith (16g), T_3 – vermicomposted coirpith (17g), T_4 – vermicomposted coirpith (18g), T_5 – vermicomposted coirpith (19g), T_6 – vermicomposted coirpith (20g). The vegetative parameters like shoot length, root length, number of leaves, number of nodules, number of flowers, fresh weight and dry weight. A significant increase in shoot length,

root length, number of leaves, number of nodules, fresh weight and dry weight were observed in T_3 treatment, followed by T_2 treatment. Minimum amount was recorded in control on 35, 45 and 75 DAS. A significant increase in number of flowers was observed in T_3 treatment followed by other treatment on 45 and 75 DAS. The biochemical characters like chlorophyll, protein and carbohydrates were analysed on 35, 45 and 75 days after sowing. The results in cluster bean clearly indicate that treatment T_3 significantly increased all the characters studied followed by T_2 treatment. The yield parameters like length of the pod, weight of the pod, number of seeds per pod and weight of the seeds per pod were significantly increased in T_3 treatment on 90 days after sowing. The results of the study clearly indicated that the treatment T_3 significantly promoted all the vegetative parameters, biochemical characters and yield parameters of the test crop as compared to the control treatment.

Keywords: DAS, vegetative growth, biochemical cha

PP-36: Tannin based sustainable functional nanomaterials for sensing and removal of melamine in water and food samples

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Abstract

The emerging contaminants which are obtained from disparate large-scale industries and domestic activities pose a threat to the ecosystem, thereby affecting the quality of life of the living beings. Effective detection and removal methods for the emerging contaminants is a need of the hour. Melamine is an important emerging contaminant which is present in multitudinous products such as coating on furniture, household goods, food packaging materials, kitchen-wares in majority. Melamine is a ubiquitous endocrine disruptor, neurotoxicant and very lethal for kidneys since it contributes to renal toxicity. Hence sensing as well as remediation of melamine is an absolute necessity in water and food industry. In the present study, Tannins derived from tea leaves extract is used in various micro and nano formulations to sense melamine through a simple colorimetric and fluorescent method. In addition, the experiments were also carried out with Tannic acid. The tea leaves are abundantly available throughout the world, and are also rich in hydroxy groups which can be used in sensing of various analytes. Experiments were conducted using Tannic acid and melamine in different solvents such as water, and formaldehyde and were characterized using various analytical techniques. The UV visible spectrum of the samples showed a significant reduction in the absorption intensity of tannic acid at 273 nm along with a peak shift to 264 nm in the presence of melamine. To enhance the sensing by multifold, gold nanoparticles and carbon quantum dots were prepared using tannic acid. The gold nanoparticles were prepared by reduction of chloroauric acid ($HauCl_4.3H_20$) by the tannins present in the tea leaves extract and from tannic acid. On the other hand, the fluorescent carbon quantum dots were prepared from tea leaves extract and tannic acid through hydrothermal method at a temperature around 200˚C for 12 hrs. The interaction of gold nanoparticles and the carbon quantum dots with melamine has been evaluated using various colorimetric and spectroscopic techniques. Both nanoparticles were developed into nano formulations such as nano gel and nano coatings using hydroxyapatite, which is a well-known biocompatible

polymer. The functional nanomaterials were introduced to HAP to form nanocomposites and optimized under various conditions to convert it into ceramic coatings and ceramic gels. The tannin and tannic acid based nano formulations were further studied using various analytical characterizations such as FT-IR spectroscopy, Photoluminescence spectroscopy, Raman spectroscopy, DLS and Zeta potential to study its surface morphology, size and fluorescence intensity and, to determine its competence in effective sensing and removal of melamine. The present nano formulations are highly suitable for identification and removal of melamine in water and food samples.

PP-37: Assessment of groundwater quality in Manali Chennai district

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Abstract

Evaluation of groundwater is vital for maintaining the safe and sustainable use of water. The physio-chemical and biological quality study of Manali region (Chennai district) has been conducted to evaluate the water quality. 21 samples from various places in Manali region is collected for the test and analysis of pH, Chloride, Hardness, Turbidity, BOD, COD, DO, Conductivity, Total Dissolved Solids & Total Suspended Solid for finding the water quality. With the use of a geographical information system and analysis of physiochemical parameters an effort has been made to expose the regional variation of ground water quality (GIS). Using GIS interpolation method in ArcMap 10.5 spatial distribution map from the physiochemical and biological parameter are generated. Also, WQI and Statistical analysis was made and the water quality in Manali region was analysed

Keyword: WQI, GIS, water quality, spatial variation, physiochemical test.

PP-38: Effect of Bio-Composting Process on paddy husk and its physicochemical characterization

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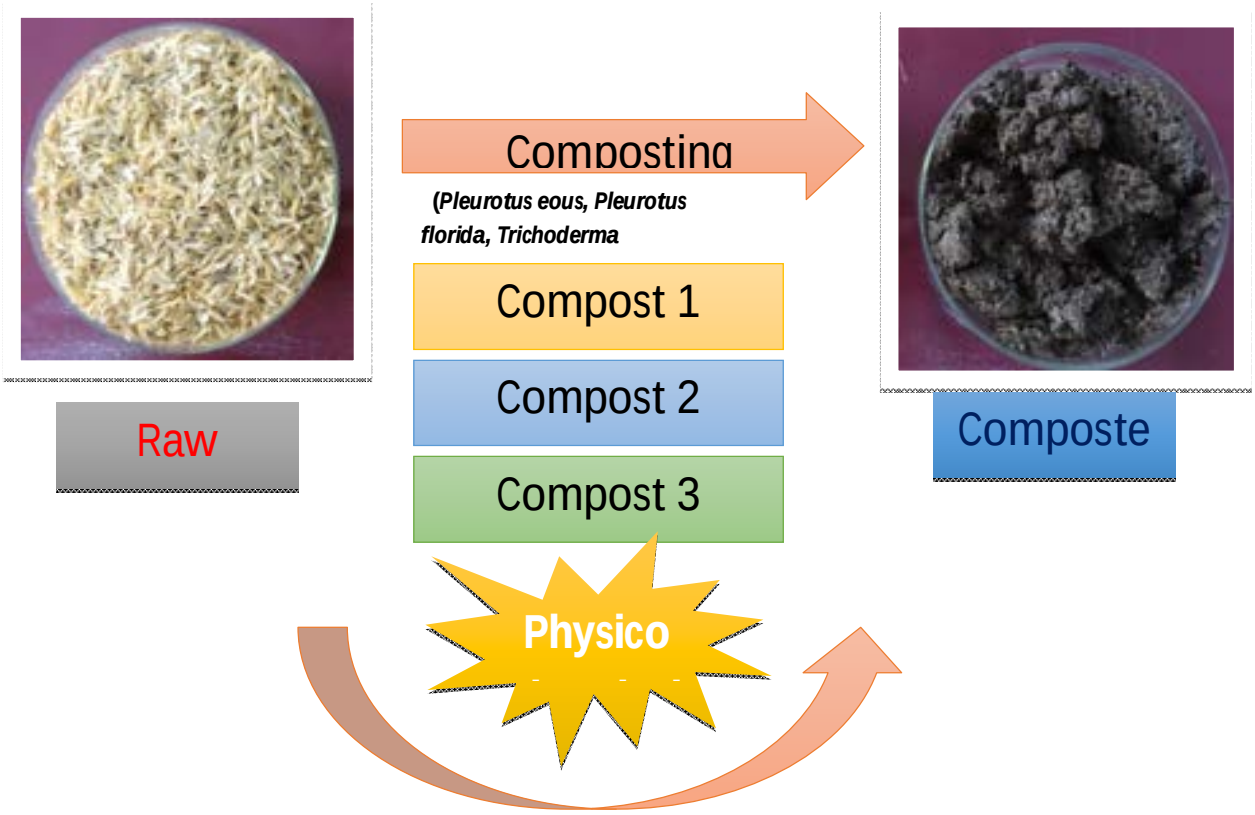
Abstract

In this recent era with the population growth and urbanization in the world and industrialization, agricultural activities can result in giving better and suitable life but also generates excessive amount of wastes. The main objective of our work is to utilize these wastes and transforming them as the environment friendly beneficial end products. Paddy is one of the oldest ancient crops and cultivated over 100 countries and consumed as staple food by more than half of the world's population, as a result large quantity of paddy husk are produced as byproducts and open dumping of this can cause serious environmental pollution. Composting is the best method to degrade the rice husk, for it is the material rich in lignin and cellulose. The composts were maintained within the 3 pits and they are C_1, C_2 and C_3 the work was carried out by analyzing the physicochemical parameters of composts and the raw sample. The composts were enriched with the introduction of the earthworm *Eisenia foetida*. Among all the 3 composts the 3rd compost pit enriched with the application of consortium of microorganisms *Trichoderma asperelloides*, *Pleurotus florida and P.eous* is found to be rich in all the minerals like N,P,K,Cu,Fe,Mn and Zn, reduced in cellulose & lignin content when compared to the raw sample. The composted paddy husk can be utilized as a biomanure to enhance the soil fertility.

Keywords: Rice husk, Compost, *Pleurotus florida, Eisenia foetida, Trichoderma asperelloides.*



PP-39: Electrical Energy Free "ELIES Portable Bioreactor" For Sustainable Ecosystem

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Abstract

In Agriculture, the availability of indigenous microbial ecosystem has become a great challenge. To improve the soil fertility as well as to improve crop growth and crop yield simultaneously is a major problem. In ancient times people had the practice of using "Kazhaneer" which was enriched with natural microflora and probiotics which was fed to the cows. Kazhaneer – resourceful waste water from every house hold like wash water of rice and pulses. Hence, the gut associated micro flora of the cows was enriched with beneficial microbes and soil probiotics. The cow dung which was used as manure contained all the beneficial microbes to enrich the soil microbial ecosystem

and improved the crop growth and yield. Such ancient practice was sustainable and the natural indigenous soil microbial ecosystem was flourishing naturally. The ultimate main problem is to safeguard our environment and to maintain the microbial ecosystem of our environment. To manage our wastes effectively and to restore our indigenous soil micro flora for a pollution free, safe ecosystem for our future generations. Environmental protection is the most significant in the present scenario. To improve soil fertility sustainably and to safeguard the natural indigenous soil microbial ecosystem is the need of the hour. To safeguard the environment, soil fertility through indigenous microorganisms in a native manner is our solution. We have designed a device in the form of a reactor named as “ELIES Portable BioReactor” works without electricity will help every farmer to prepare his/her own natural liquid Biofertilizer as an indigenous mixed microbial consortia in a sustainable natural manner.

Sustainable agriculture in a cost effective manner will not be a dream anymore. It is achievable through our device where every farmer can prepare their own Biofertilizer sustainably in a cost effective manner. Our electrical energy free “ELIES Portable BioReactor” will aid everyone to prepare their own liquid Biofertilizer as mixed microbial consortia. Our technology will aid tremendously to restore the soil microbial ecosystem and with increased crop growth and yield. Agriculture, with its allied sectors, is the largest source of livelihood in Tamil Nadu. More than two third of rural households in the State still depend primarily on agriculture for their sustenance, with 93 percent of farmers being small and marginal**.** Our technology can impact each and every farmer where they can prepare their own bio inputs required for their land which ultimately safeguards and enhances their soil fertility by restoring the native soil microbial ecosystem with significant crop yield and productivity.

Key words: Bioinoculants, Mixed microbial consortia, Beneficial microbes; Bioreactor.

PP-40: Treatment of industrial oily wastewater by advanced technologies

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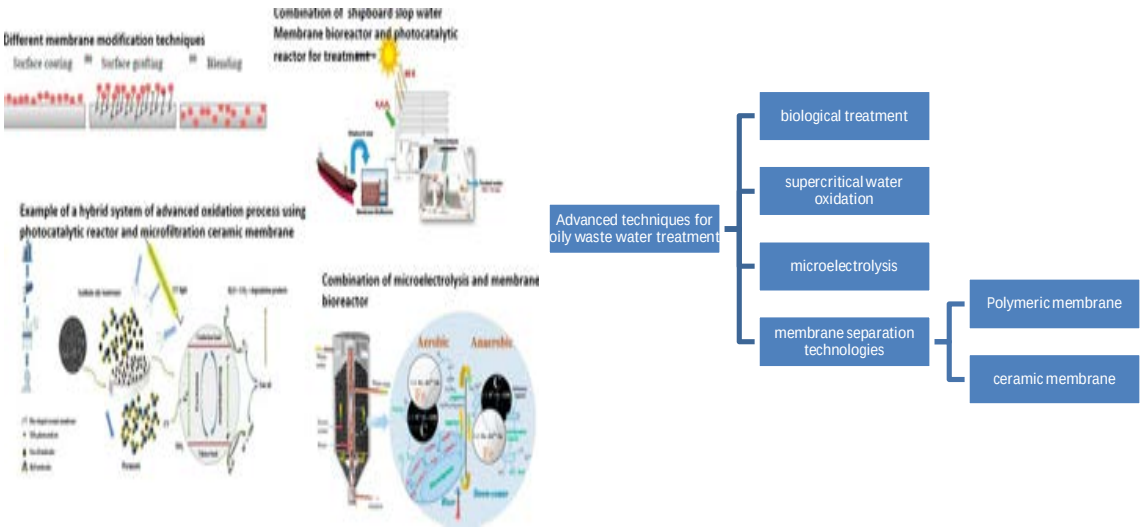
Abstract

Oily wastewater is a wastewater generated by the industries during the refinery process and which contain oils, emulsified oils, fats and greases coupled with a variety of dissolved substances (organic and/or inorganic) in suspension at high concentrations. The treatment employed in the past for oily wastewater treatment are inept due to high operational costs, low treatment efficiency, among others. Biological treatment, supercritical water oxidation, microelectrolysis and membrane separation technologies are the advanced technologies in oily industrial waste water treatment. However, with the technology innovation, new trends of coupling between techniques, use of new materials, optimization of the cleaning process and multiphysical approach present new path for improvement. This review provides the need for adoption of advanced technologies as promising alternatives to existing treatment systems for oily wastewater.

Keywords: Oil; Wastewater; Treatment; Advanced technologies



Graphical abstract

PP-41: Development of a superhydrophobic and superoleophilic SiO_2 based nanocomposite for efficient removal of oil contaminants from industrial wastewater effluents

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Abstract

Environmental pollution issues including oily water discharge and oil spill accidents are getting worse as industrialization progresses. The development of effective and affordable methods for treating oil sewage is still quite difficult. Here, an effective and affordable superhydrophobic and superoleophilic nanocomposite is prepared for the removal of fatty/oil contaminants or substances from industrial wastewater. In our present study, the silicon dioxide (SiO_2) nanoparticles were synthesized through sol-gel technique. The characterization techniques for the SiO_2 nanoparticles were performed with UV-Vis Spectroscopy, Dynamic Light Scattering and Zeta potential analyzer. The results showed a characteristic wavelength of 272 nm, particle size of 365.5 nm with a polydispersity index of 0.020 and zeta potential of -6.4 mV for silicon dioxide nanoparticles. The SiO_2 nanoparticles were modified with processed industrial cotton lint to improve superhydrophobicity and superoleophilicity. The cotton lint was processed as previously reported. Then, the cotton lint was functionalized with octadecyltrichlorosilane (OTES) and silicon dioxide nanoparticles were added to form a nanocomposite. For the developed nanocomposite, contact angle measurement was performed. The nanocomposite showed a superhydrophobicity of 145.8° and superoleophilicity of 3.2°. Hence, an effective superhydrophobic and superoleophilic nanocomposite was developed. The developed nanocomposite can be used in coconut processing industries to remove the oil contaminants from industrial wastewater effluents.

Keywords: SiO_2 nanoparticles, cotton waste, nanocomposite, superhydrophobicity, superoleophilicity

PP-42: Synthesis of Hybrid Core Shell ZnO Nanocomposite using Waste Aquatic Weeds as Bio reductant for Photo degradation of Organic Waste Pollutant and its Antibacterial Performance in Wastewater Treatment

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Abstract

Environment plays a vital role in providing resources to support the existence of life. Environmental pollution has adversely affected the global well-being due to contamination of physical and biological components of the earth. *Eichhornia Crassipes* is one of the most invasive weed species in the world, causing significant adverse ecological impact in the environment. However, it possess excellent affinity towards heavy metal adsorption and dye degradation. Herein, we synthesized rGO-Fe_2O_3@SiO_2/ZnO nanocomposite by Co-precipitation method. The samples were characterized by FTIR (Fourier Transform Infrared Spectroscopy), BET (Brunauer-Emmet- Teller) and SEM (Scanning Electron Microscope) analysis. From BET study, the surface area of the nanocomposite was found to be 101.32m^2/g. The feasibility of synthesized rGO-Fe_2O_3@SiO_2/ZnO was utilized for degradation of methylene blue and eosin yellow dye and antibacterial studies. The adsorptive performance was studied with respect to pH , contact time, adsorbent dosage, and dye concentration. The maximum percentage removal was found to be 92.5% for methylene blue and 94.8% for eosin yellow, respectively. Antibacterial study was carried out using gram negative and gram positive strains. The inhibition zones of E.coli (3.5mm) and S.aureus (3.5mm) were recorded.

Keywords: Environmental pollution, Eichhornia Crassipes, Coprecipitation, photocatalytic degradation, antibacterial studies.

PP-43: Feasibility of Magnetic Nano Adsorbent Impregnated with Prawn Shell Activated Carbon for Heavy Metal (Lead (II)) Removal

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Abstract

We are facing a serious issue of water pollution nowadays. It is caused due to various harmful pollutants like Heavy metals, Dyes, Oil spills etc. Treatment of this was found mandatory in order to reduce water pollution. Magnetic Nano Particle (MNP) was produced by the Co-precipitation process and is then impregnated with Prawn Shells (PS) to fabricate MNP-PS nanoparticles. The prepared adsorbent is studied for the removal of Lead. Lead is highly carcinogenic and cause cancer of lungs, liver, bladder and skin. Lead is found in Air, Water and Food. Drinking water and Industrial waste water are the major causes of Lead Toxicity. In spite of all other removal techniques, Adsorption is preferred because of its less usage of chemicals and wide variety of Adsorbent Choices. Using of Magnetic Nano Adsorbent (MNP-PS) was found effective because of its super paramagnetic property and reusability. The Novel Adsorbent (MNP-PS) with great adsorbent capability are carefully made for the removal of Lead in industrial effluent, household purifiers and the large-scale drinking water treatment plants. Prawn Shells which are of no economic value are used as an excellent adsorbent for the removal of heavy metals, dyes etc. Various Characterization methods including SEM with EDX, XRD, FTIR and VSM shows the property of Magnetic Nano Particle (MNP-PS). The Surface Morphology of 100-400nm was studied using SEM. EDX confirms that the prepared (MNP-PS) sample contains Iron (76.32%) and other compounds. Functional Groups were analyzed using FTIR. The effects of influential factors such as hydrogen ion concentration, MNP-PS amount, initial Pb (II) ions concentration, contact time, and temperature on the batch adsorption of Pb (II) by MNP-PS were investigated. Due to presence of sulfur and oxygen -containing sites, the maximum adsorption capacity of MNP-PS could reach 170.8 mg /g, while the adsorption equilibrium was achieved within 30 min. The adsorption kinetics and isotherms were well described by the pseudo-second -order model and Freundlich model, respectively, proposing a chemical and multi-layer adsorption of Pb (II) ions

removal by MNP-PS and mass transfer have been studied by intra particle diffusion, Boyd kinetic. The adsorption isotherms of Pb (II) ions removal by MNP-PS have been studied by Langmuir, Freundlich, Temkin, models. The adsorption experimental data were best fitted with the pseudo-second-order and Freundlich models. The thermodynamic studies showed the adsorption process was spontaneous, feasible, and exothermic in nature. The innovative strategy of fabricating magnetic nanocomposite MNP-PS from agro-waste will act as a compelling adsorbent for the expulsion of heavy metal ions from the water/wastewater by decreasing its admission in the human food chain.

Keywords: MNP-PS, Heavy metal, Adsorption, Waste water treatment, Environmental Application

PP-44: Decolorization of Industrial effluents and Azo Dyes from *Syngonium podophyllum* based microbes

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Abstract

Removal of toxic azo dyes from the industrial effluents is a much needed process in the present scenario. Attempts to use plants and associated microbes play a vital role in treating dyes as well as industrial effluents. Here we present a first and novel report about the dye degrading ability of microbes associated with *Syngonium podophyllum* which decolorizes azo dyes like methylene blue, congo red and industrial effluents collected from nearby textile industry. Our results displayed the gradual degradation of dyes and effluents when inoculated with bacterial culture isolated from the roots. The decolorization efficiency 73% for methylene blue, 54% for congo red and 75 % for industrial effluents in 4 days. In addition the 16s sequencing results revealed the organism responsible for degrading the dyes has been found to be *Enterobacter cloacae*. Our preliminary results concluded that *Syngonium associated microbes* has the ability to degrade the toxic azo dyes and treat effluents in a constant manner.

Keywords: Syngonium , ornamental plant, phytoremediation, azo dyes, effluents

PP-45: Investigating the Active Functional Groups and Metal Microbe Interaction of indigenous Bacteria, *Enterobacter cloacae* isolated from a contaminated environment and Its Potential Use in Lead Bioremediation

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Abstract

Heavy metals are metallic elements with high atomic weights, and they have five times higher density than water. Because of the high concentrations of non-essential heavy metals in soil and water reservoirs, the environment and all living things are in jeopardy. Lots of conventional methods are employed to remediate heavy metal contamination, but due to the high cost and the production of large chemical wastes, alternative methods are needed to remediate the environment. One of the essential alternative method used for remediation of heavy metal is biological remediation method. Native microorganisms obtained from polluted habitats play a fundamental role in the biodegradation and bioremediation of heavy metals; they can address the preponderance difficulties associated with remediation. Microbial bioremediation is a potentially developing strategy for reducing heavy metal concentrations in the atmosphere by removing and altering metallic molecules. Among various industries, toxic heavy metal wastes discharged by foundries pollute our environment to greater extent and hence there is a need to remediate such soil through microbial means. Heavy metal polluted Soil sample from a foundry industry was retrieved, and Atomic Absorption Spectroscopy (AAS) was employed to evaluate the metal content. Sixteen bacterial strains were isolated using, serial dilution and plating in a metal supplemented media plate, and these strains are known to tolerate heavy metals. The organism with the highest MIC value of 1300 ppm for lead was selected for further investigation among 16 distinct isolates. The chosen strain was determined as *Enterobacter cloacae* through morphological, cultural, biochemical parameters and 16S rRNA sequence analysis. Various factors influencing the metal uptake like contact time, pH, temperature and dosage concentration were studied to optimize the effectiveness of *Enterobacter cloacae* in metal removal. 100% Lead was effectively removed by *Enterobacter cloacae* under optimal conditions. It was detected through FTIR that functional groups such as carboxyl and hydroxyl groups on the bacterial cell

wall surface contribute in a significant way to the active metal binding. Using a Scanning Electron Microscope (SEM), the impact of lead on the surface of *Enterobacter cloacae* was examined which revealed the surface modification in the treated strain with shrinkage in surface area. Transmission Electron Microscope (TEM) result revealed the intracellular lead accumulation in treated bacterial strain as an electron dense discrete region internally within the cell. this study implies an emerging technology that utilizes indigenous bacteria that reside in contaminated soil as a potential candidate for protecting, resorting and safeguarding our natural environment. Thus our result reveal that the presence of maximum metal tolerance ability together with the presence of active metal binding functional groups in *Enterobacter cloacae* may momentously play a key factor in remediating the lead present in Foundry soil. Thus, exploiting *Enterobacter cloacae* as a promising candidate for *in situ* bioremediation would restore and protect our natural environment.

Keywords: Heavy metals, lead, Atomic Adsorption Spectroscopy, *Enterobacter cloacae,* Fourier transform infrared spectroscopy, Scanning Electron Microscope, Transmission Electron Microscope.

PP-46: Metal - Ligand Interaction and Accumulation in the surface sediments of River - Sea Continuum South West Coast of India

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Abstract

This study describes the geochemical distribution of Heavy metals (Ni, Cu, Zn, Pd, Cr and Cd) and identifies the critical factors that significantly control these heavy metals distribution and speciation in river, estuarine and coastal sediments from south west coast of India (Muvattupuzha River, Cochin Estuary and Arabian Sea). Twenty two samples were collected from river-estuary-sea continuum were subjected to total metal concentrations and speciation studies in accordance with BCR protocol. The study has also taken a notice on total metal concentration in river-sea continuum which

indicates estuaries are the major sink for heavy metals to reside. Their order of abundance in both river and estuary founds to be Zn > Cr > Ni > Cu > Pb > Cd and an increase in concentration of Cr more than the concentration of Zn as approaching the adjacent coastal waters side were noticed. Their average concentration founds to be 117.37mg/kg, 80.69mg/kg, 46.54mg/kg, 24.80mg/kg, 17.77mg/kg and 1.61mg/kg respectively for Zn, Cr, Ni, Cu, Pb and Cd. Crustal sources influence the abundance of heavy metals in coastal and river sediment of south-west coast of India, but estuarine parts (Cochin Estuary) were polluted indicating its bioavailability in estuary. Zn and Cd found to be more bioavailable in estuarine segment of River-Seacontinuum. Distributions of Cu and Cr in sediments from River- Sea continuum were controlled by organic carbon present in the sediments. However, Fe-Mn oxide minerals seemed to be a dominant factor in controlling the distribution of Pb in the studied sediments of south west coast of India. The outcome of this study may help in decision-making to predict the levels of these heavy metals from natural and anthropogenic sources and to control heavy metal pollution.

PP-47: Novel Salicyloyl hydrazide chelated Triazine chemosensor: Characterization, Molecular Docking, DFT and Biological Studies.

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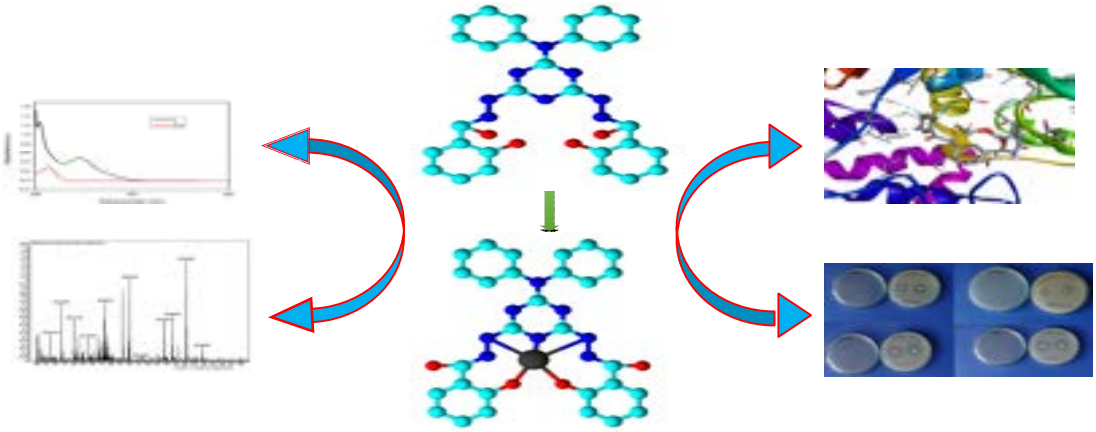
Abstract

Salicyloyl hydrazide chelated triazine ligand [L=2-diphenylimino-4,6-bis(salicyloyl hydrazide)1,3,5-triazine(DPSHT)] and a series of transition metal complexes of the type $[ML.Cl_2]$(M = Cu(II), Co(II), Ni(II), and Cd(II) have been synthesized and characterized with the aid of elemental analysis and spectral techniques such as IR, ^1H NMR, UV-visible, and Mass. Colorimetric techniques for the sensitive and selective sensing of Cu^{2+} ions were examined. Selectivity studies were carried out with different metal ions and found that the proposed chemosensor has high selectivity towards the Cu^{2+} ion with the color change from yellow to blue owing to the formation of a complex with

Cu^{2+}. The results of DFT studies clearly indicate that the interaction between the ligand and the biomolecules has a better binding ability and which is confirmed by molecular docking studies. The *in vitro* antimicrobial activity of the free ligand and their metal complexes has been studied against the microorganisms such as *Escherichia coli*, *Staphylococcus aureus*, and *candida Albicans* by well diffusion methods and found that metal complexes are more active than their ligands.

Keywords: Triazines, Schiff base complexes, Colorimetric, DFT, Molecular docking, biological studies.



PP-48: Novel Sulphanilic Acid Derived Triazine Centered Chemosensor: Characterisation, Molecular Docking, Dft And Biological Studies

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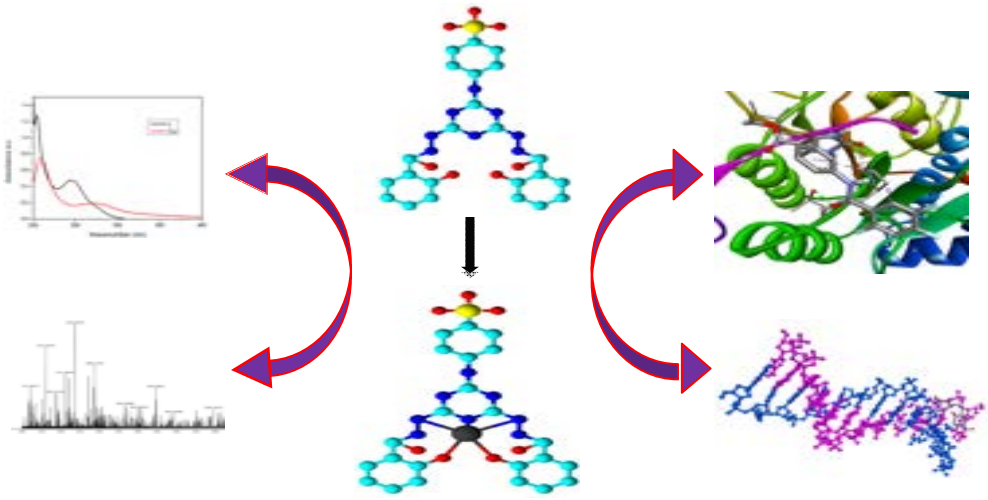
Abstract

A Novel Sulphanilic Acid derived triazine-centeredchemosensor2-Sulphanilyl-4,6-bis(salicyloylhydrazide)-1,3,5-triazine(SSHT)was synthesized and characterized byelemental analyses, and spectral techniques (IR, ^{1}H NMR, and UV-visible).The specific selectivity in sensing Cu^{2+} was effectively studied by colorimetricand fluorescence techniques. The chemosensor displaysa strong “turn-on” fluorescence

andpromising selectivity towards sensing of Cu^{2+}.The sensing was confirmed by a UV-Visible spectrum with an isosbestic point at 330 nm. The ligand forms a 1:1 complex with Cu^{2+} which was further confirmed by HR-LCMS mass spectrum and Job's plot analysis. The mechanism of sensing is based on Photo Chelation enhanced fluorescence (CHEF). When Cu^{2+} binds with the ligand gets inhibited thereby enhancing the fluorescence intensity and CHEF takes place due to the binding of Cu^{2+} with the ligand. The detection limit was found to be 0.03 µM. Real sample analysis was performed for the practical applicability of Cu(SSHT)in the environment.The optimized geometry of the complex wasattained by the DFT calculations. The interaction of ligand and complexes were analyzed by Molecular docking studies and the *invitro* antimicrobial activity of ligand and metal complexes was studied against *Escherichia coli*, *Staphylococcus aureus*, and *candida Albicans* and found to possess appreciable activity.

Keywords: Triazines, Schiff base complexes, Colorimetric, DFT, Molecular docking.



PP-49: A Study On The Ground Water Evaluation In Some Selected Villages Of Erode District, Tamil Nadu

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Abstract

Water is the nature's most wonderful abundant amnd useful compound of the many essential elements for the existence of human beings,animals and plants. Only a fraction of water is utilised for human consumption in the earth on its surface and sub surface. Ground water plays a vital role as water resource. It is colourless in nature due to the filtering action of the soil but contains more dissolved salts. A random sampling of open well water were collected from villages in around Erode . Arachalur, Kudumiyampalayam, Anna Nagar, Anumanpalli, Nagarajapuram, Pudur, Farmland of erode district, Tamil Nadu. The samples were collected and analysed for pH,Alkalinity,Acidity,Total solids,Hardness,Chloride,Iron ,Manganese and Fluoride by standard methods. Most of the samples were free from colour,odour and also free from acidity,fluoride and iron. Majority of samples were having Total solids below 1000 mg/l villages. The pH of the water samples are within the permissible range.The total hardness values were found to be slightly high and based upon permanent hardness values, It could be concluded that the water samples contain mainly chlorides and sulphates of calcium and magnesium. By observing the result it can be concluded that the parameters which were taken for the study about the water quality are below the pollution level for ground water can be use of various purposes like domestic, agricultural, industrial etc.

Keywords: Ground water,water quality parameters, domestic and industrial purposes,Standard methods.,

PP-50: Whole genome characterization of drug resistant E.coli field isolate encoding *mdf* A gene targeted by a bacteriophage isolated from a tertiary hospital waste water plant in Coimbatore, India

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Abstract

Waste water treatment plants (WWTP) are considered as a crude source of microorganisms carrying different virulence and drug resistant genes. The inhabitants are exposed from high to low gradients of antibiotics and as a way of survival they acquire Antimicrobial Resistant Genes via mobile genetic elements, evolving to a new variant. Though the treatment procedures could eliminate most of the pathogens, it's obvious for some to escape or withstand these processes and recycled use of sewage water for gardening and other purposes will end in deposition and transmission of these organisms to the environment. It's noteworthy that regardless of the characteristics acquired, bacterial cells are infected and lysed by their respective phage population occupying the same environment (WWTP). Identification of phages killing clinically important MDR organisms has emerged as one of the effective way to curb Anti Microbial resistance burden. To end this, we have isolated clinical *E.coli* isolates and screened for the bacteriophages killing them efficiently with Direct spot testing method. Whole Genome Sequencing was employed to characterize the *E.coli* field test isolate with NGS bioinfortmatic pipelines. The genomic DNA of test *E.coli* strain was extracted using QIAamp DNA Mini Kit (Qiagen, Hilden, Germany) as per the manufacturer's guidelines. Quantitative and qualitative analysis of extracted DNA was done using Qubit® 4 instrument (ThermoFisher Scientific, Oregon, USA). NGS whole genome sequencing was performed in Illumina Hi seq 2500. Total number of raw read 5343269 was scanned for contamination and accuracy through FastQC. Once the raw data meets desired quality the annotated reads were submitted to barrnap, staramr, abricate phaster softwares for finding possible AMR and phages incorporated into the

genome. 16S rRNA sequence obtained through barrnap was run in BLAST to identify the organism. The 16S was in close association with the E.coli genome. We identified the presence of mdf (A) gene which encodes Mdf (A) protein, acting as an efflux pump was identified through abricate program. The subsystem features analysed through RAST software revealed phage integration and metal resistant genes present in the organism. PHASTER was able to specifically pick out the regions where the phages got integrated, the proteins it encoded and the completeness of integrated phages. Despite the presence of AMR, metal resistant and integrated phage nucleic acids, phage isolated from wastewater was able to clearly infect and kill them in invitro assays such as direct spot testing. The introduction of this phage to the WWTP upon modification could remove bacteria which help in efficient eradication of pathogenic bacteria.

PP-51: Edible natural films in food packaging

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Abstract

Food safety has grown to be a significant public health problem, and numerous governments have implemented safety controls. However, people's attitudes toward food and health safety and how they react to such information typically rely on how concerned they are about the hazards. Plastics are nowadays used for packaging foodstuffs. This packaging has capability to prevent the detrimental changes that may occur in foodstuffs by external factors namely sunlight and microorganism. Petrochemical polymers are used extensively as packaging material which is non-renewable and non-biodegradable. Food contamination can enter the food at any point during the long process of food production, packing, and preparation. As a result, chemical contamination poses a number of possible dangers. The migration of some dangerous compounds into meals is a common one that results from food coming into direct touch with packing materials, which can cause chemical contamination. Additionally, unauthorised or incorrect additive use may contaminate food. This type of contamination can happen at any point during the production process if suitable safety measures aren't taken. A variety of additives, including antioxidants, stabilisers,

lubricants, anti-static, and anti-blocking agents, have been developed to enhance the performance of polymeric packaging materials, which have evolved into an essential component of the food manufacturing process. Recently, it has been discovered that the packaging itself can be a cause of contamination due to the compounds it contains migrating into food. Therefore, it needs landfills and thus there is need for alternative packaging material which is biodegradable as well as renewable. Edible natural polymers namely starch, pectin, xanthan gum can be used as coatings that surrounds the surface of the food. These natural polymers are categorized as lipids and polysaccharides that can be consumed by animals or humans which has no health risk. Here, the emerging contaminant in plastic packaging and importance of natural polymers in making edible films and coatings will be summarized.

Keywords: Food safety, Food safety hazard, Natural Edible film, Food Packaging.

PP-52: *Ficus Racemose* (Linn.) Plant Extract Inhibits Biofilm Formation Of *Pseudomonas aeruginosa* And *Proteus mirabilis* Clinical Isolates

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Abstract

The aim of this study is to analyze the anti-biofilm activity of *Ficus racemose* plant against *Pseudomonas aeruginosa* and *Proteus mirabilis* clinical isolates. Among the total of fifteen isolates two biofilm-forming isolates, one from each species were isolated and subjected to different concentrations of the plant extract. It was observed that the *F. racemose* plant extract showed significant anti-biofilm activity at the tested biofilm inhibitory concentration of 0.5 mg/ml extract. Further, the microscopic analysis confirmed this result with a marked decrease in the biofilm architecture proportionately to the concentration of the plant extract. This is a preliminary study, further studies are required to elucidate the molecular role of the phytochemicals of the *Ficus racemose* extract on interfering with the microbial biofilms.

Keywords: Ficus racemose, anti-biofilm activity, Pseudomonas sp., Proteus sp.

PP-53: Modification of cellulose acetate membrane by integrating magnetite @ xanthan gum nanocomposite to enhance performance characteristics

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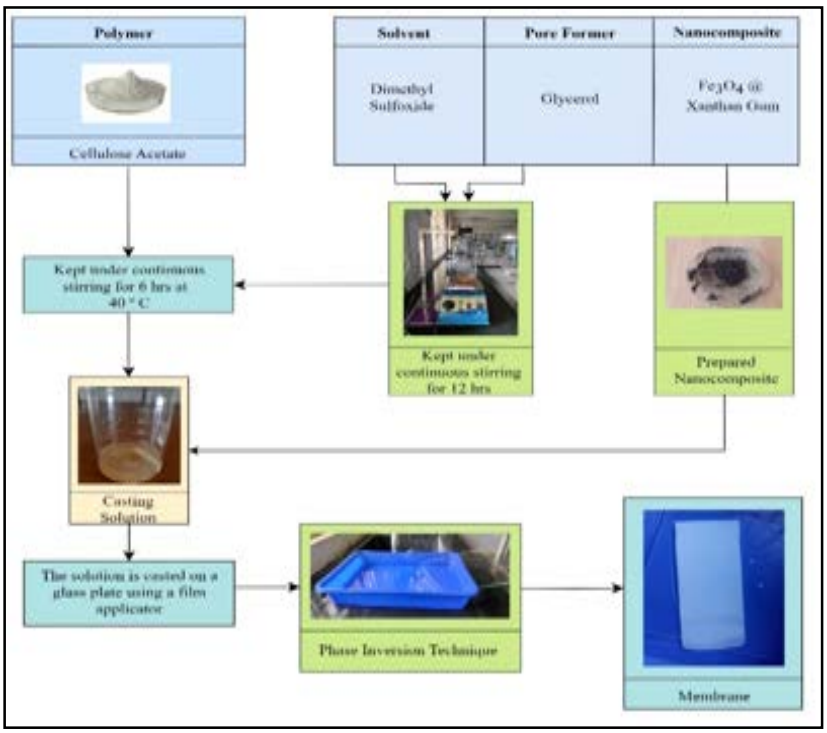
Abstract

Membrane technology is a great replacement for old separation and purification processes in process industries and wastewater treatment. Cellulose Acetate (CA) as polymer, dimethyl sulfoxide (DMSO) as a solvent, and glycerol as pore former was chosen to fabricate a controlled membrane. Polymeric solutions containing CA/DMSO/Glycerol of various weight % were fabricated to sort out the precise composition with competent nature. Magnetite (Fe_3O_4) @ Xanthan gum nanocomposite was synthesized by the co-precipitation method. $FeCl_3.6H_2O$, $FeCl_2.4H_2O$, Xanthan gum, and Ammonium Hydroxide are the components required for the preparation of Magnetite (Fe_3O_4) @ Xanthan gum nanocomposite. The obtained nanocomposite is put through FESEM and XRD for characterization. The prepared nanocomposite was blended into the polymeric solution in fewer proportions i.e., 0.1 and 0.2 weight %. The casted nanocomposite membrane was then subjected to FESEM, Contact angle test, pure water flux, biodegradability test, protein rejection test, and tensile strength test. The anti-bacterial and antifouling characteristics of the blended membrane and controlled membrane were studied to check out the variance in the performance of the membranes. Two dyes, Reactive Black 5 and Reactive Red 120 were used to examine the rejection rates of the membrane.

Keywords: Cellulose Acetate, Membrane Technology, Phase inversion, Nanocomposite



Flowchart

PP-54: Extraction of Keflex By Emulsion Liquid Membrane And Optimization Using Response Surface Methodology

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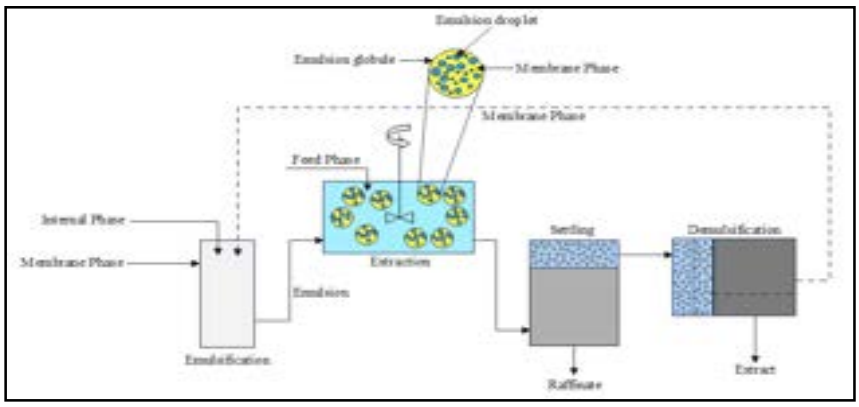
Abstract

The ecological system is seriously posed by various industrial wastewater stream's excessive discharge of hazardous metal ions, chemicals, and pharmaceutical drugs into the environment. Consequently, eliminating these dangerous substances from the wastewater of various industrial effluent streams has drawn considerable interest and is now an important area of research. Since a few decades ago, Emulsion Liquid Membrane (ELM)-based separation methods have emerged as a desirable and effective method for the elimination of industrial pollutants, hazardous metal ions, organic/inorganic acids, and different aqueous waste effluent streams. ELM, which operates on the concept of concentration difference, is among the most effective

techniques in the area of liquid-liquid separation. High selectivity and enrichment factors are essential for widespread adoption and utilization. The recovery of Keflex from diluted aqueous solutions was explored using an ELM strategy that combines solvent extraction and stripping. The ELM procedure was carried out using the carrier Alliqual-336, the surfactant sorbitan monooleate (Span 80), and the stripping agent sodium hydroxide. The interaction impacts of significant factors on the efficiency of Keflex extraction were examined. Using Response surface methodology (RSM), comparative research was conducted. The impact of input parameters on extraction efficiency was evaluated by applying statistical models in the experimental design, optimization, fabrication, and interpretation of response/output surface plots. RSM's optimal solution resulted in an empirically measured extraction efficiency close to the numerically projected value.

Keywords: Keflex, Emulsion Liquid Membrane, Extraction, Response surface methodology (RSM).



Extraction of Keflex using ELM

PP-55: Removal of a basic dye from simulated wastewater in jet loop reactor using ozone and activated carbon

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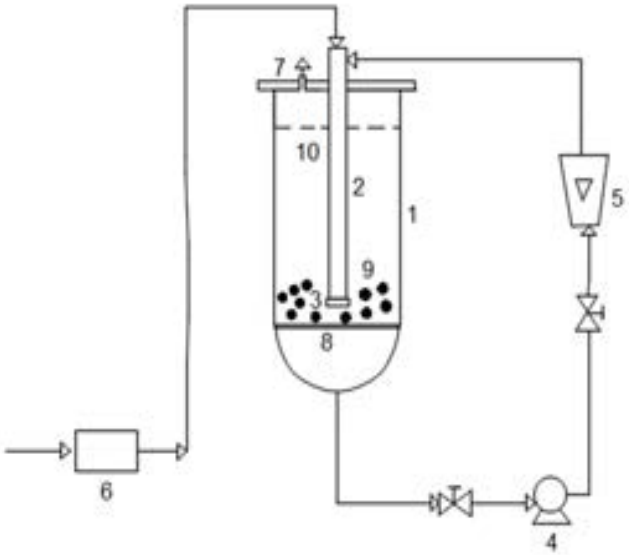
Abstract

Fresh water consumed by the textile industries are day by day increasing and causes serious deficiency. In this Study, We have prepared simulated textile wastewater containing water soluble basic dye [Methylene Blue]. The conventional textile wastewater treatment includes many treatment methods such as coagulation-flocculation, adsorption on activated carbon, membrane filtration process, electrochemical processes are very expensive and creates lot of environmental issues. The main aim of this study is to propose an alternate technique for decolorization of textile wastewater using down flow jet loop reactor with sparger. Jet loop reactor is basically a multiphase reactor we used here to treat textile wastewater with ozone. Color removal efficiencies have been studied for 50 ppm of Methylene blue dye. Experiments were conducted in down flow jet loop reactor to understand the effects of effluent flow rate, ozone dosage time, different sparger openings and adsorbent s weight on decolorization. The correlation includes many parameters such as effluent flow rate (0.2 – 0.4 L/min), ozone dosage time (10-30 minutes), number of sparger openings (2-4), Adsorbents (1 - 3 g) was analyzed and the percentage of color removal was about 93%. The models were developed using Response Surface Methodology and successfully interpreted with experimental values.

Keywords: Down flow jet loop reactor, Ozone, Activated Carbon, Decolorization, Response Surface Methodology



1	Reactor
2	Straight Throat Ejector
3	Sparger
4	Pump
5	Liquid flow meter
6	Ozone generator
7	Gas vent
8	Mesh
9	Activated carbon
10	Effluent

Jet Loop Reactor

PP-56: Studies on the application of floating garden for the restoration of Ponds

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Abstract

Polluted waters are often rich in nutrients that exist in the anionic and cationic form. Although, floating treatment wetlands have shown to have a promising capability in improving the water quality of various types of water that are high in nutrients. The capability of FTWs to improve the water quality that is rich in anionic species such as CT, F and SO, has not been explored. This study was conducted to assess the capability of FTWs planted with Zephyranthes, Zizania latifolia and Carex vigratevigrate as to whether they can assimilate the anionic species besides the limiting nutrients present in water such as CT, F and SO. A mesocosm study was

carried out in 12 tanks with a capacity to hold 521 of which 3 tanks are introduced with floating beds planted with Zephyranthes. Zizania latifolia and Carex vigratevigrate 3 tanks for control. The results show that plants had appreciable growth rate, and the FTWs performed better than the control in removing in removing F and CT. FTWs however did not performed well in reducing the SO, as it showed to be a contributor to the SO, in water. The experimental results reveal that FTWs can remove the certain anionic species present in water and the performance can be enhanced by using proper materials in constructing the FTWs such avoidance of using organic material in the FTWS.

PP-57: Color removal of textile wastes using copper dopped TiO_2 under the photocatalyst by continuous method

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Abstract

In the study, sol-gel based TiO2 nanoparticles (NPs) were doped by Cu(II), and the surface of cotton fabric was coated with Cu-doped TiO_2 NPs to develop self-cleaning and antibacterial properties. Coffee stains were introduced on the modified cotton fabric and under suntest illumination; a decrease in the color of coffee stain was followed over time via K/S value to determine self-cleaning performance. The photocurrent in a photoelectrocatalytic reactor was measured to evaluate the photocatalytic effect of Cu(II) doping. TiO2 NPs showed self-cleaning and antibacterial effects under UV-illuminated conditions. However, no effects were observed under dark (non-illuminated) conditions . The modified textiles with Cu(II) doped TiO2 NPs showed antibacterial activity against E. coli under light and dark conditions. Under the 2 h illumination period, fluctuating color changes were observed on the raw cotton fabric, and stains remained on the fabric while 78% and 100% color removals were achieved in the cotton fabrics coated by Cu doped TiO2

NPs in 1 h and 2 h, respectively. Copper-doped TiO2 nanocatalysts were synthesized by photo-deposition and sol–gel methods . The nanocatalysts were characterized by X- ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), transmission electron microscopy (TEM), and the BET method. The catalysts ' activities in the discoloration and mineralization of 0.2 mM Orange II were evaluated. The results indicated that the Cu-doped TiO2 nanocatalysts with a low copper concentration prepared by the photo-deposition method showed enhanced photocatalytic activity; while catalysts synthesized by the sol–gel method did not. In particular, the TiO2 nanocatalyst doped with 1% Cu showed the best performance. Complete color removal and 99 % of total organic carbon (TOC) removal were achieved after 15 0 - min of reaction. TiO2 nanocatalysts doped with more than 1% Cu by the photo-deposition method showed decreased photocatalytic activities.

Keywords: Catalyst, Nanoparticles , Photoelectrocatalytic , effulent , antibacterial

PP-58: Thermally exfoliated graphitic carbon nitride (g-C_3N_4) for photocatalytic degradation of multiple textile dyes

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Abstract

The pollution from dyeing industries and textile finishing contribute to almost 17-20% of all the water pollution as per a report from the world bank. Dyes are toxic organic molecules, which are not biodegradable resulting in the accumulation in the water, leading to severe toxicity issues. The conventional and municipal aerobic treatment systems are found to be ineffective in degrading these dyes. Advanced oxidation processes like photocatalytic oxidation of organic molecules are currently being explored as an effective solution to convert these dyes into harmless water and easily manageable carbon dioxide as end products. Graphitic carbon nitride (g-C_3N_4), a

metal-free, carbon-based semiconductor photocatalyst are widely explored for wastewater treatment applications. In this study, we have tuned the g-C_3N_4 properties by direct thermal exfoliation and examined their photocatalytic degradation efficiency against three most common textile dyes: methylene blue (MB), methyl orange (MO) and rhodamine B (RhB). The efficiencies of degradation are 92%, 93% and 95% respectively for MB, MO, RhB dye in 60 min of light irradiation. The degradation efficiency increases with increase in exfoliation temperature. The catalyst is characterised by X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), Field emission scanning electron microscopy (FE-SEM), Energy-dispersive X-ray spectroscopy (EDAX), Brunauer-Emmett-Teller (BET), ultraviolet differential reflectance spectroscopy (UV-DRS), to confirm the material structure, phase, surface area, elemental composition and optical properties. Further, adsorption efficiency, stability and reusability of the catalysts were also tested. Radical scavenging study was carried out to find the active species and mechanisms involved in the photocatalytic degradation reactions. Finally, the photocatalyst was found to have excellent stability even after five cycles demonstrating its potential in real-time commercial textile wastewater treatment applications.

Keywords: graphitic carbon nitride, photocatalysts, dye degradation

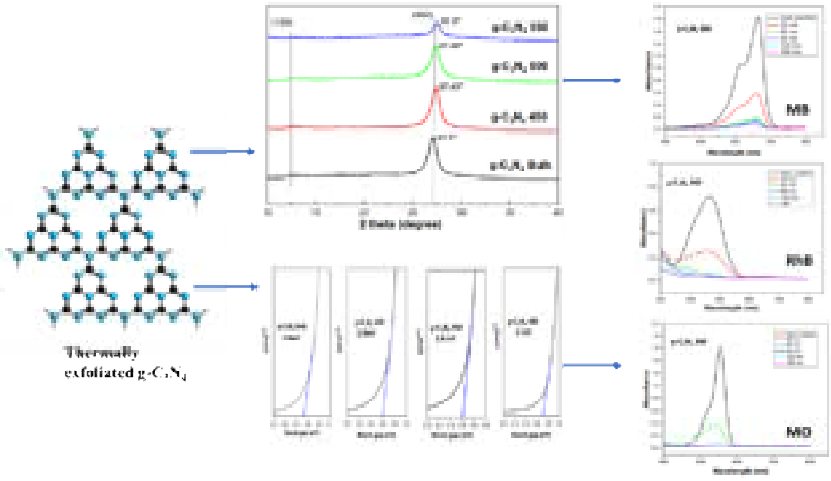

Figure 1. Schematic representation of thermally exfoliated g-C_3N_4 , few characterization techniques and UV-Vis spectra confirming the dye degradation

PP-59: Evaluation of legacy and new chlorinated persistent organic pollutants before and after the outbreak of the COVID-19 pandemic in surface water of southern India

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Abstract

During pre-pandemic time, organochlorine pesticides (OCPs) and polychlorinated biphenyls (PCBs) were investigated in the surface water of Periyar River (PR) and Bharathappuzha River (BR) in Ernakulam and Malappuram districts of Kerala, respectively and Adyar River (AR) and Cooum River (CR) in Chennai district of Tamil Nadu. After the outbreak of COVID-19 pandemic, variation in OCPs and PCBs were evaluated for AR and CR. Dominance of β-HCH and γ-HCH in south Indian rivers indicate historical use of technical HCH and ongoing use of Lindane, respectively. In > 90 % sites, *p,p′* -DDT/ *p,p′* -DDE ratio was < 1, indicating past DDT usage. However during the outbreak of the COVID-19 pandemic, elevated *p,p′* -DDT in AR and CR reflects localized use of DDT possibly for vector control. Similarly, during the first wave of pandemic, over a 100-fold increase in PCB- 52 in these rivers of Chennai mostly via surface run-off and atmospheric deposition can be reasoned with open burning of dumped waste including added waste plastic in the solid waste stream. On contrary, a significant ($p < 0.05$) decline of dioxin-like PCBs level, suggests lesser combustion related activities by the formal and informal industrial sectors after the lockdown phase in Tamil Nadu. Eco-toxicological risk assessment indicated a higher risk for edible fish in PR due to endosulfan.

Keywords: Organochlorine pesticides, Polychlorinated biphenyls, Rivers, COVID-19 pandemic, Risk Assessment

PP-60: Studies On Biomimetic Functionalized Cellulose Fibrous Membranes For The Removal Of Inorganic Arsenic Contaminants

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Abstract

The presence of inorganic arsenic contaminants in water causes serious threat to environment and human health. The fabrication of thiol functionalized nano fiber membrane can be effectively used to adsorb heavy metal ions such as As (III), As(V) and p-Arsenilic acid. In the present study, *Lemna minor* an aquatic macrophyte has been utilized as a base material for the remediation purpose. Thiol modified electro spun nano fibrous cellulose membrane (SH/CA/LM) was synthesized and employed to adsorb the typical inorganic arsenic contaminants. The prepared nano fibers were characterized using Scanning Electron Microscopy (FESEM), Energy Dispersive X-ray (EDX) analysis, and Fourier transform infrared spectroscopy (FTIR). FTIR results showed abundant nano fibres and posed evident functional groups such as -SH, -OH and C=O group, respectively. Batch experiments were carried out based on the parameters such as pH, dosage, metal ion concentration and contact time. The maximum As (III) removal was found to be 84.88%. Isotherm and Kinetic studies were carried out. Langmuir model and pseudo second order model found to be best fit for the adsorption process. The SH/CA/LM investigated in present study showed good potential for the removal of inorganic arsenic contaminants from aqueous solution.

Keywords: Adsorption, Inorganic arsenic, Thiol functionalized nanofiber membrane, Isotherm, Kinetics.

PP-61: Significantly Enhanced desalination performance of Flow – electrode Capacitive deionization with redox couples

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Abstract

Freshwater scarcity and water pollution are two of the most important environmental problems faced by human beings in the 21st century, which necessitates a continuing search for eco-friendly and cost-effective technologies for water desalination and wastewater treatment. Capacitive Deionization (CDI) is an emerging and effective electrochemical technique for the treatment of brackish water by passing the feed between a pair of oppositely charged porous carbon electrodes which electrostatically absorb to immobilize the ions of salt present in the untreated stream. A way to improve the performance of CDI is to introduce flowable electrodes instead of stationary electrodes as they ensure a continuous supply of fresh electrode surface for continuous and effective desalination, making it feasible for scale-up. The typical flow electrode capacitive deionization (FCDI) uses carbon materials as flow electrodes in aqueous conditions. But the low salt removal rate and high energy consumption have hindered further development. The presence of a redox-active substance in the electrode slurry proves to be a useful way to improve the desalting efficiency as redox reactions lead to effective electro-sorption and desorption at the exposed flow electrode surface. This displays a good synergetic effect between the faradaic redox reactions and the carbon's capacitive (non-faradaic) behavior. In this study, we have tested FCDI systems for 5 wt% activated carbon suspension and observed desalination efficiency of 16%. To further enhance the desalination efficiency, electrochemical experiments were carried out by introducing redox couples and high surface area carbon (2000 m^2/g). A combination of these factors will give maximized ion removal rate, which further reduces the energy consumption and operating voltage for the process.

Keywords: *Flow electrode capacitive deionization, Redox couples, Specific capacitance, Potassium Iodide.*

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PP-62: Spatial distribution and sediment-water partitioning of organic pollutants along Daman Ganga and Tapi rivers in Gujarat

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Abstract

Surface water and surface riverine sediment samples were taken along the Daman Ganga (DG) and Tapi (TP) rivers and were monitored for 19 organochlorine pesticides (OCPs) using gas chromatography electron capture detector (GC-ECD). In DG mean concentration of hexachlorocyclohexane (HCH), dichlorodiphenyltrichloroethane (DDT), and endosulfan (Endo) was 31 ng g^{-1}, 13 ng g^{-1}, 25 ng g^{-1} and 0.9 ng g^{-1}, 1.2 ng g^{-1}, 1.4 ng g^{-1} in surface water and sediments respectively. Surface water samples of DG showed the dominance of HCH and contributed nearly 25% to the total OCPs. Endo was prominent in sediment samples from DG, and accounted for nearly 20% of the total OCPs. In TP, in both surface water and sediment samples HCH was dominant and contributed nearly 25% and 23% to the total OCPs respectively. Water samples in DG followed the trend ∑HCH > ∑Endo > ∑DDT, sediments followed the trend of ∑Endo > ∑DDT > ∑HCH. Both water and sediment samples of TP showed a trend ∑HCH > ∑DDT > ∑Endo. In both DG and TP rivers β Endo dominated among Endo isomers in all the stations. Using the concentration of OCPs, sediment-water partitioning of OCPs were estimated. Most of the OCPs partitioning were not in equilibrium between water and sediments.

PP-63: Removal of per and polyfluoroalkyl substances from water using electrochemical oxidation process: challenges and future potential

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Abstract

A family of synthetic compounds known as per- and polyfluoroalkyl substances (PFAS) are widely used in production and often remain in the environment without proper disposal. An urgent global public health concern is the presence of PFASs in drinking water and the environment. PFAS cannot be efficiently handled with standard water treatment methods. Electrochemical oxidation (EO) is emerging as one of the most promising ways for their destruction. Rapid development of new electrode materials and electrochemically driven methods for the separation and reactivity of these compounds, electrochemical approaches provide a sustainable and potentially energy-efficient solution to the degradation of PFAS. This study investigates the viability of removing and destroying per and polyfluoroalkyl substances from water using electrooxidation methods and combining them with other techniques. Further to the treatment, performance indicators (electrodes, electrolytes, and catalysts) and PFAS degradation utilising EO are observed in this study. Additionally, the physicochemical conditions for both simulated and real contaminated water and wastewater systems are comprehensively compared. This study concludes with an evaluation of recent advances in electrochemical PFAS remediation, including the combination of electrochemical reactions and separations, as well as the urgent need for further research into PFAS remediation.

Key Words: PFAS, Water pollution, Water Treatment, Electrochemical oxidation,

PP-64: Sunlight-Harvested Photocatalytic Activity of ZnO-Graphene Microflowers with Nanorod Petals

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Abstract

Weak response in the visible light region, fast recombination of charge carriers, etc. have restricted the wide applicability of ZnO in semiconductor photocatalysis even though it possesses remarkable oxidation and reduction capacities. Here, the photocatalytic ability of ZnO was improved by the successful formation of its composite with graphene in a solvothermal assisted method. The nanocomposite material was characterized by various techniques such as X-ray diffraction (XRD), FTIR Spectroscopy, UV- visible spectroscopy and scanning electron microscopy (SEM). Both the XRD patterns and FTIR spectrum proved the effective hybridization of ZnO and graphene in the nanocomposite. The development of ZnO microflowers with nanorod petals over graphene sheets in the nanocomposite is evident from the SEM images. In comparison with bare ZnO, the nanocomposite showed excellent photocatalytic degradation of methylene methyleneblue (MB) under sun light irradiation. The influence of reaction variables on the photocatalytic efficiency of ZnO-graphene nanocomposite is also monitored.

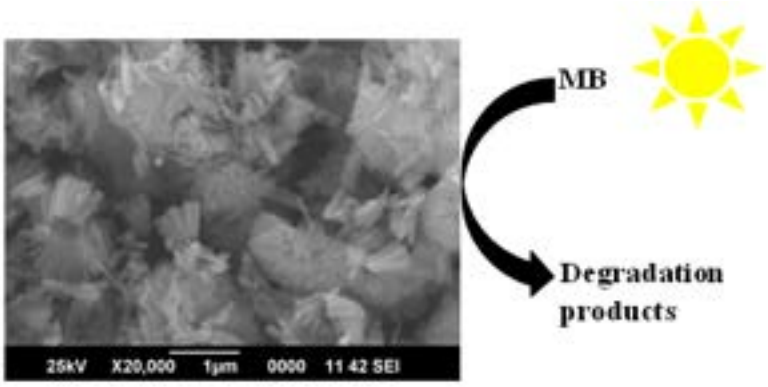

Figure 1. Pictorial representation of photodegradation of MB over ZnO-graphene nanocomposite

PP-65: Ground water purification using Iron oxide nanoparticles

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Abstract

Nanoparticle synthesis using biological method especially green synthesis has gained more prevalence. The current investigation involved synthesis of iron oxide nanoparticles from dates fruit extract and their utilization in purification of ground water polluted by heavy metals. The synthesized iron oxide nanoparticles were characterized using techniques such as Scanning electron microscopy (SEM), Energy dispersive spectroscopy (EDAX), X-ray diffraction studies (XRD) and Fourier Transformation Infrared Spectroscopy (FTIR). Iron oxide nanoparticles were used to purify ground water polluted with heavy metals such as arsenic, lead, zinc, cadmium and chromium. The adsorption capacity of the iron oxide nanoparticles and the mechanism for removal of heavy metals was determined through kinetic and equilibrium experiments. Iron oxide nanoparticles prepared by green synthesis using dates fruit extract were cost effective and eco-friendly and resulted in adsorbents with very high capacity for removal of the heavy metals, making them a very promising alternative approach for purification of groundwater.

Key words: Iron oxide nanoparticles; Dates fruit; Groundwater; Heavy metals; Adsorption

PP-66: Solar Photocatalytic Degradation of Diclofenac in Aqueous Solution Using ZnO as Photocatalyst

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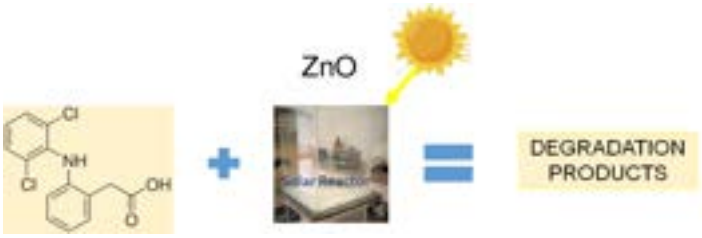
Abstract

Diclofenac ($C_{14}H_{11}Cl_2NO$, DCF) is a Non-Steroidal Anti-Inflammatory Drug (NSAID) associated with pain-relieving action, has been widely used for human and domestic livestock. Its frequent occurrence in freshwater environments and its potential toxicity

towards several organisms such as fish and mussels makes DCF an emerging environmental contaminant. It has been frequently detected in various water environments and its concentration ranges from 2.5ng/L to 57.16µg/L. The Predicted No Effect Concentration (PNEC) of DCF is 0.04µg/L. Increased exposure to DCF raises health concerns for vultures, aquatic organisms, and higher plants and causes serious threats to mammals**.** The conventional methods for DCF treatment have many disadvantages. This study focus on solar based photocatalytic degradation of Diclofenac from synthetic wastewater using zinc oxide (ZnO) as a photocatalyst. The solar photo reactor setup consists of an acrylic rectangular tank of 20cm x 20cm x 20cm with working volume of 4L. An air pump was provided for aeration and keep the photocatalyst in suspension. The setup was placed under sunlight. The experiments were conducted by varying initial diclofenac concentration (5-25 mg/L), pH (5.5-8.5), catalyst dosage (0.4-1g/L) for a contact time of 3 hours between IST 10:00 A.M. to 3:00 P.M on sunny days of similar condition. DCF was quantified using UV-Vis Spectrophotometer at 225nm. The maximum degradation and mineralization efficiency at 180 minutes were 97.90% and 61.90% respectively during optimum operating conditions of 20mg/L of DCF, 0.5g/L of ZnO and pH 6.5. The effect of reaction mixture depths (25mm to 85mm) on the removal of DCF was investigated and optimum depth is found to be 25mm. During the study on effect of solar intensity, DCF removal of 79.5% was attained at 55,000–60,000 lux during 12-1pm.

Key words: *(Pharmaceutical waste, Diclofenac, Photodegradation, Solar Photocatalysis, Zinc Oxide)*



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PP-67: Strata of Contaminants in Bhavani river, Mettupalayam

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Abstract

Fresh water bodies, particularly rivers are getting polluted, thus decreasing the potability of water. A primary reason for this is that all three major sources of pollution *viz*., industry, agriculture and domestic, which are concentrated along the rivers. Bhavani is the second largest and perennial river in Tamil Nadu, India which is a tributary of river Cauvery, which originates from Nilgiri hills of the Western Ghats, enters the Silent Valley National Park in Kerala and flows back towards Tamil Nadu through a total distance of 217 km. It flows across three districts of Tamil Nadu, Nilgiris, Coimbatore and Erode. River Bhavani flows through Mettupalayam (Coimbatore District) and enters Erode District at Bhavanisagar Dam and finally reaches Kalingarayan Anaicut at Bhavani. There are more than 100 textile units, 110 leather processing units, 2 sugar factories and 2 distillery units, which use Bhavani river water for their water requirements. Either directly or indirectly, all their effluents reach Bhavani river causing severe pollution, affecting agriculture and causing environmental damage. With these background informations, the present study was conducted to assess the physico-chemical properties of the Bhavani river water at three locations and to give basic information on drinking water quality along the course of river by following standard procedures. The results from this study revealed that two parameters BOD and COD are used to determine the organic pollutant present in the river water, it is of paramount important to determine the correlation of BOD and COD for measurement of pollutants in the river water. Regarding the BOD levels, the water sample taken from Kooduthurai recorded 6.4 mg litre^{-1} which was higher than the desirable limit of 5 mg litre^{-1}, while, the BOD value of Avalanche and Mettupalayam was 2.3 mg litre^{-1} and 4.8 mg litre^{-1}, respectively indicating that the water from Avalanche and Mettupalyam may be used for domestic purpose with proper treatment, however, the water from Kooduthurai was polluted due to discharge of chemicals from dyeing and textile industries along the banks of the river Bhavani. Similar findings of higher BOD was reported in Bhavani River at Mettupalayam and

Sirumugai by Varun Prasath and Daniel (2010). Among the study samples, the dissolved oxygen level was found to be adequate in Avalanche sample (6.3 mg litre^{-1}), whereas the value was very low in the other two samples drawn from Mettupalayam and Kooduthurai. This finding was in conformity with the findings of Sivakumar *et al.,* (2018).

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PP-68: Estimation of Illicit Drug Activities through Sewage – Based Analysis

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Abstract

Illicit drug use is a major public health problem across the globe. A recent study conducted by the Ministry of Social Justice and Empowerment suggest that Drug abuse is unabatedly increasing in India.. Nearly 29.5 million people suffer from drug use disorders. To better control the drug use, it is critical to precisely estimate the drug conception, the pattern of drug use, and the number of drug users in the country. Wastewater Based Epidemiology has become a more acceptable method for assessing drug use among a certain community. This method starts with the collection of wastewater samples from STP and the measurement of the amount of drug residues or their metabolites in the sample. The drug loads of the communities served by the surveyed STPs are determined by calculating the population of the communities, the flow rates of the STPs, and the rate of drug metabolism and excretion. This method, still being improved. Overall objective of this study is conducting a systematic sewage based analysis through Wastewater Based Epidemiology to access illicit drug activities. This data provide more consistent and logical estimates on drug consumption and use pattern through wastewater analysis. Additionally, it allows comparison of drug usage across various communities and during various time periods and can produce real time data.

Keywords: Wastewater Based Epidemiology (WBE), Sewage Based Analysis, Illicit Drugs

PP-69: Cost-Effective Adsorbent From Waste Fish Scales Removing Zinc And Ferum Ions In Wastewater

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Abstract

Heavy metals are very hazardous to live organisms; hence, heavy metal research on a novel heavy metal removal procedure is being conducted to minimize confinement in water at little expense. Zinc, a heavy metal that is highly toxic and harmful to the environment, is present in high concentrations in wastewater in various industries such as mining, ceramics, paints, pigments, pulp and paper, pharmaceuticals, and food processing sectors. In industries, several processes such as precipitation are used to remove zinc metals. Zinc is a mineral that is essential for the health of many plant and animal species, including humans. Zinc poisoning can cause nausea, anemia, skin irritation, abnormalities in protein metabolism, and arteriosclerosis. Zinc is also connected to metal fume fever, a flu-like condition induced by occupational exposure to zinc or other metals or zinc which is also linked to other metals. Furthermore, increased zinc levels can affect natural ecosystems and diminish agricultural output by preventing plant uptake of other vital elements, and it can also cause damage due to its proclivity to oxidize. Zinc concentrations in industrial waste are tightly controlled in parts of the world. Furthermore, zinc has been demonstrated to affect the performance of biological wastewater treatment systems, as have other heavy metals. As a result, firms that use or handle zinc or zinc compounds are typically required to conduct wastewater monitoring and treatment activities, both for compliance and to keep any onsite wastewater treatment systems running smoothly. One treatment that has evolved as an environmentally benign approach of removing metal from industrial and household wastewater is the use of fish scales. The objectives of this study are to define the fish scale, calculate the adsorption isotherm and biosorption kinetics in synthetic wastewater, and evaluate the fish scale's effectiveness in removing zinc (Zn) and ferrum (Fe) ions from residential wastewater. In this case, the Labeo rohita scale was applied.

PP-70: Decolorization Of Simulated Reactive Red 120 Using Immobilized Cationic And Anionic Peroxidase From *Calotropis Gigantea* (L.)

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Abstract

Peroxidase 1.11.1.7 (Oxidoreductase) has wide application in industries namely paper pulping, leather and dyeing, etc. In dyeing industries compared to soluble peroxidase Immobilized peroxidase were highly effective in decolorizing reactive textile dyes. Hence in this study to find the efficiency of immobilized *Calotropis gigantea* peroxidase on decolorize the simulated textile dye. Dye solutions, 50–200 mg/l, were treated with immobilized *Calotropis gigantea* peroxidase (specific activity of 1.0 EU per mg protein). The partially purified peroxidases were characterized into cationic and anionic, based on their interaction in Carboxy-methyl cellulose. Both the enzymes were immobilized in sodium alginate bead. The decolorization of Reactive Red 120 dye with immobilized enzyme was maximum in the pH 4.5 and 7.0 of cationic and anionic peroxidase respectively. The effect of different temperatures on the dye decolorization was monitored and it was observed that all the Reactive Red 120 dye was maximally decolorized at 30ºC with 30% and 20% of residual dye of cationic and anionic enzymes respectively. In order to examine the time taken for the decolorization, the incubation mixture was kept at various time and it was observed that both the enzyme decolorize 97% of Reactive Red 120 at 120 seconds. The blue shift was observed in UV-visible spectral analysis of cationic and anionic treated Reactive Red 120. Though this dye was not classified into carcinogenic, it is essential to decolorize the dye effluents. In this context the Calotropis peroxidase would use to decolorize the Reactive Red 120 containing dye effluents.

Key words: Peroxidase, Reactive Red 120, Textile effluent, Water contamination, Immobilization

PP-71: Metal/ Metal oxides of copper for water treatment

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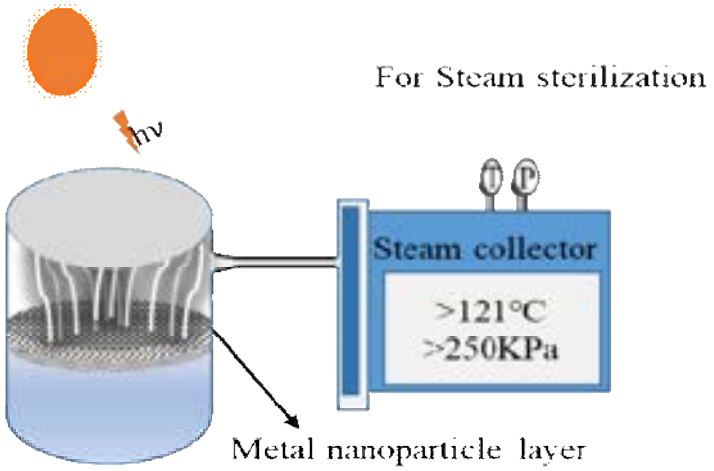
Abstract

Plasmonic nanoparticles have been widely used for their unique optical property of plasmon resonances. Owing to tunability of optothermal properties and stability, these nanostructures have applications as optical sensors, in steam generation, water desalination, thermal energy storage and biomedical applications like photothermal therapy. Specific advantages compared to other approaches for water treatment such as desalination are the considerable improved bandwidth of the absorption and a higher efficiency of photon absorption which result in an efficient harvesting of solar energy for heating, realized by the facile tuning and flexibility in synthesis of these nanomaterials. Coinage metals like Au, Ag and Cu with high densities of free electrons possess plasmon resonances in the visible region, suitable for Photothermal (PT) applications such as waste water treatment by heating. Copper being an antibacterial and antimicrobial agent, has an additional perk compared to the other two (being cheaper) to use in such applications like water treatment and disinfectant in controlling bacteria such as e-coli, coliforms, legionella etc. Conventional nanomaterial design for PT conversion has been predominantly on the manipulation of photon absorption and incorporation of Cu in suitable matrix materials to enhance the PT conversion efficiency to prevent from oxidation at 150ºC. This work reports the metal/metal oxide synthesis of Copper (Cu) microstructures through a microwave process, and aided by characterization tools such as UV-Vis, XRD, SEM and EDAX. Cu structures such as these have potential to steam sterilize the microbes by water treatment at 120 ºC and for other applications like desalination.

Keywords: Surface Plasmon Resonance, Desalination, anti-microbial, Cu nanoparticles.



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PP-72: Exposure And Health Risk Assessment Of Nitrate Contamination Of Groundwater In Selected Industrial And Non Industrial Sites, Coimbatore District, Tamilnadu

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Abstract

Ground water source plays a vital role in supporting Human health, Agriculture and Industrial development. In recent years ground water quality is degrading drastically due to the anthropogenic factors and also it affecting human health in many places in India. Coimbatore is one of the rapidly growing industrial sites in South India. Due to the dependence of groundwater resource, the assessment of contamination and human health risk is important to ensure quality water supply. Nitrate contamination in the ground water is the mounting concern due to its health effects. Therefore sampling of 10 locations from industrial and non industrial sites were analysed and it

showed the concentration of nitrate from 32.90 to 88.13 mg/L and over 37% sites showed the high level of nitrate than the permissible limits by Bureau of Indian Standards (45 mg/L) and WHO (50 mg/L). The possible health risks of high Nitrate intake was determined using USEPA human health risk assessment model for both adult and children. The result of this present study showed that chronic daily intake (CDI) ranges between 0.96 – 2.57 in males, 2.36 – 4.51 in females and 2.92 – 5.59 in Children. This study suggested that proper groundwater measures should be proposed to improve the quality of groundwater

Keywords: Ground water quality, nitrate contamination, methemoglobinemia, health hazard index.

PP-73: CeO_2 nanoparticles based electrochemical sensor for the detection of organic pollutants in water

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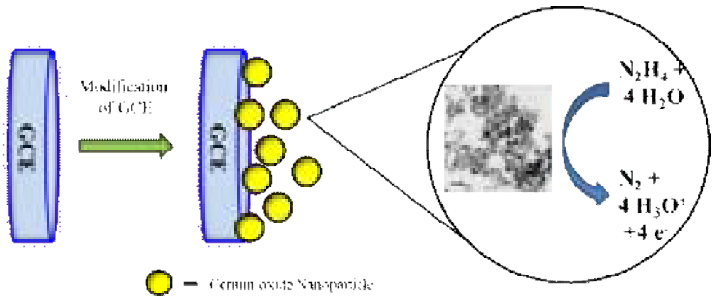
Abstract

Hydrazine is used in the preparation of pesticides, pharmaceutical products, acts as oxygen scavengers in high pressure reactors and hence is a common contaminant in water. Compared to other analytical tools electrochemical technique are versatile, easy to use and cost effective. In this work CeO_2 nanoparticles was prepared by a facile chemical synthesis method and employed for the detection of hydrazine in water samples. CeO_2 was prepared without employing any structure directing agent and was characterized using several morphological and structural characterization techniques. The CeO_2 modified electrode showed excellent electrocatalytic activity towards hydrazine oxidation and the sensing was performed using differential pulse voltammetry (DPV) techniques. The detection limit was obtained in the micro/sub-micromolar range and the sensor showed excellent linear range and sensitivity. Further the reproducibility and stability of the sensor was also analyzed. The veracity of the sensor will be tested in real water samples.



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PP-74: Niobium and Mxene doped TiO_2 composites for effectual photocatalytic dye degradation under UV light

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Abstract

Human and environmental health is being threatened by toxic organic compounds and metal ions created by anthropogenic sources. Even while electrochemical technologies for wastewater treatment have advanced significantly, the electrical energy required for treatment is typically obtained from non-renewable sources, which makes it difficult to purify water in an environmentally benign manner over the long term. Semiconductor photocatalysis has emerged as a promising new method for water purification and wastewater treatment due to direct sunlight coupling, which enables environmentally friendly and mild reaction conditions, coupled with remarkable reactivity for decomposing even trace amounts of pollutants. Organic and inorganic pollutants have been proven to be degraded using semiconductor photocatalysts. Methylene Blue (MB), Methyl Orange (MO), and Rhodamine B (Rh B) are those dyes that have drawn a lot of attention as model pollutants for photodegradation. Titanium dioxide has been broadly studied for photocatalytic applications because nanocrystalline anatase TiO_2 particles exhibit relatively high photocatalytic activity. Rapid recombination of photo-

generated electron-hole pair in titanium dioxide (TiO_2) lowers the photocatalytic efficiency of TiO_2. In this paper, Nb and Mxene doped TiO_2 composites have been synthesized by a scalable method for photocatalytic degradation of Rhodamine B dye. $Ti_3C_2T_x$ belongs to the family of Mxenes, 2D materials with an attractive combination of functional properties suitable for applications such as photocatalytic applications, batteries, supercapacitors, strain sensors, etc. We incorporated Niobium (Nb) into TiO_2 and Mxene-TiO_2 composite by a simple and cost-effective method of hydrothermal process. The structural and phase composition of these composites were characterized by a Scanning electron microscope (SEM), Transmission electron microscope (TEM), X-ray diffraction (XRD), and Fourier Transform Infrared Spectroscopy (FT-IR). The photocatalytic performance of pure TiO_2, TiO_2/Ti_3C_2 HAS, Nb-TiO_2 (TN), and Nb-TiO_2/Ti_3C_2 (TNM) nanocomposites was evaluated by photodegradation of Rh B dye under ultraviolet light irradiation. Photodegradation test results revealed that the TN composite of 97% has better photocatalytic activity than TNM (45%), pure TiO_2 (43.2%), and TM (39%) composite. This work represents a simple method to prepare highly efficient Nb-TiO_2 (TN) composite for photocatalytic application of dye degradation.

Keywords: Niobium-Mxene doped Titanium dioxide, dye degradation, photocatalysis, wastewater treatment.

PP-75: Dual-Emitting Ratiometric Fluorescent Probe for the Sensing of Hg^{2+} Ions in Water Samples

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Abstract

Dual-emitting fluorescent nanomaterials (DEFNs) have been emerging as a promising probe material for ratiometric fluorescence detection of various environmentally important chemical substances. A classical DEFNs consists of a recognition element labeled with two fluorophores, which exhibit dual-emission at a single/multiple

excitation wavelength. When a recognition element responds to a particular analyte, energy/electron transfer between the two fluorophores occurs through fluorescence resonance energy transfer (FRET) or photo-induced electron transfer or internal charge transfer. If there is no energy/electron transfer between the two fluorophores, one of them displays an intensity response unit with the concentration of analyte and the other serves as an internal standard during sensing experiment. Thus, DEFNs are capable of sensing an analyte based on monitoring the ratio of the fluorescence intensities at two emission wavelengths. Compared to single emission fluorescent probes, DEFNs provide built-in correction to avoid change in the microenvironment around the probe, photo-bleaching in fluorescence, variation in probe concentration and fluctuation in the excitation source. Hence, in this present investigation dual-emitting gold nanoclusters embedded human serum albumin nanoparticles are synthesized by using glutaraldehyde cross-linking reaction. The synthesized DEFNs show two different emission bands around 540 and 650 nm corresponding to HAS nanoparticle and gold nanocluster, respectively. In presence of Hg^{2+} ions, only the band appeared around 650 nm suppressed; however, the band appeared around 540 nm was inert. Hence, the synthesized DEFNs has been utilized as a ratiometric fluorescent probe for the selective sensing of Hg^{2+} in water samples. The limit of detection of Hg^{2+} is nearly 7 nM. Also, the sensing experiment was carried out in real water samples and the obtained results showed that the DEFNs have proven to be a promising probe material for ratiometric sensing of Hg^{2+} in the aquatic environment.

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PP-76: Ocimum tenuiflorum-assisted fabrication of iron-oxide nanoparticles and their use in wastewater treatment of textile industry

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Abstract

In the present study, Iron oxide nanoparticles were synthesized by eco-friendly, simple, and green chemistry approach using Ocimum tenuiflorum leaf extract as reducing agent. The synthesized iron oxide nanoparticles were characterized by XRD, SEM with EDX, FT-IR, Zeta potential and TGA. In addition, the prepared nanoparticles were assessed for its antibacterial properties and removal heavy metal from textile industry wastewater. Bio-inspired iron oxide nanoparticles were highly stable and cube structure with average size of 17-24 nm. The novelty of present investigation is to employ the *O. tenuiflorum* leaf extract mediated iron oxide nanoparticles in wastewater treatment. The synthesized iron oxide nanoparticles were shows good antibacterial activity against the water borne pathogens. Totally, 52-83% of heavy metals were removed from textile wastewater with help of as-synthesized iron oxide nanoparticles. The study concludes that *O. tenuiflorum* mediated iron oxide nanoparticles may employed for killing microbes and remove the heavy metals from wastewater.

KEYWORDS: iron oxide nanoparticles, *Ocimum tenuiflorum*, heavy metal removal, antibacterial activity, wastewater treatment.

PP-77: A promising antimicrobial biopolymer film developed using collagen and sodium alginate reinforced silver nanoparticles for antimicrobial resistance applications

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Abstract

Antimicrobial resistance (AMR) poses a substantial risk to both human and animal health by creating significant concerns about the spread of resistant microorganisms in our environment. Environmental pollution from industrial discharges, agricultural activities, and human wastes has accelerated and magnified the development of AMR. Here, an effective and affordable silver-biopolymeric film is prepared to eradicate antibiotic-resistant microorganisms. The silver nanoparticles were synthesized by wet chemical reduction method. The characterization techniques for silver nanoparticles were performed using UV-Vis Spectroscopy, Dynamic Light Scattering and Zeta potential analyzer. The results showed a characteristic wavelength of 436 nm, particle size of 48.38 nm with a polydispersity index of 0.316 and zeta potential of -19.7 mV for silver nanoparticles. The antibacterial activity of four different concentrations of silver nanoparticles was assessed using agar well diffusion method. Maximum zone of inhibition was obtained for 50 ppm of silver nanoparticles with diameter of 10 mm, 13 mm, 17 mm and 26 mm for *E.coli*, *S.aureus*, *Propionibacterium spp.* and *C.albicans*. Based on the results, 50 ppm of silver nanoparticles was considered as the optimized concentration; then, the silver-biopolymeric solution was prepared using collagen and sodium alginate. The solution was cast in a petri dish and allowed to dry and the dried film was crosslinked with calcium chloride solution. Thus, the prepared biopolymeric film showed high AMR against resistant microorganisms in our environment.

Keywords: Silver nanoparticles, antimicrobial resistance, biopolymer, collagen, sodium alginate

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