International Conference
on

Green Energy & Sustainable Environmental Technology

GESET-2022

A special initiative on "OZONE DAY"

HYBRID MODE

15-16, September, 2022

Jointly Organized by

SCHOOL OF CHEMICAL TECHNOLOGY
(KIIT Deemed to be University)

SAVE THE ENVIRONMENT
A Society for Research Awareness and Social Development

Abstract Book & Souvenir

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15 to 16 September, 2022

Conference Hall, KIIT Deemed to be University, Patia, Bhubaneswar, Odisha

Kalinga Institute of Industrial Technology (KIIT)
Deemed to be University
(Established U/S 3 of UGC Act, 1956)
Bhubaneswar, Odisha, India

MESSAGE

It is a matter of great pleasure that School of Chemical Technology, Kalinga Institute of Industrial Technology, Bhubaneswar in association with Save the Environment, Kolkata is going to organize an International Conference on Green Energy & Sustainable Environmental Technology (GESET-2022). Environmental pollution is an issue with an immense impact on the quality of life and can have serious impact on the economic and social wellbeing of the global population. Therefore, designing sustainable solutions for the existing environmental challenges is the need of the hour. I am indeed happy to notice that the objective of this conference lies in setting up dialogue and discourse for achieving sustainable development.

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

I wish the conference and its deliberations all the success.

Dr. Achyuta Samanta
Founder, KIIT & KISS

Institution of Eminence by the Govt. of India | 'A' Category as per notification of Ministry of HRD, Govt. of India | 'Tier' Accreditation (Washington Accord) by NBA for Engineering Streams | Accredited by NAAC in 'A Grade' | Accredited by IET, U.K. (B.Tech. Programme)

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LASSONDE SCHOOL OF ENGINEERING YORK UNIVERSITÉ UNIVERSITY

DEPARTMENT OF CIVIL ENGINEERING
Suite 337 · Bergeron Centre for Engineering Excellence
4700 Keele Street · Toronto · Canada M3J 1P3

MESSAGE

September 8, 2022

Very distinguished delegates,

Welcome to the 2022 International Conference on Green Energy and Sustainable Environmental Technology (GESET), co-organized by Save the Environment and the Kalinga Institute of Industrial Technology. I am delighted to be with you to draw attention to environmental actions: an area at the heart of the 2030 UN Agenda for Sustainable Development. Altering arrays of production and consumption is essential to reverse environmental degradation and fight climate change. So, we must reach a common understanding of the environmental challenges we face and join hands to be proactive and firm in our actions. Our actions must draw traditional knowledge from India and synchronize it with modern technologies.

Over the coming three days of the conference, we are looking forward to learning, improving and strengthening in several areas, steps towards the action mode.

Where do you see the most value for the Universities, research centres, industries, and governmental bodies to focus future analytical work on the trends in priority areas? What should be the scope of our analysis measuring the economic and social benefits of environmental action? And what outcomes do you expect of the ongoing and future environmental cooperation initiatives?

I am looking forward to hearing your thoughts on all these issues. We are grateful for the support and cooperation received from DST as we all unite to deliver a global mandate to make our planet more sustainable, safe, and inclusive.

Thank you all for your attention. I wish you a very successful conference, building new bridges to solve environmental complexities!

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From Vedas:

1.1 आपः सुक्तम् - आपो हि ष्ठा मयोभुवस्था न ऊर्जे दधातन
Apah Suktam - Aapo Hi Sthaa Mayo-Bhuvasthaa Na Urje Dadhaatana
1.2 आपो हि ष्ठा मयोभुवस्था न ऊर्जे दधातन ।
महे रणाथ चक्षसे ॥१॥
Aapo Hi Sstthaa Mayo-Bhuvasthaa Na Uurje Dadhaatana |
Mahe Rannaatha Cakssase ||1||

Meaning:
1.1: O Water, because of your presence, the Atmosphere is so refreshing, and imparts us with vigour and strength. 1.2: We revere you who gladdens us by your Pure essence.

||Air is the Guru, Water the Father, and the Earth is the Great Mother || (Guru Granth Sahib, page 8)

With sincere regards,

Satinder Kaur Brar, Ph.D.
I Professor and James and Joanne Love Chair in Environmental Engineering I
Academician, European Academy of Sciences and Arts
Cercle d'Excellence d'Université du Québec
P: 416-736-2100 ext. 55228 · F: 416-736-5360; E-mail: satinder.brar@lassonde.yorku.ca
Webpage: https://inzymes.yorku.ca; http://bioemeres.ete.inrs.ca/about/
Member of the college of new scholars, artists and scientists of Royal Society of Canada,http://www.rsc.ca/en/college-new-scholars-artists-and-scientists

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MESSAGE

It gives me immense pleasure that School of Chemical Technology, Kalinga Institute of Industrial Technology, Bhubaneswar in association with Save the Environment, Kolkata is going to organize an International Conference on Green Energy & Sustainable Environmental Technology (GESET-2022).

In order to sustain the beauty and natural function of the environment, mankind is expected to take responsible steps toward environmental sustainability which will ensure the continuation of life on this planet. Recycle, reduce and reuse has to be the stratagem for attaining sustainability in the waste management strategy and the deliberations at the conference should pave the path for a wider discourse in this ever-increasing problem. The presence of distinguished researchers, academicians, industry persons and students from all across the country and abroad at a single platform is a step forward in this direction.

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

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

Prof. Sasmita Samanta
Vice Chancellor
Kalinga Institute of Industrial Technology

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MESSAGE

With great delight and enthusiasm, **Save The Environment, Kolkata** and **School of Chemical Technology, KIIT Deemed to be University, Bhubaneswar** welcome all to the *International Conference on Green Energy & Sustainable Environmental Technology [GESET-2022]* being organized at the Conference Hall, KIIT deemed to be University, Patia, Bhubaneswar (hybrid mode) from 15th - 16th September, 2022, to celebrate the World Ozone Day this year.

After a long hiatus of 2 years, it is a sheer pleasure to welcome and interact with esteemed delegates in physical mode.

The theme hallmarked by The United Nations for year 2022 is '*Montreal Protocol @ 35: Global Cooperation Protecting Life on Earth*. The theme sounds straightforward but at the same time is extremely thought-provoking and crucial. Technological advancement and fast-paced progress are on the rise, assuring a better life for all across continents. However, this has its own undercurrents in the form of adverse climate change, amongst which, Ozone layer depletion is a severe effect which we need to address in a collaborative manner. The UN invokes that we 'need to act in collaboration, forge partnerships and develop global cooperation to address climate challenges and protect life on earth for future generations'. STE's key objective focuses on similar principles as aforesaid.

GESET-2022 pledges to be an erudite event where eminent scientists and academicians, expert researchers and industry personnel will discuss measures to protect our Ozone cover from detrimental substances like aerosols, CFCs and halons. Governmental and non-governmental organizations have to productively collaborate to spread awareness globally regarding Ozone layer preservation and put up efforts for the same. We have to be persistent in our endeavor of shielding 'Earth's own umbrella', by restricting the usage of all kinds of Ozone depleting substances in our day-to-day lives.

We hope that the technical sessions in GESET - 2022 will ponder over steps to reduce depletion, salvage the effects on climate change, and collaborate as a unit for this noble mission.

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I am highly indebted to our **Chief Patron, Prof. Achyuta Samanta, Founder, KIIT & KISS**; our **Patrons for the event Prof. Sasmita Samanta, VC, KIIT University & Prof. Arunabha Majumder, Emeritus Professor, Jadavpur University & Patron, STE** for their valuable time and kind consent to grace GESET-2022. I am grateful to **Dr.Suraj K Tripathy, Associate Dean, School of Chemical Technology, KIIT & Convener; Co-Conveners Dr.Sankha Chakrabortty, Assistant Professor, School of Chemical Technology, KIIT & Mrs.Chhanda Basu, General Secretary, STE** for their whole-hearted efforts in organizing the conference successfully. I am also thankful to the **Organizing Secretaries, Dr. Shirsendu Banerjee, School of Chemical Technology, KIIT and Dr. Jigni Mishra, Project Associate, IARI & E.C. member, STE** for their relentless efforts and constant support. I sincerely thank the entire organizing committee and conference secretariat, especially **Mr. Gian Kashyap** for being there persistently. Special thanks are reserved for all the participants and audience, especially the young researchers who have contributed their innovative ideas and outlook for preserving the Ozone layer which we shall come across in this abstract book. I extend my best regards to everyone on the occasion of World Ozone Day, 2022 and welcome you all to GESET-2022.

With regards,

(Dr. Kshipra Misra)
President, Save The Environment (STE), NGO, Kolkata
www.stenvironment.org;
Former Additional Director & Head
Department of Biochemical Sciences (DBCS)
Defense Institute of Physiology and Allied Sciences (DIPAS), DRDO,
Lucknow Road, Timarpur Delhi-110054
Mobile: 919871372350

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MESSAGE

I am ecstatic that the KIIT School of Chemical Technology and Save the Environment, Kolkata are organising the International Conference on Green Energy & Sustainable Environmental Technology (GESET-2022).

At the International Conference on Green Energy and Sustainable Environmental Technology (GESET 2022), academics, scientists, researchers, business leaders, and policymakers will discuss the most recent developments in sustainable technologies and materials for harvesting "Green Energy" while protecting the OZONE LAYER's delicate ecosystem. This conference will also provide a premier interdisciplinary forum for researchers, practitioners, and educators to present and discuss the most recent advancements in the fields of sustainable technology development, in an effort to protect the planet by reducing various environmental problems such as air pollution, water pollution, and other forms of pollution.

This academic institution's conference is crucial to the academic development of teachers and students. I am well aware that faculty members and patrons must devote additional time and resources to this vital endeavour. I am certain that the conference will serve as a turning point for the advancement of waste management and sustainable development-related research and innovation.

It is my firm conviction that the attendees will take away a great deal of value from the proceedings of the events, and I would want to use this opportunity to wish the conference every possible success.

Dr. Suraj K Tripathy
Convener- GESET-2022

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MESSAGE

I am extremely gratified that the International Conference on Green Energy & Sustainable Environmental Technology (GESET-2022) is being organised by the KIIT School of Chemical Technology in collaboration with Save the Environment, Kolkata.

I wish the conference great success and hope that it will serve as a catalyst for the much-needed disclosures regarding a sustainable strategy for clean energy production and ozone layer protection. Academics, scientists, researchers, business leaders, and policymakers will gather at the International Conference on Green Energy and Sustainable Environmental Technology (GESET 2022) to discuss the most recent advancements in sustainable technologies and materials for harvesting "Green Energy" while also safeguarding the OZONE LAYER's delicate ecosystem. In order to protect the Earth by reducing various environmental problems, such as air pollution, water pollution, or other types of pollution, this conference will also provide a premier interdisciplinary platform for researchers, practitioners, and educators to present and discuss the most recent developments in the fields of sustainable technology development. Such scientific gatherings will be organised on a regular basis in an effort to ensure that knowledge is always being transferred from experts to laypeople via students and decision-makers. The organising committees should be commended and given high praise for their efforts.

I strongly believe that the participants will much benefit from the events' proceedings, and I once more wish the conference great success.

Dr. Sankha Chakrabortty
Co-Convener- GESET-2022

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Chief Patron

Prof. Achyuta Samanta, Founder, KIIT & KISS

Patrons

Dr. Sasmita Samanta, VC, KIIT Deemed to be University
Prof. Arunabha Majumder, Emeritus Prof., Jadavpur University, Kolkata and Former Dir., AIIHPH, Kolkata

Conveners

Dr. Suraj K Tripathy, Associate Dean, School of Chemical Technology, KIIT
Dr. Kshipra Misra, President, Save The Environment & Former Addl. Director, DIPAS (DRDO), Delhi

Co-conveners

Dr. Sankha Chakrabortty, Assistant Prof., School of Chemical Technology, KIIT Deemed to be University
Mrs. Chhanda Basu, General Secretary, STE

Organizing Secretaries

Dr. Shirsendu Banerjee, School of Chemical Technology, KIIT Deemed to be University
Dr. Smrutirekha Mishra, School of Chemical Technology, KIIT Deemed to be University
Dr. Jigni Mishra, Research Associate, IARI, New Delhi & E.C. Member, STE

Local Organizing Committee

Dr. Luna Goswami, School of Chemical Technology, KIIT Deemed to be University
Dr. Sashikanta Nayak, School of Chemical Technology, KIIT Deemed to be University
Dr. Satyabrata Si, School of Chemical Technology, KIIT Deemed to be University
Dr. Shraddha Dhal, School of Chemical Technology, KIIT Deemed to be University
Dr. Priti Sundar Mohanty, School of Chemical Technology, KIIT Deemed to be University
Dr. Biswajit Pany, School of Chemical Technology, KIIT Deemed to be University

Other Committee Member

Ms. Meerambika Behera
Ms. Nitika Tiwari
Ms. Anuradha Upadhyaya
Ms. Jyotisikha Mohapatra
Mr. Dilip Kumar Kar
Mr. Anurag Panda

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International Advisory Committee

Prof. Cecilia Stalsby Lundborg, Karolinska Institute, Sweden
Prof. Marco Frasconi, Univeristy of Padova, Italy
Dr. Achintya N. Bezbaruah, NDSU, USA
Prof. Satinder K. Brar, Professor, Lassonde School of Engineering, York University, Toronto, Canada
Prof. Linda Schweitzer, Emeritus Professor, Oakland University, Rochester, MI & Research Scientist at Southern university A&M College in Baton Rouge, Louisiana, USA.
Prof. Amitava Adhikary, Research Associate Professor, Oakland University, Rochester, MI, USA.
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Dr. Sanjeev Varshney, Scientist 'G', Intl. Cooperation DST, Govt. of India
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Dr. Maulin Shah, Chief Scientist & Head, Enviro Technology Ltd., Ankleshwar, Gujarat, India
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Dr. Jayashree Bhattacharjee, Former Director Professor & Hod Department of Bio Chemistry Faculty of Medical Sciences University of Delhi
Dr. Mukesh Sharma, Scientist 'E' & OIC NIH, Roorkee
Dr. Gopinath Halder, Professor, National Institute of Technology Durgapur, India
Dr. Ajay Mandal, Professor, Department of Petroleum Engineering, IIT (ISM) Dhanbad
Dr. Tarun Kumar Naiya, Associate Professor, Department of Petroleum Engineering, IIT (ISM) Dhanbad
Dr. Titash Mondal, Assistant Professor, IIT Kharagpur

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Dr. Ashwini Mohapatra, Manager (T), CIPET Bhubaneswar
Dr. Pijush Kanti Mandal, Sr. Tech. Officer, CIPET Bhubaneswar
Mr. Chaturmukh Pattanaik, Former Executive Director, Delta Steel, Nigeria
Mr. Bibek Dash, Scientist, CSIR-IMMT, Bhubaneswar

About the Organisers

About STE

Vision: To protect the present and future generations of India from various environmental hazards.

SAVE THE ENVIRONMENT (STE), Kolkata was registered on 29th November 1990 under the West Bengal Societies Registration Act. Since then, STE has been involved in various projects related to solving the long standing issue of arsenic contamination in groundwater in India. Some of the major activities undertaken by the society are given below.

- In 1992, with the collaboration of WWF (India), STE started actively working for resolving groundwater arsenic poisoning in several arsenic prone districts of West Bengal.
- In 1994, STE began working in close association with All India Institute of Hygiene & Public Health, Kolkata which led to installation of STE's first arsenic removal plant in 1997. The plant was inaugurated by the Minister of PHED (West Bengal) on 23rd January, 1997.
- In the year 2000, in collaboration with AIIH&PH and Indo-Canada Environment Facility, STE started a community based program to mitigate arsenic pollution in West Bengal.
- In June 2001, STE had an opportunity to start a special clinic, which is first of its kind to provide free treatment to patients of arsenic poisoning. A vocational training centre was inaugurated for the arsenic patients in 2003 and setting up of a special hospital for arsenic patients is under process.
- STE is working very actively with DRDO, Ministry of Defence, India to promote and implement a patented, low cost arsenic removal technology developed by DRDO.
- STE has successfully completed three projects from Department of Science & Technology, Government of India to propagate and implement arsenic and iron removal technologies in the affected areas.
- STE, with the help of Indian Institute of management (IIM), Ahmedabad has developed a model for sustainability of arsenic mitigation programs in rural setups of India
- Projects on an extensive scale have been eventuated to mitigate arsenic / iron problem in 24 Parganas (N) & Nadia districts in West Bengal, Ballia district in Uttar Pradesh, Bhagalpur

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District in Bihar and Agartala in Tripura. Since 1997 till date, STE has had the privilege of supplying arsenic-free drinking water to more than 1, 00, 000 people in India.

- About 60 community type arsenic removal plants have been installed and more than 5,000 domestic filters have been distributed so far.
- Also, STE regularly conducts health camps along with doctor volunteers in rural areas of West Bengal with the aim to eradicate arsenic poisoning in India.
- Apart from these, STE proactively organizes conferences, workshops, seminars, sit and draw competitions and science fairs, with the noble objective of propagating awareness among the general public, regarding environmental protection.

School of Chemical Technology at the KIIT (KSCT)

School of Chemical Technology at the KIIT (KSCT) is conceived with the specific objective of creating an interdisciplinary academic and research center integrating the fields of applied chemistry, chemical engineering, materials science and nanotechnology to produce human resources for industries. With Prof. JeanMarie Lehn (Nobel Laureate in Chemistry, 1987) as its advisor and mentor, the school is poised to herald a new era of innovative education and research in India. Within a very short time, KSCT has established vibrant research collaborations with many foreign universities (Murdoch University, Australia; Karolinska Institute, Sweden; Institute of Chemical Technology, Prague; Korea Institute of Geosciences and Mineral Resources, South Korea).

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A special initiative on "OZONE DAY"

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(HYBRID MODE)

At Campus-11 Conference Hall in place of Conference Hall

Jointly Organized by

Programme Schedule: GESET-2022
15th September, 2022

9.00-10.00	Registration of the Delegates
10.00-10.15	Entry of guests and delegates to the conference room and lighting of the lamp
10.15 -10.25	Welcome of guests and welcome address of GESET-2022 Conference by **Dr. Suraj K Tripathy**, Convener, GESET-2022
10.25 -10.35	Introduction of STE by **Dr. Kshipra Mishra**, President, Save the Environment
10.35-10.40	Opening Remarks by **Prof. Arunabha Majumder**, Patron
10.40-11.00	Felicitation of Awardees
11.05 -11.15	Address by Patron: **Prof Sasmita Samanta**, VC, KIIT Deemed to be University
11.15 -11.25	Address by Honorable Chief Patron: **Prof. Achyuta Samanta**, Founder, KIIT and KISS
11.25-11.35	Address by **Prof. Narendra Singh**, Guest of Honour
11.35-11.45	Address by **Prof. Satinder K. Brar**, Chief Guest
11.45-11.50	Release of Abstract Book by the Dignitaries
11.50-11.55	Vote of Thanks by **Prof. Jnyana Ranjan Mohanty**, Registrar KIIT Deemed to be University
11.55-12.00	National Anthem
12.00-12.15	**High Tea and Networking session**
Keynote Talk	
Chairperson: Prof. Arunabha Majumder	
12.15-12.35	Keynote Talk: **Prof. Satinder K. Brar** Professor and James and Joanne Love Chair in Environmental Engineering, Lassonde School of Engineering, York University, Toronto, Canada ***Title: Sustainable Technologies for Education and Environmental Remediation (STEER)***

Technical Session: I[11.50 to 13.30 Hr]	
Chairperson: Prof. Ajay Gupta & Dr. Kshipra Mishra	
12.40-12.55	Invited Talk: **Dr. Vivek Verma** Associate Professor, IIT Kanpur ***Title: Agar based biodegradable packaging materials***
12.55-13.10	Invited Talk:**Dr. Leena Nebhani** Associate Professor, IIT Delhi ***Title: Concerted effect of functionality and pore size on dehydrogenation of ammonia borane via its nanoconfinement in polymer grafted mesoporous silica leading to tunable hydrogen release***
13.10-13.25	Invited Talk: **Dr. Srinivas Patnaik** Professor, KIIT Deemed to be University ***Title: Effect of Benzo(a)pyrene in infer skeletal deformities in embryonic zebrafish***
13.25-13.30	Vote of thanks
13.30-14.30	**Lunch Break& Networking Session**
Keynote Talk	
Chairperson: Dr. Kesava C Rao	
14.30-14.50	Keynote Talk: **Dr. Narendra Singh** Scientist 'F' Addl. Director, DRDO ***Title: Designed region specific passive greenhouses and standardized process for round the year vegetable production***
Technical Session: II[14.30 to 16.10 Hr]	
Chairpersons: Dr. Vivek Verma & Dr. A.K. Sahoo	
14.50-15.05	Invited Talk: **Dr. Mousumi Roy** Professor, NIT Durgapur ***Title: Developing an Extended theory of Planned behavioural model towards Green energy and Sustainable environmental technology development***
15.05-15.20	Invited Talk: **Dr. Pratik Kumar** Assistant Professor, Indian Institute of Technology, Jammu, ***Title: Aspects of green material in the field of emerging contaminant removal***
15.35-15.50	Invited Talk: **Dr. Ratul Kumar Das** Senior Researcher, Save the Environment ***Title: Sericin: A Green Material for the Development of Curcumin Based Nanoformulation, Emulsion System and Nanoflowers***
15.50-16.05	Invited Talk: **Dr. Yatin Ulhas Gadkari** Assistant Professor, Pharmaceutical Technology ICT - IOC Bhuvaneshwar, India ***Title: Green chemistry, Sustainability, environmentally benign approach in today world***
16.05-16.10	**Vote of Thanks**
16.10-16.25	**Tea Break & Networking Session**

Keynote Talk	
Chairperson: Prof. Satinder K. Brar	
16.30-16.50	Keynote Talk: **Dr. Kesava C Rao** Dy. General Manager at R&D, NMDC, Hyderabad ***Title: Green Technologies for Mineral Processing***
Technical Session: III[16.30 to 18.00 Hr]	
Chairpersons: Dr. Srinivas Patnaik& Dr. Ratul Kumar Das	
16.50-17.05	Keynote Talk: **Dr. Achintya Bezbaruah** Greener Materials for Drinking Water Treatment, Gehrts Presidential Professor of Environmental Engineering, Professor of Civil, Construction and Environmental Engineering, Director, Grand Challenges Scholars Program, Advisor, NDSU Engineers Without Borders ***Title: Greener Materials for Drinking Water Treatment***
17.05-17.20	Invited Talk: **Dr. A.K. Sahoo** Dean and Professor, KIIT ***Title: Sustainable machining and machinability studies for difficult-to-cut materials***
17.20-17.35	Invited Talk: **Dr. Saurav Sarma** Associate Professor, Department of Biotechnology, Bennett University ***Title: Value-added product development from industrial solid waste: A case study***
17.35-17.50	Invited Talk: **Dr. Jayato Nayak** Assistant Professor, Mahindra University ***Title: Environmental pollution, toxicity profile and treatment approaches for industrial wastewater and its chemical pollutants***
17. 50-17.55	Invited Talk: **Dr. MS Satyanarayana** Research Scientist, Hollingsworth & Vose ***Title: Current Scenario of Plastic and Polymer waste***
17.55-18.00	**Vote of Thanks**
18.00 onwards	**Networking Session**
16.30-18.30	**Oral Presentation by registered Delegates [D1: Parallel Sessions-I]** **Oral Presentation by registered Delegates [D1: Parallel Sessions-II]**
End of Day 1 Technical Session	
Dinner at Campus 11 Auditorium Dining Space from 19.30 onwards	

16th September, 2022

Keynote Talk	
Chairperson: Prof. Arunabha Majumder & Prof. Satinder K. Brar	
9.30-9.50	Keynote Talk: **Prof. K.K. Pant**, IIT Delhi ***Title: Role of Chemical Engineering in reducing Carbon Footprints***
9.50-10.10	Keynote Talk **Prof. Papita Das** Professor, Jadavpur University ***Title: Utilization of biomass for treatment of pollutants***
Technical Session-I 10.10-10.45 Hr	
Chairperson: Dr. Kalpana Bhargava & Dr. Saurav Sarma	
10.10-10.25	Invited Talk: **Dr. Biswajit Ruj** Chief Scientist and Former Head, CSIR-CMERI ***Title: Solid Waste Management with a Special Reference to Plasticwaste: Its Safe Disposal & Recovery of Value Added products***
10.25-10.40	Invited Talk: **Dr. Atun Roy Choudhury** Head- Technical & Planning, ECO-India ***Title: Biomining and legacy waste management***
10.40-10.45	**Vote of Thanks**
10.45-11.00	**Tea Break & Networking Session**
9.30-10.45	**Oral Presentation by registered Delegates [D2: Parallel Sessions-I]** **Oral Presentation by registered Delegates [D2: Parallel Sessions-II]**
Second Technical Session 10.50-13.30	
Chairperson: Dr. Kesava C Rao&Prof. Papita Das	
11.00-11.20	Keynote Talk: **Dr. Kali Sanjay** Chief Scientist and Head, CSIR-IMMT Bhubaneswar ***Title: Sustainable Engineering for sustainable environment***
11.25-11.40	Invited Talk: **Dr. Gaurav Saxena** Assistant Professor, Shoolni University ***Title: Environmental pollution, toxicity profile and treatment approaches for industrial wastewater and its chemical pollutants***
11.40-11.45	**Vote of Thanks by Chairperson**
10.50-11.50	**Oral Presentation by registered Delegates [D2: Parallel Sessions-I]** **Oral Presentation by registered Delegates [D2: Parallel Sessions-II]**
11.50-12.30	**Vote of Thanks & Valedictory Session**
Lunch& Networking Session: 12.45 onwards	

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Keynote Talks

SUSTAINABLE TECHNOLOGIES FOR EDUCATION AND ENVIRONMENTAL REMEDIATION (STEER)

Satinder Kaur Brar

Professor, Lassonde School of Engineering, York University
E-mail: skbrar@yorku.ca

ABSTRACT

The industrial world and municipalities generate nutrient-rich residuals referred broadly to as "biomass". Biorefineries will transform biomass into a wide range of biochemicals and their intermediates, such as the enabling platforms that are expected to occupy the centre stage in the Circular Bioeconomy. In this context of biomass residual management, their value-addition in an integrated bioeconomy approach is timely and required. Over the past two decades, our research group has developed interdisciplinary experience (science-engineering interface) achieving different milestones in the value-addition of residues from different sources into valuable bioproducts, such as enzymes, lipids, biofuels, aroma compounds, and animal feed, among others. Likewise, we succeeded in isolating Arctic-based psychrophilic microorganisms and grew them in the laboratory from flasks to 2000L fermenters, producing the enzymes. Eventually, these enzymes were used in degrading petroleum hydrocarbons in groundwaters and surface waters. This also helped us scale the process with an innovative jellyfish type of design to treat pollutants in the oilsands. We always strive to find solutions to the waste problems that render retrofit advantages so that the technology will not incur additional costs to the end user, such as industries and municipalities. Canada being a forest-rich nation, the technical know-how has also paved the way to revitalizing the forestry residues into drop-in fuels which can be directly used as a fuel by the automotive industry. The research continues in our laboratory on different facets of value-addition of residues and has led to 4 patents so far that are being used by the industrial sector. As an offshoot of the value-addition, our laboratory has developed ingenious techniques to use enzymes in environmental remediation. In this context, the research has been focused on conventional contaminants, such as petroleum hydrocarbons and pesticides and extended to the contaminants of emerging concern (CEC) which are found in trace concentrations of micro- to nano-grams per litre. Some of these CEC comprise pharmaceuticals, plasticizers, endocrine disrupters, flame retardants, and cyanotoxins, among others. Our team has been devising biological methods comprising microorganisms and/or enzymes to biodegrade these CECs. Our approach has been oriented around efficacy as a holistic system, which means that the transformation products of the targeted CEC must be non-toxic or less toxic than the precursor compound. Over the years, our team established the fact that there is no single

technology that functions well for a wide range of these contaminants found in the environment. Often, it is the hybrid technology that reigns! When the value-added bioproduct does the tango with the contaminants, the results are amazing. This approach helped us close the loop on those bioproducts that were produced from the residues to treat contaminants in the environment. From here, we conceived the idea of One WATER (covering various themes of Water, Artificial intelligence, Treatment systems, Education and training and Resource recovery) organizational research unit. One WATER conglomerates researchers from diverse fields of science, engineering, social sciences, business, and cultural studies. This will provide us with the platform to break barriers and learn from each other to advance our understanding and strive to overcome challenges in water science. We always have solutions in nature, just we need to look around and find the right one. This has been the mantra of my team steering forward the goal of environmental sustainability which has been also listed in the UN sustainable development goals.

GREENER MATERIALS FOR DRINKING WATER TREATMENT

Achintya Bezbaruah

Gehrts Presidential Professor of Environmental Engineering
Professor of Civil, Construction and Environmental Engineering
Director, Grand Challenges Scholars Program
Advisor, NDSU Engineers Without Borders

ABSTRACT

The development of greener materials for environmental applications is imperative as otherwise the used materials adversely affect the ecosystem components. Materials for drinking water treatment additional care and should be designed for the environment. It is important that we start with benign raw materials (chemicals) and the life cycle cost and risks are minimized. The disposal of the spent materials used for remediation needs to be planned out before the materials are developed. The risks and benefits to the stakeholders and their acceptance of the material (or technology or service) should be determined and appropriate steps should be taken to alleviate stakeholders' concerns. The reliability of the materials should be evaluated to ensure their robustness. This presentation will highlight the issues based on research on nano-based materials for arsenic and fluoride removal primarily conducted at North Dakota State University.

SUSTAINABLE TECHNOLOGIES FOR RECOVERY OF VALUE ADDED PRODUCTS FROM SECONDARIES AND INDUSTRIAL WASTES

Dr. Kali Sanjay

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ABSTRACT

The bar for environmental standards has been increasing continuously. Industries are facing difficulty in the proper disposal and treatment of solid and liquid wastes, as it involves the negative cost of the treatment prior to proper disposal. For moving towards sustainable development, technically and economically sensible processes can be developed for recycling these wastes to recover valuable metals/chemicals. Hydrometallurgical techniques can be implemented to utilize these resources to produce value-added products. This can reduce the stress on the environment while compensating the negative disposal costs.

Some of the industrial residues/wastes that are processable include sludges, spent catalysts, residues, fly ash, scrap, overburdens, off-grade ores, dusts, slimes, dross, slags, e-wastes, effluents, etc. CSIR-Institute of Minerals and Materials Technology (CSIR-IMMT), Bhubaneswar, has been looking to the needs of the industries in developing processes that utilize such resources. Efforts by the institute have resulted in process scale-up and commercial implementation. The present talk will focus on these efforts by CSIR-IMMT.

Keywords: Non-ferrous metals, industrial wastes, effluents, hydrometallurgy.

UTILIZATION OF WASTE BIOMASS FOR TREATMENT OF POLLUTANTS

Prof Papita Das

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&
Director, School of Advanced Studies in Industrial Pollution Control Engineering
Jadavpur University, Kolkata, India

ABSTRACT

The biomass is a non-edible residue from different industries that is gaining importance as a source of biomaterial and energy, despite previously being considered as environmental problem. This biomass can be used for obtaining cellulose nanofiber which can be used for the treatment of wastewater and also can be used to generate value added products like biofuel. Rapid pace of industrialization, population expansion, and unplanned urbanization have contributed greatly to the severe pollution of water bodies and surrounding soils. The main sources of freshwater pollution can be attributed to discharge of untreated toxic industrial wastes and dumping of industrial effluents. Huge volumes of wastewater from different industries are pumped directly into water bodies. The waste water contains contaminants such as metal ions, organic compounds. The impact of this is severe – aside from the damage to the environment. Beside that biomass (micro-organism) and plant biomass can be used to separate the pollutants from waster bodies. Researchers are developing technologies that enable all of the plant biomass and wastes from industries to be used in production, including the woody lignin and cellulose, instead of just the edible sugary, starchy or oily parts. These wastes biomasses can be used for treatment of various pollutants present in air and water.

Invited Talks

AGAR BASED BIODEGRADABLE PACKAGING MATERIALS

Dr. Vivek Verma

Associate Professor, IIT Kanpu

ABSTRACT

Environmental concerns arising from commercial plastics have led to reduce, reuse, and recycle concepts. However, such efforts leave us wanting for more, and motivate us to opt for biodegradable polymers, which are sustainable alternates of currently used plastics. Special attention is given to use biodegradable polymers for packaging application. High strength and stability, low permeability to moisture and air, and processability is desired for such applications. Most of the biodegradable polymers are natural and need further modifications to meet industrial needs. In our research group we use physical and chemical methods to improve the properties of Agar, a seaweed-based polymer, for packaging applications. The talk will focus on the steps taken toward using agar as potential packaging material.

CONCERTED EFFECT OF FUNCTIONALITY AND PORE SIZE ON DEHYDROGENATION OF AMMONIA BORANE VIA ITS NANOCONFINEMENT IN POLYMER GRAFTED MESOPOROUS SILICA LEADING TO TUNABLE HYDROGEN RELEASE

Dr. Leena Nebhani

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ABSTRACT

Materials based on silica are promising in diverse areas owing to their excellent biocompatibility, thermal stability, facile synthesis, and numerous possibilities for chemical modification. The silica particles can be precisely engineered, enabling the silica particles apt for various applications. New strategies and techniques have been developed for the synthesis and structural tailoring of silica-based materials. The functionalization of silica with organic functional groups or polymers can lead to hybrid materials with new physical and chemical properties. Organically modified poly(acrylamide) (PAM) grafted mesoporous silica nanoparticles (MSNs) have been evaluated for the first time as a hybrid material for hydrogen release experiments via nanoconfinement of ammonia borane (AB). PAM was grafted from two different types of R group (isobutyric acid and phenyl ethyl) containing in-built RAFT agent primed MSNs (PAM-COOH-MSNs, PAM-Ph-MSNs). To evaluate the suitability of these PAM grafted MSNs as an efficient hybrid material for hydrogen release at lower dehydrogenation temperature than neat AB, AB was nanoconfined into PAM grafted MSNs (AB-PAM-COOH-MSNs, AB PAM-Ph-MSNs). The hydrogen release from AB nanoconfined PAM grafted MSNs were performed using temperature-programmed desorption-mass spectroscopy (TPD-MS). Significantly it was observed that AB-PAM-COOH-MSNs and AB-PAM-Ph-MSNs justified the nanoconfinement by the lower onset of hydrogen release temperature in comparison to neat AB. The possible mechanism for lower dehydrogenation temperature of PAM-COOH-MSNs in comparison to PAM-Ph-MSNs was possibly attributed to the size reduction of AB as well as the interaction between functional groups of polymers as well as MSNs with AB. Additionally, impurities such as diborane and ammonia during hydrogen release were suppressed for both PAM grafted MSNs. Justifying the evidence for AB-PAM COOH-MSNs in comparison to AB-PAM-Ph-

MSNs. It can be proposed that decidedly organically modified poly(acrylamide) grafted MSNs can be used as efficient nanocarriers for ammonia borane nanoconfinement and hydrogen release.

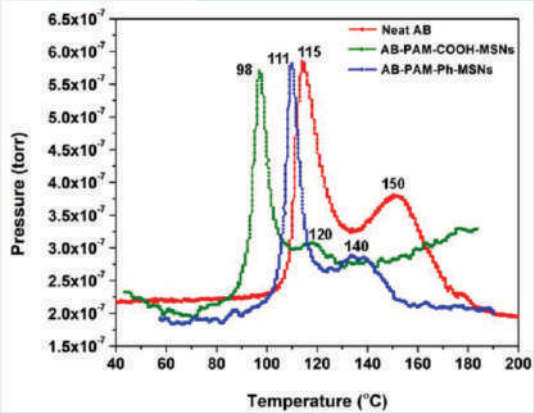

Figure. TPD-MS for hydrogen release from AB nanoconfined in polymer grafted MSNs and neat AB. The dehydrogenation temperature for AB-PAM-COOH-MSNs was observed at 98°C and AB-PAM-Ph-MSNs was observed at 111°C in comparison to neat AB at 115°C. Published in ACS Applied Energy Materials 2021, 4, 7, 6585–6598.

EFFECT OF BENZO(A)PYRENE IN INFER SKELETAL DEFORMITIES IN EMBRYONIC ZEBRAFISH

Srinivas Patnaik, Hasnaa A Elfawy and S Anupriya

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ABSTRACT

Benzo(a)pyrene (BaP) has become an integral component of disposed of plastic waste, organic pollutants, and remnants of combustible materials in the aquatic environment due to their persistent nature. The accumulation and integration of these polycyclic aromatic hydrocarbons (PAHs) have raised concern to human health and ecological safety. This study assessed the BaP-induced in vivo molecular toxicity with embryonic zebrafish inferred by oxidative stress and apoptosis. BaP was found to induce morphological and physiological abnormalities like delayed hatching ($p < 0.05$). Computational analysis demonstrated the high-affinity interaction of BaP with the zebrafish hatching enzyme (ZHE1) with Arg, Cys, Ala, Tyr, and Phe located at the active site revealing the influence of BaP on delayed hatching due to alteration of the enzyme structure. RT-PCR analysis revealed significant down-regulation of the skeletal genes Sox9a, SPP1/OPN, and Col1a1 ($p < 0.05$) genes. The cellular investigations unraveled that the toxicity of BaP extends to the skeletal regions of zebrafish (head, backbone, and tail) because of the elicited oxidative stress leading to apoptosis. The study extended the horizon of understanding of BaP toxicity at the molecular level which will enhance the indulgent and designing of techniques for better ecological sustainability.

DEVELOPING AN EXTENDED THEORY OF PLANNED BEHAVIOURAL MODEL TOWARDS GREEN ENERGY AND SUSTAINABLE ENVIRONMENTAL TECHNOLOGY DEVELOPMENT

Mousumi Roy

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ABSTRACT

In the backdrop of huge challenge of climate change and global warming, green energy with sustainable technology development has evolved as an urgent need of the present world. A transition to green economy involves a radical change in energy-end use behaviour along with wide deployment of energy- efficient and energy-conservation technology. Applying the theory of planned behaviour on people of a large developing economy like India, the study aims to focus on the socio-psychological constructs that have significant influence on people's willingness to change their lifestyle towards the paradigm of green energy. Results of the study offer support that attitude, subjective norms, perceived behavioural control are important determinants to influence behavioural change towards promotion of people's green and sustainable energy consumption behavioural intention. However, it is the moral values and obligations that make people more sensitive to the possible environmental impact of unsustainable energy regime. Only reverence for these values can strengthen human behavioural intention towards green energy through reduced carbon intensity of modern lifestyle. Promotion of moral values and obligations to motivate positive behavioural actions is a potential solution towards building a sustainable and green economy from demand side management.

Keywords: Perceived behavioural control, Low-carbon economy, Theory of planned behaviour, Moral values and obligations.

ASPECTS OF GREEN MATERIAL IN THE FIELD OF EMERGING CONTAMINANT REMOVAL

Dr. Pratik Kumar

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ABSTRACT

In the field of drinking water and wastewater treatment, the role of green material is becoming more pronounced and vibrant. Considering the implications and limitations posed by conventional treatment technology, the need of sustainable-cum-cost-effective solutions has emerged in various domains of water treatment and management. The rising popularity of green material is contagious because of a high feasibility, sustainability and cost-effective index. Water unavailability and its limited security is a serious concern to most of us where various conventional treatment systems have shown poor longevity and bad performance in the long run. This brings down to an establishment of sustainable technology as a retrofit or a complete replacement to an existing choked system. Green materials could play a pivotal role in alleviating the water treatment challenges and may provide a better solution by balancing the technical aspects and economical constraints.

In this talk, the focus will be on the drinking water domain where a growing need of green material will be pointed out. The concern of emerging pollutant removal will be discussed using an example of algal toxin present in stagnant water sources. An example of a green biofilter system will be shared that comprises a sustainable material in form of graphitized sand that will be compared to a conventional sand material. The aspects of green material in the field of emerging contaminant removal will be presented.

SERICIN: A GREEN MATERIAL FOR THE DEVELOPMENT OF CURCUMIN BASED NANOFORMULATION, EMULSION SYSTEM AND NANOFLOWERS

Ratul Kumar Das

Save The Environment, Gurugram, India

ABSTRACT

Sericin protein obtained from *Philosamia ricini* (also known as Ahimsa silk or Peace silk or Eri) was used to prepare a nanoformulation of curcumin. The blank and curcumin encapsulated nanoparticles were prepared by desolvation method using acetone as the desolvating agent. The physicochemical characterization of the synthesized nanoparticles was carried out with different instrumental analyses. The highest encapsulation efficiency and loading capacity of the encapsulated sericin nanoparticles were found to be 85.25% and 1.066, respectively. In a different approach, a sericin-curcumin-ethyl oleate (O/W) emulsion system was developed by desolvation method. The emulsion was prepared by using curcumin solution dissolved in ethyl oleate (EO) and aqueous solutions of sericin in varying concentrations (1, 2, 3, 4 and 5 mg/mL). The oil phase (EO) and the aqueous phase (sericin solution) were mixed using a high speed vortex shaker for 10 minutes. Optimization of the oil phase was done to achieve maximum emulsion yield without excess oil suspended on top of the emulsion as well as to check the 'oiliness' of the emulsion system. Optimization of ratio of oil to water was also carried out. Yet in another approach, effect of high and low molecular weight sericin on Sericin-copper phosphate hybrid nanoflowers was investigated.

Keywords: Sericin, Curcumin, Nanoparticles, Emulsion, Nanoflowers.

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SUSTAINABLE MACHINING AND MACHINABILITY STUDIES FOR DIFFICULT-TO-CUT MATERIALS

Ashok Kumar Sahoo

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ABSTRACT

Extensive work on the aspects of machinability of hardened steel has been noticed using CBN, PCBN, cermet and ceramic cutting tools under dry environment. Again, hard machining of steel at elevated hardness above 50 HRC using low cost multi-layer coated carbide insert is rarely investigated and lacking as far as literature studies are concerned and will be essentially worthwhile for research to improve its performance. Dry hard machining is easier to machine hardened components due to thermal softening. But at the same time, evolution of heat at the cutting zone drastically increases the tool wear and results in the deterioration of the tool life and spoils the surface finish and dimensional accuracy. Majority of hard turning investigations are undertaken under dry environment and few studies were undertaken on application of coolants. So, there is an agreement and disagreement of application of coolants in hard turning and thus needs further investigations on this area and open for researchers. In conventional machining, cutting fluid acts as coolant and lubricant. However in hard machining the use of flood cooling displays thermal shock, thereby accelerating fracture of work-piece and cutting tool and thus unsuitable for hard turning applications. Near dry machining/ minimum quality lubrication (MQL) worked more efficiently compared to flood/wet cooling. High pressure cooling jet/ spray impingement cooling also provide enhanced performance but its application in hard turning is very rare.

Hard turning with MQL is a novel technique in which extremely small quantity of cutting fluid is applied precisely at the cutting zone. In MQL, heat transfer is predominantly in the evaporative mode, which is more efficient than the convective heat transfer prevalent in conventional wet turning. It is expected that the MQL can enhance the machining performance besides adding to economical and ecological benefits. Application of nanofluid assisted MQL (NFMQL) machining of hardened steel /aerospace alloys/difficult-to-cut materials are lacking in the research and thus worthy of investigation towards sustainability.

Sustainability Pugh matrix assessment revealed that MQL/NFMQL environment enhanced the economical, technological as well as environmental and operator health aspects. Reduction of energy consumption and savings of carbon footprints observed under MQL/NFMQL and thus saves manufacturing cost.

Keywords: Hard machining; Dry machining; MQL; NFMQL; Spray cooling; Sustainability

VALUE-ADDED PRODUCT DEVELOPMENT FROM INDUSTRIAL SOLID WASTE: A CASE STUDY

Saurabh Jyoti Sarma

Department of Biotechnology
Bennett University, Greater Noida (UP) 201310.

ABSTRACT

Production of valuable products from solid industrial waste is a current topic of research. We have collaborated with an industry located in Delhi NCR to turn their solid waste into valuable products. The industry generates around 40 tons of solid waste per month, which are mostly lignocellulosic biomass. We have isolated a few microbial strains that can compost the waste to organic fertilizer. Cellulase, xylanase and lignin degrading enzyme producing microorganisms were isolated from different sources. After a number of initial screening experiments, a consortium of some selected strains was prepared. The consortium is being used to compost the solid waste. Further process optimization has been going on to develop a rapid method for composting the waste. Additionally, the solid waste has a range of valuable phytochemicals. We have extracted the phytochemicals by different methods. The phytochemicals will be identified, and suitable technologies will be developed to purify some of these high-value compounds.

Keywords: Composting; Industrial waste; Phytochemical; Solid waste.

PROCESS INTENSIFICATION: ADVANCED APPROACH IN JUDGEMENT OF GREEN TECHNOLOGY AND SUSTAINABILITY

Jayato Nayak

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ABSTRACT

The new strategy that envisages faster, more efficient and clean production through green and more flexible route involves less energy, less material consumption and reduced manpower compared to a conventional production scheme is termed 'Process Intensification' (PI). Features of Process Intensification: A new paradigm in chemical pharmaceutical and allied process industries towards 'greener and cleaner' productions. An answer to the challenges in sustainable development while increasing output. Emphasizes on simpler modular design. Smaller is safer! It can also lead to improved energy efficiency, lower processing charge (by using reduced inventories and renewable resources) and waste reduction and reuse. Minimization of hold-up, inventory and feedstock while maximizing process performance and throughput.

A Case Study:

Process intensification in acetic acid production by membrane integrated hybrid reactor system Conventional chemical route of production – 1. Methanol Carbonylation; 2. Ethylene oxidation A very simple scheme of acetic acid production in a membrane integrated reactor system (MIRS) from cheese whey has been developed. Integration of microfiltration membranes was done as a primary clarifier unit (for microbial bodies) and the permeate from microfiltration was further

treated with NF technology. Flat sheet cross-flow modules as represented in Figure 6C were used, which enabled high permeate flux and long-term operation due to the high sweeping action over the membrane surfaces. The concentration of the produced acetic acid was further enriched by nanofiltration exploiting NF-1 membranes. A high productivity of 4.06 g. $L^{-1}.h^{-1}$ with a final acetic acid concentration of 96.9 g L^{-1} with 98% purity was obtained.

The by-products from the proposed plant are whey-protein and reusable water. Such a plant that can annually treat 5×10^8 L of cheese whey produces 3,000 ton of dry whey protein powder as by-product through forward-osmosis and vacuum drying. Conventionally the involvement of triple effect evaporators and spray dryers for the sole production of whey protein powder involves huge energy consumption apart from involving high equipment cost, maintenance and manpower expenses. Thus the configuration for whey protein regeneration section which is actually a by-product recovery division of the main plant of acetic acid production stands to be very much simpler than the classical ones. To operate such a compact membrane based plant, a total water supply of 80.12×10^6 L/year is very much required as applications involving membranes require continuous supply of water. But in the proposed plant, due to presence of feed concentration enrichment units like forward osmosis, huge volume of water which is about 264×10^6 L/year could be recovered after nanofiltration treatment. Thus there is further cost saving on utility account.

Comparison of total consumptions in a classical vis-à-vis proposed plant for acetic acid production (capacity: 10,000 tonnes/year)

Energy requirement: 5500 kWh/ton acetic acid in conventional and 55.76 kWh/ton acetic acid in MIRS Total space required: 5000 m^2 (conventional) and 902 m^2 (MIRS) including installation spaces and pipe lines. The annualized production cost of 98.7% pure 962 g/L of acetic acid: $(0.03 + 0.40) \approx 0.43$ $/ kg.

In the Indian market, Total of packaging, transportation, marketing (media and advertisement) of a max. of 35% ; Profit of max. 20% and contingency of about 20% of the production cost, the total selling cost of the product deduces to: US $ 0.76 per kg. Similar grade acetic acid costs about US $ 1.3 per kg.

Conclusions:

Sustainable production in manufacturing acetic acid where multi-stage membrane separation modules are judiciously integrated with conventional fermentation device. Culminate in a very eco-friendly, small, compact, energy-saving yet flexible plant with the promise of high yield, productivity, and purity of the desired product.

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SOLID WASTE MANAGEMENT WITH A SPECIAL REFERENCE TO PLASTIC WASTE: ITS SAFE DISPOSAL & RECOVERY OF VALUE ADDED PRODUCTS

Dr. Biswajit Ruj

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ABSTRACT

Municipal Solid Waste (MSW) management is a major environmental issue in Indian cities. Due to rapid increase in urbanization, industrialization and population, the generation rate of municipal solid waste in Indian cities and towns is also increased day by day. Improper management of municipal solid waste (MSW) causes hazards to inhabitants. Composition of MSW varies from region to region, county to country and it is observed that on an average around 10-12 % plasticwaste present in MSW which is very difficult to dispose safely as plasticwaste is non-biodegradable in nature. Here in this presentation two routes say thermal pyrolysis and plasma pyrolysis process have been elaborately discussed which were carried out in CSIR-Central Mechanical Engineering Research Institute, Durgapur as a Research & Development activity program of this institute. Objective of both the process is same but the route is different. Plasma pyrolysis process involved high temperature and produces syngas which is combustible in nature and this syngas is being converted to electrical power whereas for thermal pyrolysis process three products say pyrolystic oil, gas and char have been collected as byproducts which are all have commercial importance. It is observed that in thermal pyrolysis process around 60 % pyrolytic oil, 20% gas and rest is char have been collected. Here in this presentation 20 kg/hr. capacity plasma pyrolysis process and 15 kg batch thermal pyrolysis process for safe disposal of plasticwaste and fuel/energy recovery process have been presented in details.

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DESIGN AND FABRICATION OF A NOVEL TRIPHASIC ANAEROBIC BIOREACTOR FOR THE CO-TREATMENT OF ASSORTED SUBSTRATES

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ABSTRACT

Accessibility of suitable substrates and further segregation requirements are the primary constraints associated with the wet biomethanation process. Though the wet process is highly regarded for its effectivity and efficacy in municipal solid waste management manual 2016, the process is grievously goofed to cater for the desired output when loaded with substrates containing relatively high oil and fatty acid content. Therefore, secondary segregation becomes mandatory, before anaerobic digestion, leaving behind a partly degraded moist cake which is undoubtedly difficult to handle. This triggered the idea of hybrid dry biomethanation to overcome the challenges of the wet process and enhance product recovery. A triphasic capsuled gravity flow batch bioreactor (TCGBR) comprising an aerobic pretreatment unit, thermophilic anaerobic/anoxic pressure chamber, and aerobic post-treatment unit is designed. The lab-scale reactor is designed for a capacity of 5 kg. The first chamber is designed to receive the shredded mixed waste from a rotary shredder mounted on the top of the chamber. The mixed waste will be aerobically digested and pre-treated with the help of indigenous microbes for over a week. The chamber would be facilitated with aeration and mechanical turning to enhance the degradation rate. The overall air requirement and turning frequency in the first chamber are ascertained as $0.05m^3$ per hour, for 20 min in every 72 h. An air-tight valve would be affixed between the chambers to facilitate the downward movement of the substrate. Pre-treated biomass would be further subjected to anaerobic/anoxic digestion for 21 days. Biogas generated from this chamber would be trapped and reinjected back into the same chamber, to enhance the gas pressure required for increased biogas production. Once the methane potential of the substrate gets over, it shall be moved to the final aerobic stabilization chamber. The third chamber also would receive an equivalent air supply and turning frequency as that of the first one. The leachate generated from the entire process shall be collected and recirculated back into the first chamber to ensure zero discharge. The modular design, minimal pumping requirement & power consumption, and concomitant by-product recovery are the salient features of TCGBR.

Keywords: Dry biomethanation, TCGBR, pre-treatment, post-treatment, organic municipal solid waste, slaughterhouse waste.

Oral Presentations

A CRITICAL REVIEW AND ANALYSIS OF FAECAL SLUDGE TREATMENT OPTIONS AT URBAN AREAS AND CITIES IN INDIA TOWARDS SUSTAINABLE DEVELOPMENT OF WATER RESOURCES AND ECO-FRIENDLY POLLUTION CONTROL.

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ABSTRACT

This study conducted to assess the current scenario of Faecal Sludge Treatment Plants (FSTPs) at various States in India and emphasise implementation of FSTP in all cities and urban areas to achieve Sustainable Development Goals (SDG) with respect to sustainable water resources, Open Defecation Free (ODF) country and eco-friendly pollution control. The study aims to show the total savings of expenditure, the government can get, through implementation of Faecal Sludge and Septage Management (FSSM) in all urban areas. Meanwhile, India has taken unprecedented initiatives of sanitation schemes since 2014. ODF was declared in 2019 in India. Universal access to toilets was achieved in Urban India through construction of 66 lakh household toilets and more than 6 lakh community and public toilets. Only 40% of urban India connected to sewer networks and number of operational / under construction Sewage Treatment Plants (STPs) are about 1,200. Almost 60% of urban India stands upon On-site Sanitation Systems (OSS). Thus, FSSM enables rapid and cost-effective provision of safely managed sanitation to 100% of the population especially in small and medium cities which have no provision for treatment of faecal sludge and sewerage systems. Through FSSM human waste (excreta) can be managed at INR 200 to INR 250 per capita / annum, while the more comprehensive sewerage system costs INR 7,000 to INR 11,000 per capita / annum. Therefore, FSSM presents an opportunity to rapidly deliver safely managed sanitation at relatively lower cost, which is a viable option to achieve SDG-6.2. This study shows an estimated amount, India can save yearly to the tune of around INR 4,400 billion when 100% integrated FSSM is ensured in entire urban areas. Besides, it can yield reusing of treated water from septage for irrigation and

other purposes as well as using the sludge as manure with co-composting after cost effective sustainable treatment.

Keywords: Faecal Sludge Treatment Plant; Sustainable Development Goal; Open Defecation Free; Faecal Sludge and Septage Management; On-site Sanitation Systems.

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A REVIEW ON IMPACT OF CHEMICAL FERTILZER ON SOIL EROSSION AND PREVENTIVE MEASUREMENT

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ABSTRACT

While water and wind erosion are part of intensive research activities all over the world, soil loss due to crop harvesting (SLCH) is rarely acknowledged. SLCH occurs in tuber and root crops, which were cultivated on at least 1.1 million km² worldwide in 2019. Thus, 8.4% of arable soils were affected by this kind of soil loss which can reach erosion rates of 22 Mg ha^{-1} $harvest^{-1}$. Although these erosion rates are as high as for water and wind erosion, there are only 27 scientific references available that focus on SLCH. Hence, the relationship between possible environmental degradation and perception in science appears to be ambivalent. The aim of this review is to raise awareness of SLCH and harvest erosion. To achieve this aim, firstly the current state of knowledge on SLCH is summarized based on peer reviewed and international references. A special focus is on the rates of SLCH, on available regression equations to calculate the soil losses by harvest and on the environmental effects. Secondly, important research gaps and necessary research activities are identified. It becomes apparent that (i) new data is required which considers developments in harvest techniques and soil management, (ii) data from North Indian, South Indian and Oceania is urgently needed as no references for these regions are available yet, (iii) models to predict SLCH are necessary and (iv) research is required on the fate of the adhering soil within the landscape and on its environmental effects.

Keywords: herbicides, human health assessment. Soil contamination, environmental rich assessment

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A REVIEW ON ADVANCEMENT AND SUSTAINABLE TECHNOLOGY IN DEVELOPING NANOCOMPOSITES FOR TREATING INDUSTRIAL WASTEWATER

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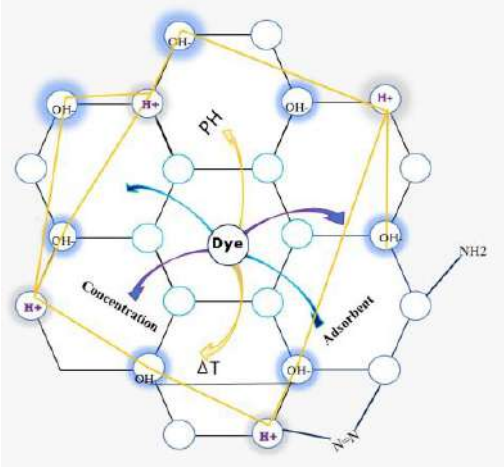
ABSTRACT

Water contamination is one of the most unpropitious issues facing globally. Since, the industrial effluent waste water drains into water bodies increasing the concentration of heavy metal in the human body causing health and environmental hazard. Some of heavy metals creates adverse impact on living organisms and ecosystem when exposed to high concentration. They might exist in food supply chain and in wastewater, that necessitate the need of modern treatment technologies. Many industries across the world lack sufficient sustainable technologies to provide proper water treatment in affordable cost. This has represented a critical risk to the overall climate, where the harmful dyes and heavy metals incorporated into human consumption water in a superficial level that leads to collapsing the ecosystem. In order to surpass these issues, any trade effluents before dumping into waterbodies or public places, must be treated to reduce its toxicity, in addition usage of safe mode of collection of waste. Current study prompts the improvement of different waste water treatment frameworks. To maintain the continuous processing in effective manner, nanocomposites play a major role to eliminate industries contaminants i.e., heavy metals, dying pigments. And experts are working on developing a variety of nanomaterials that have a high potential for adsorption of contaminants. Moreover, nanocomposites are widely used in wastewater treatment which have a large surface area, a high adsorption limit, high mobility in arrangement, reactivity, and their small size encourages its application in waste water treatment. In addition, the present preceptive thoroughly examines the use of advance nanocomposites-based materials for water treatment for the removal of heavy metals and dyes. In the present review, primary focus is on the studies related to adsorption-based nanocomposites and several types of nanocomposites to remove heavy metal/dyes. Further, various principle methods involved such as ion exchanges, membrane filtration, precipitation, and coagulation methods and mechanism involved in adsorption on composites aspects i.e.,

isotherm followed by kinetics were compared. Future more, this review highlights the factor effecting adsorption nanocomposites and future sustainable aspects of nanocomposite's/nanomaterials in treatment of waste water to eliminate dyes and heavy metals.

Keywords: Nanocomposites, Adsorption, Heavy metals, dyes, Waste water treatment.



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A REVIEW ON BIO-ACTIVE MATERIAL SYNTHESIS FROM INDUSTRIAL WASTE

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ABSTRACT

Industrialization and urbanization have led to an increased accumulation of waste materials that needs to be transformed in to a nutrient rich and high-quality product. The dairy industry is one of the largest global producers of wastewater and generates huge volumes of dairy processing sludge, which can be converted in to Bio-fertilizer by treated the DPS using earthworm. Vermicast produce by earthworm use as a carrier material for Biofertilizer production. Fertilizers are an effective way to improve crop production on arable land. A country may become self-sufficient in food production by increasing the use of chemical fertilizers, but this has an adverse impact on the environment. The contamination caused by inorganic fertilizer residues is simultaneously receiving greater attention worldwide. Increased use of hazardous chemical fertilizers poses a great concern for the future of agriculture. Biofertilizers are defined as products containing living microorganisms that, when added to soil, seeds, or plant surfaces, expand the rhizosphere or the internal tissues of plants, triggering plant growth. Bacteria use for fertilizer production capable of nitrogen fixation, phosphate solubilization, plant hormone synthesis, or decomposition of organic compounds would fall into this category. Bio-fertilizer are a promising alternative to hazardous chemical fertilizers and play a key role in increasing crop yield and maintain long term soil fertility, which is essential for meeting global food demand. Reuse of waste to produce valuable product can fulfil the concept of circular economy.

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A REVIEW ON BIOMASS AND WIND AS RENEWABLE ENERGY FOR SUSTAINABLE ENVIRONMENT

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ABSTRACT

As the population is increasing at a rapid pace we now need to find ourselves in a position where cities are using a growing amount of renewable energy. Renewable energy is the key to help alert climate change and this approach must be sustainable. This review analysis the potential of wind, biomass and hybrid system in the field of renewable energy production. Initially the manuscript addressed the feed stocks and their potential for different bio-fuel such as bio ethanol, bio-diesel, bio-methane, bio-hydrogen and bio-hythane from the biomass. A focus on long term energy sustainability of wind and biomass based hybrid configuration with wind and its various design factors, problems, graphs were examined To identify biomass based hybrid energy system can provide a cost effective and environment beneficial alternative particularly for off grid rural electrification. This study provides designers academicians and policymakers with the information on the most recent design restriction on the factors related to biomass wind hybrid energy system.

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ADSORPTION OF ANTIBIOTIC ENROFLOXACIN BY BIO WASTE DERIVED CARBON CHAR POST CHEMICAL ACTIVATION

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ABSTRACT

This study underlines the activation by chemical treatment on the biochar derived from sugarcane bagasse (*Saccharum officinarum*) (CASBB), a common bio-waste material, widely available in local market places. It focuses upon the sorptive expulsion by CASBB of the toxic pharmaceutical compound, enrofloxacin (ENX), which is found to make it's way into water bodies in the form of extra medicinal effluent from the pharma industries and consumer's excreta. Dried biomass was carbonised in a muffle furnace to obtain biochar. Post carbonization, acid activation on raw biochar was affected by impregnating it with 85%(w/w) orthophosphoric acid (H_3PO_4). Through a number of sequential batch process studies, the effects of some crucial parameters were evaluated on the adsorption of the aquatic pollutant ENX, up into CASBB. The parameters measured were: Resident time (2-24 hours); Stirring intensity (80-180 rpm); pH (2-9); initial ENX concentration (4-25 mgL^{-1}); temperature (15-35°C); and adsorbent dosage (0.05-0.3g). The highest ENX elimination rate was 95.8% when ENX initial concentration was 10 mgL^{-1}, pH was 7, temperature was 30°C, adsorbent dose was 0.2g or 6.67 mgL^{-1}, agitation speed was 160 rpm, and the resident period was 6 hours. The best fit to the kinetic data is represented by the pseudo-2nd order kinetic model. The isotherm data showed the best suit for the Langmuir model. The current sorption experiment upheld an appreciable level of spontaneity as per the exothermal process of thermodynamics, conforming to the feasibility of the process. Repeat usability of regenerated adsorbent, was found to be 87.56%; even till fourth cycle. Finally, the spent-up adsorbent was disposed of by subterrain engraving, complying to safe disposal guidelines of World Health Organization. The cost sheet for developing the adsorbent, considering the reusability potential, proved it's manufacture is viable commercially. Conclusions appear to favour the usage of chemically activated sugarcane bagasse biochar for the sorptive elimination of ENX from aquatic medium.

Keywords: *Saccharum officinarum*, Sorption; Enrofloxacin, Reusability.

ASSESSING SURFACE WATER QUALITY FOR DRINKING WATER SUPPLY USING GIS BASED WATER QUALITY INDEX (WQI) IN BAITARANI BASIN, ODISHA

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ABSTRACT

Agriculture, industry, human and animal needs, and river infrastructure all depend on them. Untreated sewage and other types of pollution have been released into major rivers around the world, including those in the Baitarani Basin, as a result of increased industrial activity and rapid human population in semi-urban and metropolitan cities. Since the dawn of human civilization, anthropogenic and natural processes have continued to contaminate the water supply. Environmental degradation and declining water quality are major world concerns. 13 locations were observed seasonally in this study to determine how monsoonal precipitation affected environmental factors and the Water Quality Index (WQI). Over the course of a year, sampling technique was employed in the pre-, monsoon, and post-monsoon phases (2020-2021). Various physicochemical parameters, like TDS, TSS, EC, DO, PH, Turbidity, Alkalinity, SO_4^{2-}, NO_3^-, BOD, TH, HCO_3^-, Ca^{2+}, Mg^{2+}, PO_4^{3-}, Cl^-, Na^+, K^+ and Fe were examined to determine whether water was suitable for a range of applications. The readings for pH, EC, TDS, TH, main cations, and DO were all noticeably under BIS and WHO recommendations. Turbidity, TSS, and, in certain cases, BOD values were all above the permissible threshold, implying contaminated waterways. Utilizing the measured values, the Kriging methodology was used to create interpolated maps for each component, and the WQI algorithm was used to estimate the water purity. The findings indicated that the WQI values ranged from 18 to 60 in pre-monsoon phase, from 17.92 to 59 in the monsoon, and from 20 to 78 in the post-monsoon timeframe. The results revealed that the water quality fluctuated between average and good mostly in chosen sites and that pollutants rises from upstream to downstream. Principal component analysis (PCA) and the clustering technique (CA) were also used. These techniques were performed to analyse the state of the water for effective management. The sampling locations are grouped by CA into homogeneous clusters with comparable behaviours. The river's water quality can be described

using PCA by identifying key factors that are relevant to each season. PCA was successful in explaining 76%, 74%, and 72% of the overall cumulative variation in water quality over the course of the year. The PCA results showed that the most significant factors affecting water quality were BOD, Fe, turbidity, and TSS. Significant contributors to river water pollution have been highlighted as fertilizers, home and industrial wastewaters, land degradation, soil leaching, organic contaminants, and environmental contamination. The quantifiable benefits, however, varied different seasons. The calculated rates of the criteria and the WQI clearly demonstrate that the Baitarani River water demands a suitable treatment procedure as well as actions to prevent to stop the deteriorating water quality. Appropriateness of methodologies for planning and designing related to sampling sites for regulating water quality management initiatives in river basins. To improve health and protect water resources and the environment, strict rules and regulations must be implemented in order to protect this water resource from pollution.

Keywords: Baitarani Basin, anthropogenic, Water Quality Index, Principal analysis, clustering.

BIOFERTILIZER FROM EXTRACTS OF SEAWEED BLENDED WITH COAL WASHERY REJECTS

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ABSTRACT

The coal washery rejects the major environmental hazard during the process of coal washing. Our work aims to convert the coal washery rejects into bio-fertilizer by adding them with seaweed which can pave the way to sustainable development by utilizing these wastes for plant growth. The seaweed and seaweed blended with coal rejects of different ratios were made into liquid extracts by the alkali extraction method using potassium hydroxide and have been completely analyzed for the nutrients present in it. From the analysis report, one of the ratios contains a high percentage of potassium along with other elements such as sodium, Nitrogen, carbon, etc. compared to the seaweed liquid extract. This liquid extract with nutritional compounds can efficiently promote the growth and productivity of plants. The liquid extract which is a combination of seaweed with coal rejects can be applied to plants via Foliar spray could serve as an ideal biostimulant and a potential alternative to hazardous chemical fertilizer in green agriculture.

Keywords: Seaweed, Coal washery Rejects, Organic Fertilizer, Nutrients.

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BIOREMEDIATION OF DISTILLERY EFFLUENT USING A NEWLY ISOLATED BACTERIAL STRAIN, BACILLUS PARAMYCOIDES HC08 AND PHYTOTOXICITY EVALUATION FOR ENVIRONMENTAL SAFETY

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ABSTRACT

The water and soil resources are severely polluted by the untreated or partially treated distillery effluent (DE) creating an environmental concern due to presence of numerous water soluble, recalcitrant, and coloring chemicals, primarily melanoidins. Therefore, DE must be properly treated and detoxified before it may be dumped into the environment as per the stringent environmental regulations worldwide. This study examines the decolorization and detoxification of DE from distillery industry by a newly isolated laccase producing bacterial strain HC08. The bacterial strain HC08 was isolated from the soil/sludge contaminated by DE. As per the biochemical and 16S rRNA gene sequencing analysis, the bacterial strain HC08 was characterized and identified as *Bacillus paramycoides* HC08. According to bioremediation experiment, after 144 hours of treatment at 35°C, pH 7 and 120 rpm, the bacterial strain, *Bacillus paramycoides* HC08 substantially decreased pollution loads (color: 72%, lignin: 66%, BOD: 92%, COD: 82%, and phenol: 86%) in real DE in the presence of 0.5%, glucose; 0.5%, peptone; 0.05%, MgSO4; 0.05%, K_2HPO_4. The fourier transform infrared (FT-IR) spectroscopy, high-performance liquid chromatography (HPLC) and gas chromatography-mass spectrometry (GC-MS) analysis demonstrated that the vast majority of chemicals present in the untreated sample were entirely eliminated and that only a small number of metabolites were produced after bacterial treatment. The detoxification of DE was investigated using a phytotoxicity test using the seeds of mung bean (*Phaseolus aureus* L). In phytotoxicity tests, seed germination (%), root length, shoot length, root: shoot ratio, seed vigor index (SVI), were improved in bacterially treated seeds and phytotoxicity (%) were lowered as compared to the seeds irrigated with untreated DE with different concentrations of 25, 50, 75, and 100 (%, v/v). The results imply that bacterial strain, *Bacillus paramycoides* HC08 successfully alleviated the phytotoxic effects in mung bean (*Phaseolus aureus* L). Thus, bacterial strain, *Bacillus paramycoides* HC08 could be a viable bacterial culture for bioremediation of DE for environmental safety and public health protection.

Keywords: Distillery effluent, Bacteria, Bacillus paramycoides, Degradation, Phytotoxicity

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CHLORINE RESISTANCE MECHANISM FOR SURVIVAL STRATEGY

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ABSTRACT

Chlorination is the most widely practiced method of disinfection for potable waters since the turn of century, and principal means by which the microbial quality of water is maintained in water distribution sites. This study aimed to describe the isolation, identification, and characterization of chlorine resistant bacteria, and to understand the mechanism behind chlorine resistance. The sensitivity of all isolates towards chlorine stress was determined, and a total of nine isolates that showed resistance to 20 ppm chlorine concentration were selected for this study. The following organisms were identified: KB1 (*Acinetobacter baumannii,* MT994588), DB4 (*Serratia marcescens,* MW013141), 3929-1 (*Serratia marcescens,* MW149491), NA4-2 (*Acinetobacter pittii*, MT994257), IA2 (*Acinetobacter baumannii*, MT974422), 1750 (*Serratia marcescens*, MT974429), NA3-2 (*Acinetobacter junii*, MT974430) and NA4-1 (*Acinetobacter junii,* MT993631). As per reports, presence of antibiotic resistance, biofilm production, and antioxidant assays can be correlated to chlorine resistance; therefore, assays for the same were carried out. As per antibiotic resistance profile, DB4 showed resistance to 6 antibiotics, followed by 1750 which showed resistance to 5 antibiotics. However, only NA 3-2 showed biofilm production. In addition, NA 3-2 showed increased catalase, superoxide dismutase, and ascorbate peroxidase activity, whereas 3929-1 showed increased guaiacol peroxidase activity which might be their mechanism for survival. These results indicate that a differential mechanism was adapted by organisms to combat chlorine stress.

Keywords: Chlorination, AST, biofilm, antioxidant assays, reactive oxygen species

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COMPREHENSIVE BIOLOGICAL TREATMENT OF PETROLEUM OILY SLUDGE FROM PETROLEUM INDUSTRY

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ABSTRACT

The extensive use of petroleum products results generation of huge amount of petroleum waste. Petroleum sludge (PS) is one of the significant solid wastes produced from the petroleum refinery industry. PS is a complex mixture of waste oil, waste water, sand, mineral matter, and considered as hazardous waste according to Environmental Protection Act due to its mutagenetic, carcinogenic properties. The effects results towards the numerous impacts towards living beings, ecological disasters, and environmental issues. Therefore, effective treatment of petroleum oily sludge has attracted widespread attention. Till date number of physicochemical methods such as incineration, forth flotation, solvent extraction, pyrolysis and ultrasonic treatment have been implemented to treat the PS. Generation of secondary pollutants, high chemical consumption, and high energy utilization are the major drawbacks of these methods. Owing to these issues, biological methods are considered as cost-effective, eco-friendly and efficient to treat PS. Bioremediation of petroleum hydrocarbon pollutants showing a promising approach by the use of microorganism among all the tested methods. This research work elaborates the various biological methods such as bioaugmentation, biostimulation and combinatorial bioaugmentation and biostimulation for remediation and treatment of petroleum sludge. This paper work also provides the literature survey on efficiency, knowledge gap, and future scope of each method.

Keywords: Petroleum sludge, Bioremediation; Bioaugmentation; Biostimulation.

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DEGRADATION AND DETOXIFICATION OF PULP PAPER MILL EFFLUENT USING A NEWLY ISOLATED BACTERIAL STRAIN, BACILLUS CEREUS GS123

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ABSTRACT

The water and soil resources are severely polluted by the untreated or partially treated effluent released by the pulp paper mill industries. Pulp paper mill effluent (PPME) must be properly treated and detoxified before it may be dumped into the environment as per the stringent environmental regulations worldwide. Therefore, this study examines the decolorization and detoxification of effluent from pulp and paper mills by a bacterial strain GS123 with ligninolytic enzyme (lignin peroxidase) activity. The bacterial strain was isolated from the soil/sludge contaminated by pulp and paper mill effluent. As per the biochemical and 16S rDNA gene sequence studies, the bacterial strain GS123 was identified as *Bacillus cereus* GS123. According to bioremediation experiment, after 144 hours of treatment at 35°C, pH 7 and 120 rpm, the bacterial strain, *Bacillus cereus* GS123 substantially decreased pollution loads (color 73%, lignin 62%, COD 84%, and phenol 92%) in real effluent. The fourier transform infrared (FT-IT) spectroscopy, high-performance liquid chromatography (HPLC) and gas chromatography–mass spectrometry (GC-MS) examination demonstrated that the vast majority of chemicals present in the untreated sample were entirely eliminated and that only a small number of metabolites were produced after bacterial treatment. The detoxification of effluent was investigated using Allium cepa L. (onion) root tip cells in genotoxicity assays. In genotoxicity tests, root tip cells were evaluated for mitotic index (MI), chromosomal aberrations (CA), and nuclear abnormalities (NA) following treatment with effluent concentrations of 25, 50, 75, and 100 percent (v/v). The results imply that bacterial strain, *Bacillus cereus* GS123 successfully alleviated the genotoxic effects in Allium cepa L. (onion) root tip cells. Thus, bacterial strain, *Bacillus cereus* GS123 could be a viable bacterial culture for bioremediation of PPME for environmental safety and public health protection.

Keywords: Pulp paper mill effluent, Bacteria, Degradation, Bacillus cereus, detoxification,

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DEGRADATION, DECOLORIZATION, AND DETOXIFICATION OF TEXTILE DYEING EFFLUENT USING A NEWLY ISOLATED BACTERIAL STRAIN, BACILLUS ALBUS KTS12

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ABSTRACT

Textile dyeing effluent (TDE) from wet processing units is a major environmental problem as it contains a variety of chemical, pigments, suspended solid, heavy metals and recalcitrant organic pollutant released into the environment. TDE is therefore must be properly treated and detoxified before it may be dumped into the environment as per the stringent environmental regulations worldwide. This study examines the decolorization and detoxification of TDE from textile industries by a newly isolated bacterial strain KTS12 with high ligninolytic enzyme (lignin peroxidase) activity. The bacterial strain, KTS12 was isolated from the soil/sludge contaminated by textile dyeing effluent. As per the biochemical and 16S rDNA gene sequence analysis, the bacterial strain KTS12 was identified as *Bacillus albus* KTS12. According to bioremediation experiment, after 144 hours of treatment at 35°C, pH 7 and 120 rpm, the bacterial strain, *Bacillus albus* KTS12 substantially decreased pollution loads (color: 78%, BOD: 92%, COD 86%, and phenol 88%) in real effluent. The fourier transform infrared (FT-IT) spectroscopy, high-performance liquid chromatography (HPLC) and gas chromatography-mass spectrometry (GC-MS) examination demonstrated that the majority of chemicals present in the untreated TDE sample were entirely eliminated and that only a small number of metabolites were produced after bacterial treatment. Further, the detoxification of TDE was investigated using Allium cepa L. (onion) root tip cells in genotoxicity assays. In genotoxicity tests, root tip cells were evaluated for mitotic index (MI), chromosomal aberrations (CA), and nuclear abnormalities (NA) following treatment with TDE concentrations of 25, 50, 75, and 100 percent (v/v). The results imply that bacterial strain, *Bacillus albus* KTS12 successfully alleviated the genotoxic effects in Allium cepa L. (onion) root tip cells. Thus, bacterial strain, *Bacillus albus* KTS12 could be a viable bacterial culture for bioremediation of TDE for environmental safety and public health protection.

Keywords: Textile dyeing effluent, Bacteria, Bacillus albus, Degradation, detoxification,

DISINFECTION OF SHIGELLA DYSENTERIAE FROM MUNICIPAL TAP WATER USING FENTON-LIKE PROCESS

Pranjal

ABSTRACT

Water borne illness are the emerging pandemic in the coming world. Many dreadful pathogens are carried and spread through water. At the same instant these pathogens are developing resistance to most of the antibiotics. This alarming situation calls for development of some techniques which not only eliminates the microbes but also destroys its antibiotic resistant genes. Advanced oxidation process is the best option to this tackle this. The production of reactive oxygen species is the key feature of this type of process. They disinfect the bacteria from water along with eliminating their drug resistant gene. Here, the disinfection pattern of *Shigella dysenteriae* has been seen from tap water using Fenton like process. The parameters were optimized to give the best result. Effect of single and multi-parameters on the inactivation process was observed. The concentration of each reagent was optimized. Ionic composition of tap water also favors and speeds up the process and reactive oxygen species(ROS) formation. Hence, importance of water source was established.

DUAL EMITTING POLYMER-CARBON DOTS COMPOSITES FOR SENSOR APPLICATION

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ABSTRACT

Carbon dots, considered quasi-spherical carbon nanoparticles, are composed of carbon, oxygen, and hydrogen atoms with a size of fewer than 10 nanometers. Since their discovery, Carbon Dots, a new class of carbon-based nanoparticles have drawn a lot of attention due to their excellent mechanical, chemical, and fluorescent characteristics as well as their great photostability and biocompatibility. The emission characteristics of carbon dots have already found various potential applications in which bio-imaging and sensing are major highlights. In addition to their high emission efficiency, CDs are nontoxic and can be synthesized through a variety of green chemistry processes. It is challenging to develop a biocompatible, widely adopted fluorescence imaging probe with emission beyond the cellular and tissue auto-fluorescence interface. In a simple one-step carbonization process, Citric acid as the carbon source and a non-essential amino acid were heated in multiple ratios and further washed and dried to get the multiple color-emitting CDs. The present finding deals with a simple and low-cost fabrication of brightly fluorescent and multiple color emitting carbon dots having blue and green emissions in different wavelengths in UV regions. These CDs can be used for the fabrication of novel photo-luminescent materials as well as in bio-imaging due to their excellent biocompatibility.

EVALUATION OF ANTIMICROBIAL ACTIVITY AND MECHANISM OF BIOGENIC SILVER NANOPARTICLES AND ITS BIOCOMPATIBILITY TOWARDS MAMMALIAN CELL

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ABSTRACT

Rapid increases in the infectious diseases along with increase in drug resistant pathogenic microorganisms are considered as major health concern. Hence development of alternative therapeutic procedures like nanoparticle based therapy receiving much attention now a day. Based on this aspect, in the present work we have investigated the antimicrobial efficiency of Ag NPs. Green synthesis protocol was designed for synthesis of Ag NPs. Ag NPs was successfully synthesized using *Aloe vera* and *Andrographis paniculata* plant leaf extracts. Morphology of the nanoparticles is investigated using Transmission Electron Microscope (TEM) and found to be cubic and spherical. EDAX study has revealed the presence of Ag elements in nanoparticles. Size distribution of nanoparticles is characterized by using Dynamic Light Scattering (DLS) method. The synthesized nanoparticle has shown antimicrobial property against *Candida krusei* and *Staphylococcus aureus* at 100 and 200µg/mL of Ag NPs. Experimental study results antimicrobial activity of nanoparticles due to generation of reactive oxygen species (ROS). Cytotoxicity evaluation confirmed the NPs have maintained highly antimicrobial activity with reduced toxicity against 3T3 primary mouse fibroblast cells. Obtained results suggest the possible effective use of synthesized nanoparticles in different biomedical applications.

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EXPLORATION OF MULTI POLLUTANT REMEDIATION POTENTIAL OF LANDFILL BACTERIA

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ABSTRACT

Landfill remains a major issue of concern for being the leaching source of unique blend of toxic, recalcitrant pollutants including multiple heavy metals, plastics and their additives, posing serious threat to our environment. Bioremediation is the most cost effective, convenient and environment friendly path of tackling these pollutants. Dynamic distribution of these toxic pollutants claims the landfills to be the storehouse of potent multi-pollutant remediating bacteria. In the present study landfill sample (soil mixed with water) was subjected to an enrichment culture procedure to obtain heavy metal transforming/removing and plastic degrading microorganism. Following an initial three months' incubation, multiple bacterial strains were recovered as pure culture. These organisms showed varied Cr^{6+} reduction, other heavy metal tolerance/accumulation ability. Eleven of the best chromate reducing bacteria (>30% of 500µM Cr^{6+}, 192 hrs.) showed enhanced efficiency with elevated rate of chromium transformation in presence of heavy metal mix (Ni, Zn, Cu, Cd). Additionally, they were able to utilize bisphenol A as a sole carbon source, and four among them had LDPE metabolizing ability. Optimized biomass concentration, pH, carbon source mix and heavy metal mix demonstrated a 97.46% Cr^{6+} reduction in 72 hours by one of the four strains. Cell morphology and bacterial colonization was visualized using scanning electron microscopy in chromium (with heavy metals) and LDPE amended sets, respectively. Fourier Transform Infrared Spectroscopy was used to characterize the variability in LDPE film stability, which was further supported by the increase in roughness parameters of the treated samples as indicated by Atomic Force Microscopy. Bioremediation potential of the selected bacteria were evaluated using Leachate based microcosms.

Keywords: Landfill, Chromium reduction, BPA, LDPE degradation

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EXPLORING THE POTENTIAL OF LANDFILL MICROORGANISMS IN DEGRADATION OF NON-PRETREATED LOW- DENSITY POLYETHYLENE

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ABSTRACT

Landfills are man-made nutrient-rich environment with varied types and levels of toxic, recalcitrant and slowly biodegradable pollutants, including plastics. These environments provide niches for inhabiting microorganisms to execute various catabolic reactions facilitating pollutant biodegradation. Yet, the landfill microbial community and their plastic biodegradation potential is less explored. The present study characterized community composition and plastic biodegradation potential using samples from 36 years old landfill site (Pirana), at Gujarat, India. Following physicochemical characterization and toxic substance profiling, selective enrichment-based strategies were used to exploit potential of landfill microorganisms to utilize non-pretreated low-density polyethylene (LDPE) as carbon source. Nearly 40 strains were isolated from the plastic enriched culture and their resistance to multiple heavy metals (As, Cr, Cd, Ni, Co, Cu, Pb, Zn) at elevated concentrations (5 - 25 mM) and strong biodegradative ability for non-pretreated LDPE were assessed. Ability of these bacterial strains to utilize plastic adjuvants like Bisphenol A, as the sole carbon source was also observed. Four of these bacterial strains affiliated to *Microbacterium*, *Enterobacter*, *Peribacillus*, and *Ralstonia* showed improved survival and ability to colonize on LDPE (as observed by Scanning Electron Microscopy). Atomic Force Microscopy and Fourier Transform Infrared Spectroscopy confirmed that the selected bacterial strains led to significant physical and chemical deterioration of the LDPE film, indicating its biodegradation. A synthetic bacterial consortium was further developed using the selected strains for improved degradation of the non-pretreated LDPE. This study elucidated plastic biodegradation abilities of landfill microorganisms and developed a microbial community for focused degradation of non-pretreated LDPE plastics. Further investigations are carried out to gain mechanistic understanding, including genomic details of the isolated plastics degrading strains for their application in plastic remediation.

Keywords: non-pretreated LDPE, plastics degradation, bioremediation, landfill microbial community, synthetic microbial community

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IDENTIFICATION AND UTILIZATION OF ZINC SOLUBILIZING BACTERIA *CHITINOPHAGA POLYSACCHAREA* MK886725 FOR ZINC NUTRITION OF RICE TO COPE WITH ZINC MALNUTRITION

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ABSTRACT

In the present investigation, total 25 soil samples were collected from rice rhizosphere grown in Zn deficient area of block-Palari (Balodabazar) and block-Dharsiwa (Raipur), Chhattisgarh state, India. Out of 25, total seven isolates of zinc solubilizing bacteria were isolated and assessed for their ability for zinc solubilization in both solid and liquid basal media. Further, on the basis of zinc solubilizing capacity, two best performing isolates (Zn-Lat-4 & Zn-Lat-5) were tested in farmers' fields at Village Kauadih and Latera, block- Palari, Balodabazar,Chhattisgarh sate, India during the year 2019. All isolates were studied for their phenotypic and biochemical characteristics and were confirmed as zinc solubilizing bacteria. All have shown halo zones on agar plates suspended with insoluble zinc. The largest zone diameter of 13.78 mm was attributed to isolate Zn-Lat-4. All isolates showed variation in their zinc solubilizing capacity in broth medium ranges between 8-20 ppm. Isolate Zn-Lat-4 showed the highest Zn solubilization capacity with 19.45 ppm soluble zinc followed by isolate Zn-Lat-5 which solubilized 17.34 ppm zinc. The 16S rDNA gene sequencing of isolate Zn-Lat-4 was identified as *Chitinophaga polysaccharea* and got an accession number MK886725 from NCBI. In farmers' field trial the organism *Chitinophaga polysaccharea* have increased the crop yield by 12.91% and can be used as zinc biofertilizer to mitigate Zn deficiency in rice to cope with zinc malnutrition in humans and to increase rice productivity in Zn deficient areas of India.

Keywords: Rice, Zinc solubilizing bacteria, *Chitinophaga polysaccharea*, Malnutrition.

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IN DEPTH ANALYSIS ON E-WASTE SITUATION IN MUMBAI AND DELHI AND ITS SUSTAINABLE MANAGEMENT

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ABSTRACT

The term E-waste comprises both 'Electronic' and 'Electrical' components which are damaged, rendered useless after exceeding its shelf life or manufactured in surplus.

E-waste sources and contributors include those from both formal and informal sector, viz. smartphones, personal computers (PCs), tablets, televisions (TVs), incandescent lamps etc. Hospitals are also major contributors and their e-discards vary from MRI machines and EKG monitors to batteries and resistors. On the one hand, E-waste contains many precious metals whose recovery and reuse should be a priority in the process of resource-recovery, but on the other hand, many hazardous constituents such as PCBs and dioxins, radioactive isotopes and mercury may negatively impact the environment if not managed properly, and may have hazardous consequences to human health too. Various organizations, government agencies and statutory environment bodies have adopted environmentally-sound options and strategies for E-waste management to tackle the ultimate problem of E-waste disposal. However, due to the burgeoning amount of E- waste generated in populous metropolitan cities like Delhi and Mumbai, the varying nature of the waste and the chemical reaction following thereafter, it becomes imperative to search for an efficient and effective E-waste management practice to minimize the possibilities for hazards and using the best available technology for moving towards resource recovery and waste minimization. This paper presents an in-depth analysis of the varying E-waste composition and waste generation in two metropolitan cities: Mumbai and Delhi; the potential for recovery and reuse of precious metals and other resources recovered from e-waste. The present condition of E-waste management will also be analysed and the alternatives towards sustainable E-waste management in India will be explored within the preview of the Circular Economy objective.

Keywords: E-waste, informal sector, E-waste management, human health, sustainability.

MEMBRANE BIOREACTORS AND ALGAL-BACTERIAL SYMBIOSIS IN WASTEWATER TREATMENT

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ABSTRACT

Water is a primary requirement for almost every kind of life to survive on this planet. With an increase in population-led urbanization and industrialization, there has been an increased load on water resources. The limited water resources are being used for domestic, commercial, industrial and research purposes and hence the generation of wastewater is proportionally high. Treatment facilities to treat various types of wastewaters have evolved greatly ranging from use of biological processes, use of nano technology, advanced chemical and physical process to using all these technologies in compact modular forms to serve as onsite decentralized wastewater treatment systems. Membrane bioreactor (MBR) technology is one such technology which combines biological and physical treatments at a level which is sufficient to treat various types of domestic and industrial wastewater. MBR is popularly known to be effective in treating various contaminants and parameters in wastewater such as suspended solids of various sizes, ammonia, COD, BOD and phosphate along with various other contaminants of organic and inorganic origin. This current study discusses some preliminary results on MBR technology and algal bacterial cultures providing 100% removal of ammonia, nitrate, COD in 6 hours.

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MENSTRUAL HYGIENE AMONG SCHOOL-GOING GIRLS OF RURAL AREA OF MIDNAPUR, WEST BENGAL, INDIA

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ABSTRACT

Background: Menstrual Hygiene Management (MHM) for school girls is a neglected issue in low income nations. Restricted access to water, sterilization and cleanliness in school have made it hard for girls to cleanly and unquestionably deal with themselves during menstrual cycle. The purpose of this study was to determine menstrual hygiene practice among school girls.

Methods: The present cross-sectional study was conducted in Bengali school going girls in rural area of Paschim Midnapore district of West Bengal, India. Data were collected from rural area of Midnapur district. The study was carried out by giving questionnaires to 232 students .Subject selection were 9 to 16 years girls.

Result: 82% sample felt abdominal pain,14% in excessive bleeding and 4% felt breast pain. About 89% of 232 respondents had heard about of menstrual cycle before their menarche. Mother (71%) and freinds (7%) are two vital wellspring of information identified with menstruation cycle before menarche.

It was uncovered that nobody gave any details idea regarding period until their first menstruation. Limitation from religious touch was normal for practically all as Indian and about 93.5% respondents were Hindus. A normal information said that, 97% of the respondents were keeping away from religious function and followed by don't eat certain food (6%), don't preparing food (27%), don't play (39%). They not utilize sanitary pad because of it costly, inaccessibility and trouble of removal. From frequency analysis of menstrual hygiene it was evident that a girl on average changes their absorbents 3 times in a day and cleans their genital 4 times in a day . A significant part of the review was accessibility of latrine in school and home were carried.

Conclusion: Girls should be educated about the facts of menstruation and proper hygienic practices.

Keywords: Knowledge, Menstruation, Practice, Sanitary pads, Hygiene.

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MIGRATORY WATERBIRD COLONIZATION, LIMNOCHEMICAL CONDITIONS AND EFFECT OF GUANOTROPHIC NUTRIENT LOADINGS ON HABITAT QUALITY IN WINTERING HABITATS ON CENTRAL ASIAN AND EAST ASIAN-AUSTRALASIAN FLYWAYS IN WEST BENGAL, INDIA.

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ABSTRACT

Nutrients (mainly nitrate and phosphate) in the guano of the aquatic birds might alter the water quality in freshwater wetlands and, thus, waterbirds could play a considerable role in nutrient loadings in these wetlands. We recorded the changes in the abundance of waterbirds for consecutive two wintering seasons, October through March (2018-2019 and 2019-2020), in four wetlands of Bankura and Purulia district in West Bengal, India, on Central Asian and East Asian-Australasian Flyways. This study aimed to assess the monthly variation in the physico-chemical parameters along with total guano and nutrient loadings by waterbirds. Waterbird species varied from 37 to as high as 61 in the wetlands. Three vulnerable (VU) and one critically endangered (CR) species were recorded from the wetlands. Overall guano loading in the study tenure varied from 50.2 kg month^{-1} to 2979.1 kg month^{-1} depending on the wetland resources and the abundance of waterbird species. In most cases, total guano loading showed significant positive correlations with both total N and P loading, and consequently with the nitrate and phosphate concentrations. Physico-chemical conditions of the water were also observed to influence nitrate and phosphate concentrations. Anthropogenic sources also effected the nitrate and phosphate concentration. In all four wetlands, guano and nutrients added by herbivorous waterbirds were much higher than the carnivorous and omnivorous waterbirds due to the manifold higher abundance of herbivorous waterbirds. Avian guanotrophy in the wintering season conceivably sustained the nutrient prerequisites of the wetland ecosystem for the rest of the year and it has a profound effect on smaller wetlands as it can lead to eutrophication. However, sustainable management of these wetlands depends on the delicate balance of two factors, guanotrophic nutrient addition and fitness to attract the migratory waterbird populations during the wintering period.

Keywords: Guanotrophication, Habitat Quality, Nutrient loading, Eutrophication, Migratory birds.

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PHYCOREMEDIATION OF TEXTILE EFFLUENT USING A NEWLY ISOLATED MICROALGA STRAIN, *SCENEDESMUS* SP. GS-NVNTRY03 AND ECOTOXICITY ASSESSMENT

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ABSTRACT

The water and soil resources are severely polluted by the untreated or partially treated textile effluent (TE) creating an environmental concern due to presence of numerous recalcitrant, and coloring chemicals, primarily dyes. Therefore, TE must be properly treated and detoxified before it may be dumped into the environment as per the stringent environmental regulations worldwide. This study examines the phycoremediation and detoxification of TE from textile industry by a newly isolated microalga strain, **GS-NVNTRY03 that was** isolated from the water samples of Renuka Lake, Sirmour, Himachal Pradesh, India. As per the biochemical and 18S rRNA gene sequencing analysis, the microalga strain **GS-NVNTRY03** was characterized and identified as ***Scenedesmus* sp. GS-NVNTRY03.** For phycoremediation, a self-fabricated vertical photobioreactor (v-PBR; working capacity: 2 L) was used for the treatment of TE. The operating conditions were: treatment duration: 12 days and temp: 25-28°C under a 12/12h light/dark cycle in cool-white fluorescent light illumination at 1000-4000 lux. In all of the examined cycles, 68-72% of the color and 76-81% of the COD from the textile effluent was removed. The results showed that microalgae have successfully acclimated to TE and have increased biomass output by roughly 28%. The detoxification of TE was investigated using a phytotoxicity test using the seeds of mung bean (*Phaseolus aureus* L). In phytotoxicity tests, seed germination (%), root length, shoot length, root: shoot ratio, seed vigor index (SVI), were improved in bacterially treated seeds and phytotoxicity (%) were lowered as compared to the seeds irrigated with untreated TE with different concentrations of 25, 50, 75, and 100 (%, v/v). The results imply that microalga strain, ***Scenedesmus* sp. GS-NVNTRY03** successfully alleviated the phytotoxic effects in mung bean (*Phaseolus aureus* L). Thus, microalga strain, ***Scenedesmus* sp. GS-NVNTRY03** could be a viable option for phycoremediation of TE for environmental safety and public health protection. Overall, the results suggest the importance of unicellular green alga as an environmental preservation system.

Keywords: Textile effluent, Microalgae, Scenedesmus sp., Phycoremediation, Ecotoxicity

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POINT SOURCES AS MAJOR CONTRIBUTORS OF ANTIBIOTIC POLLUTION: A QUANTITATIVE ASSESSMENT OF ANTIBIOTICS

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ABSTRACT

The major contributors to antibiotic pollution can be classified into point and non-point sources. The point sources include hospital wastewaters, WWTP effluents, WWTP biosolids, etc., which are the major contributors to antibiotic pollution in the receiving water bodies, contaminating different environmental domains such as soil and surface waters, groundwaters, sediments, microbiota, and drinking water. Antibiotic pollution has posed a major global threat. This issue insights concerned with the inherent capabilities of bacteria possessing antibiotic resistance and the assessment of the post-therapeutic effects on biological systems before the treatment with antibiotics. The unprecedented advantage of antibiotics in medical healthcare is undeniable; however, pharmaceutical residues are widespread and occasionally found in surface water with inherent bioactive properties. The trace amount of antibiotics in the aquatic ecosystem is a great challenge for water quality assessment due to their toxic impact on non-target organisms. The dissemination of various antibiotics in different environmental domains occurs via both point and non-point sources, but the point sources are the major contributors to the omnipresence of antibiotics. Animal farms and veterinary hospitals are the main point sources that contribute to the contamination of water with antibiotics and their metabolites. Such compounds entering the environment in active form could induce antibiotic resistance in bacteria, which could pose a major problem to human health. Animal farming and the veterinary sector utilize a huge amount of antibiotics as the demand for animal products, especially meat, has increased to a much greater extent. The objective of this work was to analyze antibiotic contamination in wastewater through various point sources, as these are the starting points for disseminating antibiotics into the environment. For this study, nine antibiotic reference standards were chosen (Ciprofloxacin, Amoxicillin, Ampicillin, Sulfamethoxazole, Chloramphenicol, Tetracycline, Ceftriaxone, Metronidazole, Trimethoprim). The samples were collected from the College of Veterinary Science, including the Hospital waste sample. The samples were concentrated via solid phase extraction, and then they were analyzed in the HPLC-UV system.

Keywords: HPLC-UV, Antibiotics, Emerging pollutants, Solid Phase Extraction, Pharmaceuticals

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PRACTICAL ASPECTS OF SINGLE USE BANE PLASTIC THERMOCOL (STYROFOAM) POLLUTING ENVIRONMENT WITH NO SOLUTION

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ABSTRACT

Thermocol is produced from complex material called polystyrene a synthetic polymer made from monomers of the aromatic hydrocarbon styrene. It transforms into liquid state on heating at more than 100°c and returns to solid state on cooling.

Thermocol ecologically dangerous, Non-bio-degradable ,Non Recyclable leads to polluting Air, Water and Soil The government has issued a list of single-use plastic items that are banned include polystyrene (thermocol) for decoration, candy sticks, plastic flags, ear buds with plastic sticks, plastic straws, spoons, trays, packaging films around sweet boxes, invitation cards, plastic or PVC banners which are less than 100 micron. Burning thermocol is extremely dangerous as it releases toxic gases including carbon monoxide and styrene vapours. is cancerous "Polystyrene, also known as Styrofoam, poses a great danger to landfills. India already ban the manufacture, import, stocking, distribution, sale and use of identified single-use plastic (SUP) items, which have low utility and high littering potential, all across the country from July 1, 2022. Solution is bane should be practically implemented to save Environment from Thermocol.

Keywords: Thermocol, Non-Bio-degradable,Non Recyclable, Pollution, Bane.

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PRODUCTION OF CRUDE FUNGAL ENZYMES AND THEIR APPLICATION IN PRETREATMENT OF ALGAL BIOMASS FOR BIOFUEL PRODUCTION

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ABSTRACT

Fungal enzymes have shown a wide range of applications in recent times due to their extensive mechanism applicable in various industries. An exciting approach of fungal enzymes pertains to its application for the pretreatment of algal biomass to produce biofuels as an alternative to conventional petroleum-based fuels. Today, one of the major challenges in biofuel production is the hydrolysis of algal biomass to obtain potential precursors for biofuel production. In this context, biological pretreatment offers an effective method for biomass deconstruction compared to conventional means (physical and chemical). The cell wall of algal biomass is made of cellulose, hemicelluloses, xylans, and other polysaccharides. Therefore, fungal species are appropriate in biological pretreatment as they can naturally produce enzymes such as cellulase, xylanase, amylase, pectinase, chitosanase, and achromopeptidase that can degrade the algal cell wall without hampering the internal cell constituents. One of the significant advantages of utilizing fungal enzymes over other methods is its higher efficiency and downstream yields. The present paper aims to evaluate various agro-residual wastes such as corn cob, rice straw, dry leaves and sugarcane bagasse utilized for the growth of different fungal strains, along with the enzymes that can be focused on the application of pretreatment of algal biomass. Among three fungal strains *Rhizopus oryzae* (RO), *Aspergillus lentulus* (AL), *Aspergillus fischeri* (AF) considered for crude enzyme production. AL has shown the best yield with an enzyme activity 5.784 FPU mL−1 (cellulase activity), 0.0613 IU mL−1(xylanase activity), 5.0613 IU mL−1(glucoamylase activity) on corn cob ≤50 micron. On treating the algal cells *Chlorella pyrenoidosa (CP)*, *Chlorella sorokiniana (CS)*with the crude enzyme of AL for 48 hours about 90% cell death was encountered. Moreover, to 55%- 65% of total sugar and COD of biomass yield was observed. Hence utilizing crude fungal enzymes shows potential role in disrupting the algal cell wall and holds great industrial application.

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REMOVAL OF TOXIC DYES USING INDUSTRIAL WASTE : A SHORT REVIEW

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ABSTRACT

Wastewater effluents from different industries such as textiles, leather, rubber, paper and plastics, contain several kinds of synthetic dye stuffs. Discharging even a small amount of dye into water can affect aquatic life and food webs due to the carcinogenic and mutagenic effects of synthetic dyes. Synthetic dyes are difficult to biodegrade due to their complex aromatic structures, which provide them physico-chemical, thermal and optical stability, thus bringing some difficulties for the treatment of these dyes. Hence, it is imperative that a suitable treatment method should be devised. In recent years, many methods including coagulation and flocculation, reverse osmosis, chemical oxidation, biological treatments, photodegradation, and adsorption, have been developed for treating dye containing wastewater. Among various treatment technologies, adsorption technique is quite popular due to its simplicity and high efficiency, as well as the availability of a wide range of adsorbent.in this paper we use PG as adsorbent to treat dye water. Phosphogypsum is a high volume solid waste by-product generated when sulfuric acid reacts with the phosphate rock during manufacturing of phosphoric acid and phosphate fertilizers. World production of this waste exceed 200 milion tons per year. PG discharges to the water bodies contains toxic elements, heavy metals and radio nucleosides harmful to eco system and human health and there for concern regarding environmental impact. Phospogyosum can be used agricultural fertiliser as well as bricks making. Due to its porosity we have taken phosphogypsum as adsorbent. And tries to optimising it by taking different concentration of PG, in different dye concentration, at different ph.

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RESPONSE SURFACE OPTIMIZATION ON FERMENTATIVE PRODUCTION OF ACETIC ACID FROM CHEESE WHEY ALONG WITH VALUABLE BY-PRODUCT GENERATION

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ABSTRACT

Conventional acetic acid production and purification routes using chemical technology are energy-intensive due to involvement of a number of unit operations like distillation, absorption, evaporation, condensation [1,2]. This is why experimental investigations were carried out in a membrane-integrated hybrid bio-reactor system for direct and continuous production of acetic acid and whey protein from waste cheese whey under response surface optimized conditions. In this novel scheme of fermentative production, using *Acetobactor aceti* [2116], the major operating parameters were optimized to improvise the production of acetic acid. Simultaneous production of whey protein powder added economy to the process. Findings indicate that acetic acid could be produced directly and continuously from waste cheese whey with high productivity, yield and purity under response surface optimized conditions, in a simple, flexible, energy-saving and environmentally benign membrane-integrated hybrid reactor system.

SYNTHESIS OF VALUE ADDED BIO-ACTIVE MATERIALS FROM AGRO-BIOMASS

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ABSTRACT

Rice is a major staple food for many Asian countries, the utilization of the rice straw residue for fuel and chemicals would be very economical. In the production of rice, a large amount of solid residue is produced, for which alternative utilizations are scarce or are not commonly applied in industry. Rice straw (RS) is a waste product of rice harvest that is generated in equal or greater quantities than the rice itself. This is the lignocellulosic mass which mainly contains cellulose (32-47 wt%), hemicellulose (19-32 wt%), lignin (5-24 wt%), some amount of silica, ash and proteins etc. The products found from the valorisation of rice straw can be used in the synthesis of different chemicals. Bio-based silica and lignocellulose were simply produced via the recycling of rice biomass waste using a fast chemical treatment procedure. Rice husk and rice straw wastes were collected, ground, and chemically treated with sodium hydroxide to extract silica/silicate from the dried plant tissues. The liquid extract is then treated with acid solutions in order to precipitate silica/silicate at neutral medium. Lowering the pH of the supernatant resulted in the precipitation of lignocellulose.

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TRANSFORMATION AND SUSTAINABLE MANAGEMENT OF ARSENIC IN RICE PADDY SOIL: INFLUENCE OF NITROGEN CYCLING

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ABSTRACT

Geogenic arsenic (As) contamination and prolonged use As laden water for irrigation of the paddy soils in the Bengal Delta Plain (BDP) have led to "the worst mass poisoning in the human history." Multifaceted interactions between the indwelling microorganisms and various biogeochemical factors in As biotransformation in paddy soil are extensive and detailed. Among all these factors, nitrogen (N) is one of the limiting nutrients for rice production, and ammonium (NH_4^+) and nitrate (NO_3^-) ions are the most predominant available forms of N present in paddy soil. However, the response of NH_4^+ oxidation, towards the potential biogeochemical processes involved in As stress in the paddy soil, is yet to be elucidated. A recent report from our group had indicated, rice soils could be involved in two major guilds, one involved in N-metabolism and the second involved in As/Fe as well as other metabolisms. Thus, to validate the interplay of As and NH_4^+ and possible role of indigenous microorganisms, cultivation dependent approach was adopted by enriching, isolating and characterising ammonia oxidisers from As contaminated rice soils. Bacterial cultivability demonstrated that the indigenous microbial community of the soil had an intrinsic resistance towards As. A significant change in the amended NH_4^+ concentration was observed, which was further validated by the abundance of ammonia monooxygenase gene across the enrichments. A decrease in the soluble arsenate (As^{5+}) concentration was observed in presence of NH_4^+ amendment, suggesting a crucial role of NH_4^+ in As mobilisation. Among all the isolates, 7 bacterial strains affiliated to the genera *Achromobacter*, *Bacillus* and *Rhodococcus*, showed maximal NH_4^+ utilisation as well as As tolerance potential. These three genera were significantly detected among the rare taxa of As contaminated rice soils and their potential role in N cycling was also suggested. Further, role of these organisms in NH_4^+ oxidation and As biotransformation are being assessed and validated.

Keywords: Arsenic contamination, paddy soil, nitrogen cycling, ammonia oxidising bacteria, arsenic tolerance.

MICROBIAL DEGRADATION OF ACID ORANGE DYE BY AN APPLICATION OF *PSEUDOMONAS* SPP. Ms1979

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ABSTRACT

In the present study an attempt was made to examine the potential of two bacterial strains for decolorization of Acid Orange 10. The strain, isolated from textile effluent treatment plant was characterized on the basis of morphological, biochemical & genotypic characteristics & it was identified as *Pseudomonas spp.* & *Bacillus spp*. The effect of pH, temperature and initial concentration of dye was studied with an aim to determine the optimal conditions. The bacterial strains used in the study were *Pseudomonas spp.* MS1979 & *Bacillus spp.* MS1982. Out of this *Pseudomonas spp.* MS1979 emerged out to be most potent decolorizer, being selected for further studies. The selected bacterium shows higher decolorization in static condition as compared to shaking condition. The optimum pH was 7.0. It shows good decolorization efficiency even in alkaline region. The optimum temperature was 37^{0}C. The strain could decolorize Acid Orange 10 (250 mg/l) by 94% within 24 h under static condition, pH 7.0, temperature of 37^{0}C and initial dye concentration of 250 mg/l. Biodegradation and decolorization was confirmed using UV-VIS spectrophotometry, thin layer chromatography (TLC) and fourier transform infrared spectroscopy (FTIR) analysis. The study confirmed the potential of *Pseudomonas spp.* MS1979 in the bioremediation of Acid orange 10.

Key Words: *Pseudomonas*, *Bacillus*, Acid orange, Bioremediation, Static, Shaking

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IN-SITU HYDROGEN PEROXIDE MEDIATED DYE DECOLORIZATION IN A MICROBIAL PEROXIDE PRODUCING CELL

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ABSTRACT

Microbial Peroxide Producing Cells are a type of Bio-Electrochemical Systems which help in the production of Hydrogen Peroxide (H_2O_2). A double chamber microbial peroxide producing cell containing a working volume of 40 mL of synthetic media as anolyte and *Shwanella peutrifascians* as anode respiring bacteria and 50 mL of catholyte containinc 50 mM Na_2SO_4 at pH 3 was used. The H_2O_2 was attained with concentration as high as 95 mM on the 6th day of operation with an Open Circuit Voltage (OCV) of 342 mV in 6 days, with the mean current density was about0.09711 mA/m^2, and the mean power density was about 11.4668 mW/m^2. Three dyes, i.e., crystal violet, methylene blue and Azo-dye Eriochrome Black-T were used for decolorization in the catholyte. The color disappeared in 5 days. The concentration of H_2O_2 decreased with the reduction in the color intensity of the dyes till the 5th day of operation, however, after 5 days, its concentration increased. This was possibly due to the fact that the H_2O_2 was getting consumed in the catholyte and after the decolorization, was unused, hence, its concentration increased.

Keywords: Azo dye, Microbial Electrochemical Systems, Microbial Peroxide Producing Cells, Hydrogen Peroxide

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MICROBIAL UPTAKE OF BTX PROMOTES *IN SITU* BIOREMEDIATION IN A PETROLEUM REFINERY WASTE CONTAMINATED SITE

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ABSTRACT

Petrochemical industries contribute significantly to the energy sector around the world. However, wastes generated from the refining units in the form of oily sludge and wastewater cause havoc thereby damaging the soil environment. Bioremediation using microbial biomass have been deemed effective by various investigators to alleviate such alarming issues. Benzene, toluene and xylene (BTX) being a crucial component was supplemented in minimal salt media (MSM) in the present study. 7 indigenous strains were isolated from oil-contaminated site. The soil samples showed high chemical oxygen demand (COD) and total suspended solids (TSS) indicating elevated levels of pollution. The minimum inhibitory concentration (MIC) was deduced as 1000 mg/L BTX. Except GE2, all other strains exhibited visible growth for approximately 33 days. It was validated by the highest bacterial count and biomass concentration for GR2 and GE1 (~10^8 CFU/mL and ~0.147 mg/mL respectively). Maximum COD removal was observed for GR2 (~95%) at an initial concentration of 1000 mg/L. The removal efficiency at 10, 50, 100, 250 and 500 mg/L BTX was in order GR2 > GR1 > GE1 > GR4 > GS1 > GR3 > GE2. Also, highest μ_m and K_s values were obtained for GR2 (0.0563 d^{-1}) and GR1 (373.22 mg/L) respectively whereas the least was obtained as 0.0058 d^{-1} and 2.41 mg/L for GR3. Moreover, growth of the strains was best described by Monod's kinetics, except for GE1 and GS1 which exhibited best-fit for Haldane's model. Subsequently, the K_i values obtained were ~500 mg/L. Hence, the strains exhibiting prospects of survival in BTX supplemented media have potential for in situ bioremediation of petroleum refinery waste contaminated site.

Keywords: Biomass, Bioremediation, in situ, Petroleum, Soil

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SAVE THE ENVIRONMENT (STE) was founded and registered on 19th November 1990. In 1992 with the collaboration of WWF (India), the organization started working to combat arsenic poisoning problem of water in the arsenic prone areas of West Bengal. Since then STE has been involved in various projects related to combat arsenic problem in India.

Our Vision
To protect present and future generations from various environmental hazards.

Our Mission
To create awareness and motivation among rural communities & provide cost effective, energy efficient & environment friendly technologies.

Our Activities
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