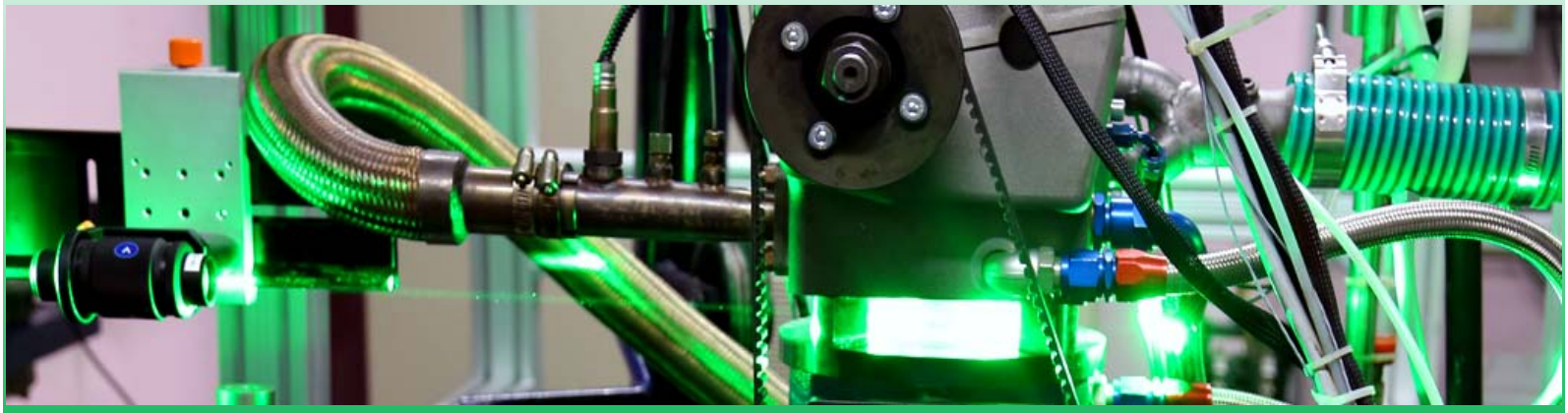
Book of Abstract

Fourth ISEES International Conference
On

Sustainable Energy and Environmental Challenges (IV-SEEC)

27th Nov 2019 – 29th Nov 2019

International Society for Energy, Environment and Sustainability



National Environmental Engineering Research Institute, Nagpur

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About International Society for Energy, Environment and Sustainability (ISEES)

International Society for Energy, Environment and Sustainability

About the Society

The International Society for Energy, Environment and Sustainability was founded at IIT Kanpur in January, 2014 with an aim to spread knowledge in the fields of Energy, Environment, Sustainability and Combustion. In this changing environmental scenario, the time has come where more emphasis has to be laid on renewable energy resources. Moreover, in this dynamic scenario of swelling competition and reducing profits, staying environmentally responsible can be extremely challenging for any organization. More efficient systems have to be developed to meet the increasing energy demands keeping in mind its environmental impact. People have to become more aware and concerned about the environmental challenges which the world is facing today to make it a better place for us and our future generations. The Society aims to spread knowledge in the above mentioned areas among people and make them more aware about the environmental challenges which the world is facing today. The Society is involved in various activities like conducting workshops, seminars, conferences, etc. in the above mentioned domains. The society also recognizes young scientists and engineers for their contributions in this field. It comprises of experts from leading research institutions working in various domains related to energy

Aims and Objectives

1. To organize Workshops/ Symposia/ Conferences/ Lectures/ Courses for wide dissemination of knowledge to its members and society at large, in the areas related to energy, combustion, sustainability, and environment related subjects.
2. To publish technical papers, monographs, books and journals in the areas mentioned above.
3. Organizing events and activities for the benefits of the underprivileged in the society as per the capability of society members.

Journal of Energy and Environmental Sustainability (JEES)

Journal of Energy and Environmental Sustainability is official publication of the International Society for Energy, Environment and Sustainability dedicated to all the areas of conventional and

renewable energy that are relevant for environmental sustainability. The journal will publish two issues in a year and offer a platform for high-quality research in the interdisciplinary areas of energy and environmental science and engineering.

ISEES Membership

1. The Society shall have the grades of Student Member, Member, Fellow and Honorary Fellow. In addition, institutions and organizations will be given Institutional or Corporate membership on payment of dues and satisfying other eligibility criteria as specified by the executive body from time to time.
2. Fellow of the Society will be the highest grade of membership.
3. A graduate in engineering, technology, science, social sciences, humanities or having equivalent qualification as recognized by ISEES may apply for the membership of the Society. In case of unrecognized qualifications, ISEES executive committee (EC) will decide on the recognition of the qualifications. The same shall be updated in the membership documentation from time to time. Award of membership shall be at the sole discretion of the EC.
4. A member may withdraw permanently from the membership of the society at any time by giving a notice in writing to the secretary. In such cases, neither partial nor full refund of membership fee shall be done under any circumstances. There shall not be any exception to this provision.
5. The membership of any student member/ member/ fellow can be withdrawn by ISEES EC in case of unethical, immoral and criminal conduct of the individual concerned. Any action not in alignment with the objectives, interests and purpose of the society may also lead to suspension of the membership. The permanent withdrawal can only be done after an opportunity to present his/ her views to the EC has been given to the defaulting member. The decision of the ISEES EC in this regard shall be final and irrevocable in all such cases.

Privileges of Membership

1. A member whose subscription is paid up to date shall be entitled:
2. To be notified of all relevant activities of the Society.
3. To vote at all Annual General Body Meetings (AGBM) and special meetings of the Society and voting (online/ ballot) on various issues including elections and referendums.
4. Reduced registration fee in the events organized under the banner of the Society.
5. Receive a copy of the proceedings of the meetings (to the corporate members only).
6. To be included in a directory of experts along with the domain expertise to be published by the ISEES from time to time.
7. Corporate members will be able to send two delegates free/ subsidized rates to the events organized by the Society. They will also get partial fee waiver in the advertisement published in the society newsletters/ literature/ ISEES website.

Awards and Recognition

1. A member whose subscription is paid up to date shall be entitled:
2. To be notified of all relevant activities of the Society.
3. To vote at all Annual General Body Meetings (AGBM) and special meetings of the Society and voting (online/ ballot) on various issues including elections and referendums.
4. Reduced registration fee in the events organized under the banner of the Society.
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6. To be included in a directory of experts along with the domain expertise to be published by the ISEES from time to time.
7. Corporate members will be able to send two delegates free/ subsidized rates to the events organized by the Society. They will also get partial fee waiver in the advertisement published in the society newsletters/ literature/ ISEES website.

Membership Fees

	Type of membership	Annual Membership Fee	Five-Years Membership Fee	Life Membership Fee
India/ SAARC Countries	Student Members	1000 INR	--	--
	Member/ Fellow	2000 INR	5000 INR	10000 INR
	Corporate	10000 INR	--	50000 INR
	Honorary Fellow	0	0	0
USA, Europe and Developed Countries	Student Members	50 US$	--	--
	Member/ Fellow	100 US$	250 US$	500 US$
	Corporate	500 US$	--	2500 US$
	Honorary Fellow	0	0	0
	The ratio of A and B will depend on relationship between INR and US$ after taking into account the PPP (between India and USA).			

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Dr. V. Ashok, VSSC, Thiruvananthapuram.

IV SEEC ORGANISERS

Dr. Rakesh Kumar
Director,
CSIR-National Environmental Engineering Research Institute (NEERI),
Nehru Marg, Nagpur - 440 020
Maharashtra India

Dr. Rakesh Kumar obtained M.Tech. in Environmental Science and Engineering from IIT-Bombay and Ph.D. in Environmental Engineering from RTM Nagpur University. Before assuming the charge of Director of the CSIR-National Environmental Engineering Research Institute (CSIR-NEERI) on 23rd May 2016, he was Chief Scientist and Head of CSIR-NEERI Mumbai Zonal Centre. He has a vast experience in all fields of environmental science and engineering, especially air pollution control and management, urban air quality monitoring, emission inventory and modeling, environmental impact assessment, environmental audit, climate change and health.

Dr. Kumar has given a notable contribution in developing technologies for reuse and recycle of domestic and industrial wastewater, which brought a paradigm shift in the country. His efforts have always been for upliftment and application of Science and Technology for a sustainable development. His goal is to provide science and technology oriented solutions for the benefit of society and industry.

He has received 9 awards for his outstanding contributions in Environmental Science & Engineering, among which the notable ones are Commonwealth Commission Award, UK in 1994; “Environmental Leadership Award” by US Asia Environmental Partnership and US-AID for the year 2005 for outstanding contribution in improving quality of life for the population of Asia. He has been given an award for largest number of technology transfer for low cost waste water treatment-PHYTORID in the year 2012. He has been given VASVIK award for 2012 for his exemplary work for urban environment improvement and sustainable technology "Phytorid" for sewage treatment for better environment. He has also been awarded "Hiyoshi Think of Ecology Award" in September 2015 for his work on use of ecology in solving environmental engineering problems. He has served as ‘Adjunct Professor’ at Centre for Environmental Science and Engineering, IIT-Bombay. He is Expert Member of more than 30 Committees / Panels constituted by various Ministries of Government of India and State Governments.

Dr. Kumar has ten patents on pollution control devices including two international patents, and published more than 100 papers in national and international Journals and 90 papers in national and international conferences.

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Prof. Ashok Pandey is currently Distinguished Scientist at CSIR-Indian Institute for Toxicology Research, Lucknow, India and Honorary Executive Director at the Centre for Energy and Environmental Sustainability- India. He has been Visiting Professor/Scientist and UNESCO Professor in many countries, including France, Brazil, UK, Switzerland, Malaysia, Thailand, etc. Formerly, he was Eminent Scientist at the Center of Innovative and Applied Bioprocessing, Mohali and Chief Scientist & Head of Biotechnology Division at CSIR's National Institute for Interdisciplinary Science and Technology at Trivandrum. Professor Pandey has ~ 1200 publications/communications, which include 16 patents, 54 books, 130 book chapters, 465 original and review papers, etc with h index of 84 and >29,000 citations (Goggle scholar).

Professor Pandey is the recipient of many national and international awards and fellowships, which include Life-Time Achievement Award from the International Society for Energy, Environment and Sustainability (2017); Fellow of Royal Society of Biology, UK (2016); Academician of European Academy of Sciences and Arts, Germany (2016); Fellow of International Society for Energy, Environment and Sustainability (2014); Fellow of National Academy of Science, India (2012); Fellow of Association of Microbiologists of India (2010); Fellow of International Organization of Biotechnology and Bioengineering (2008); Fellow of the Biotech Research Society, India (2005); Honorary Doctorate degree from Univesite Blaise Pascal, France (2007); Thomson Scientific India Citation Laureate Award, USA (2008); Lupin Visiting Fellowship, Best Scientific Work Achievement award, Govt of Cuba; UNESCO Professor; Raman Research Fellowship Award, CSIR; GBF, Germany and CNRS, France Fellowship; Young Scientist Award, etc.

Professor Pandey was Chairman of the International Society of Food, Agriculture and Environment, Finland (Food & Health) during 2003-2004. He is Founder President of the Biotech Research Society, India; International Coordinator of International Forum on Industrial Bioprocesses, France, Chairman of the International Society for Energy, Environment & Sustainability and Vice-President of All India Biotech Association.

Prof Pandey is Editor-in-chief of Bioresource Technology, Honorary Executive Advisors of Journal of Water Sustainability and Journal of Energy and Environmental Sustainability, Subject editor of Proceedings of National Academy of Sciences (India) and editorial board member of several international and Indian journals. He is editor-in-chief of a book series on Current Developments in Biotechnology and Bioengineering, comprising twelve volumes published by Elsevier and another series on Biomass, Biofuels and Biochemicals, comprising six volumes.

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Prof. Avinash Kumar Agarwal obtained his B.E. (Mech Engg., 1994) from Malviya Regional Engineering College, Jaipur and M.Tech. (Energy, 1996) and Ph.D. (Energy, 1999) from Indian Institute of Technology Delhi. After his Post-Doctoral Fellowship (1999 – 2001) at the Engine Research Center, University of Wisconsin, Madison, USA, he returned to India in 2001 and joined Department of Mechanical Engineering, Indian Institute of Technology Kanpur as Assistant Professor, where he is serving as a Professor currently. He was a Visiting Professor to University of Loughborough, UK, Photonics Institute, University of Vienna, Austria, Hanyang University, South Korea and Korea Advanced Institute of Science and Technology, South Korea.

At IIT Kanpur, Prof. Agarwal worked in the areas of IC engines, combustion, conventional fuels, alternative fuels, hydrogen, fuel sprays, lubricating oil tribology, optical diagnostics, laser ignition, HCCI, particulate and emission control, and large bore engines. He has developed laser fired hydrogen and CNG engines in automotive sizes and developed the first electronic fuel injection system equipped locomotive engine for Indian Railways, which improved duty-cycle fuel economy and reduced particulate emissions substantially. Currently, Prof. Agarwal is involved in development of Methanol and DME fuelled vehicles for automotive sector. He is Editor-in-Chief of Journal of Energy and Environmental Sustainability and Associate Editor of Journal of Energy Resources Technology (Transactions of ASME), International Journal of Vehicle Systems Modelling and Testing and the Journal of the Institute of Engineers (Series C).

For his outstanding contributions, Prof. Agarwal is conferred upon Clarivate Analystics India Citation Award-2017 in Engineering and Technology, Prestigious Shanti Swarup Bhatnagar Prize (2016) in Engineering Sciences, Rajib Goyal Prize in Physical Sciences (2017); NASI-Reliance Industries Platinum Jubilee Award (2012); INAE Silver Jubilee Young Engineer Award (2012); Dr. C. V. Raman Young Teachers Award (2011); SAE International's Ralph R. Teetor Educational Award (2008); INSA Young Scientist Award (2007); UICT Young Scientist Award (2007); INAE Young Engineer Award (2005); Devendra Shukla Research Fellowship (2009-12) and Poonam and Prabhu Goyal Endowed Chair Professorship (2013-16) at IIT Kanpur; AICTE Career Award for Young Tecahers (2004); DST Young Scientist Award (2002); and DST BOYSCAST Fellowship (2002). He is a Fellow of Society of Automotive Engineers International, USA (SAE; 2012), American Society of Mechanical Engineers (ASME; 2013), Indian National Academy of Engineering (INAE; 2015) and International Society for Energy, Environment and Sustainability (ISEES; 2016). At IIT Kanpur, Prof. Agarwal has established a state-of-the art "Engine Research Laboratory" (www.iitk.ac.in/erl).

Dr. Pramod M. Padole
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Prof. Pramod M. Padole, Professor (HAG) in the department of Mechanical Engineering, VNIT Nagpur has taken charge as the Director of Visvesvaraya National Institute of Technology, Nagpur on 28th June, 2018. Prof. Padole is an erudite professor, popular teacher and eminent researcher with a dream to use science and technology for better community life. Prof. Padole is also an alumnus of VNIT, Nagpur. He did his BE (Mech.) & PhD from VNIT and Master's in Machine

Design from VJTI, Bombay. Prof. Padole joined VRCE in September, 1988. With vast experience of three decades of teaching, research and administration, Prof. Padole worked as the Dean Faculty Welfare from 2014 to 2017, also worked as Prof. In-charge of alumni affairs of the institute for more than 5 years. Prof. Padole was also instrumental for developing CAD/CAM centre in VNIT and has started PG Course in CAD/CAM.

Mechanisms and Machine Design, finite element method and Bio mechanical engineering are his research areas. Prof. Padole has guided 17 PhD research scholars and supervised more than 50 M.Tech projects. Presently 4 PhD research scholars are working under him. He has more than 140 research publications in reputed international and national journals to his credit. He has two Patents to his name. Prof. Padole has visited various countries like Germany, UK, USA, Romania, France and Hon Kong for presenting his research work & has chaired technical sessions at prestigious international conferences. Prof. Padole also worked as the President of Bio-medical engineering forum and developed functional and applied technologies & implants. Prof. Padole has successfully completed more than 14 consultancy projects in the areas of appropriate technology, design and finite element analysis which were funded by DST, MHRD, KVIC and AICTE.

Prof. Padole has received "Academician Par Excellence" award from Institute of Engineers in 2017 for his life-time contribution in the areas of product development, process development and technology transfer. He has also received best "S&T" innovation award from Government of India for KVIC sponsored project and developed 10 intervention technologies for creating self-sustainability & economic development of rural sector. Prof. Padole is equally good at Painting, Sports and Singing. Some of the sample Paintings can be seen in VNIT Website Gallery.

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Dr. Nitin Labhasetwar is a Ph.D. in Chemistry with 32 years of research experience in environmental and energy related research. He has worked as *STA/JSPS Fellow* and *Visiting Overseas Researcher* at NIMS, Tsukuba, Japan and as a *Visiting Professor* at Kyushu University, Japan under the GCOE programme. He has also worked at other International Laboratories on development of materials and processes including low cost and nano-materials for their applications in energy & environmental applications, vehicular emission control, photocatalysis, GHG emission control, cleaner energy generation, heterogeneous catalysis etc. He has over 158 research publications with over 4300 citations and 22 international patents in addition to a few contributions in books. He has received 9 awards for excellence in research and also received various fellowships in India and abroad. He is a reviewer for more than ten SCI journals and member of Editorial Advisory Boards of two international journals. He has supervised 15 students for PhD and several others for Master courses. He is currently involved in more than 15 R&D projects.

IV SEEC CONVENERS

Prof. Shantanu Bhattacharya
IIT Kanpur

Dr. Akhilendra Pratap Singh
IIT Kanpur

Dr. Sunil Kumar
CSIR-NEERI, Nagpur

Er. Ankit Gupta
CSIR-NEERI, Nagpur

Er. Piyush Kokate
CSIR-NEERI, Nagpur

Dr. Santanu De
IIT Kanpur

ISEES FELLOWS

ISEES FELLOWS (2020)

Prof. Amit Agarwal
Department of mechanical Engineering
IIT Bombay, Mumbai

Dr. D B Sahoo
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Prof. Rajendra Bordia
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ISEES FELLOWS (2017)

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Vienna University of Technology (TU Vienna, Photonics Institute),
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ISEES AWARDS – 2020

ISEES Young Scientist Awardees (2020)

Dr. Pawar Samadhan Anand

Dr. Samadhan Pawar is pursuing his post-doctoral fellowship at the Department of Aerospace Engineering, Indian Institute of Technology Madras. His research interest focuses on understanding the phenomenon of the onset of thermoacoustic instability, usually observed in propulsion and power generation systems. He has published 16 journal papers, filed one patent, and attended 17 national and international conferences and workshops. He was awarded the 'Institute Research Award' by IIT Madras for conducting outstanding research during his Ph.D.

Dr. Shankar Chakma

Dr. Sankar Chakma is presently working as Assistant Professor of Chemical Engineering at Indian Institute of Science Education and Research (IISER) Bhopal, Madhya Pradesh. He completed M.Tech. and Ph.D. degrees in Chemical Engineering in 2011 and 2015, respectively from IIT Guwahati. His research interest includes mechanistic investigation of sono-hybrid physical, chemical and biological processes for sustainable energy and environmental applications. His research work has shaded light on the intricacies of the ultrasonic processes and have helped to identify the relative contributions of different parameters in the process to the overall outcome of the process in terms of either kinetics or yield.

Dr. Swatantra Pratap Singh

Dr. Swatantra Pratap Singh is an environmental engineer with experience in membrane fabrication, environmental nanotechnology, fate and transport of pollutants and emerging contaminants in the environment. Currently, he is an Assistant Professor in Environmental science and Engineering department at IIT Bombay. He has developed a key technology to fabricate the membranes for water purification and print graphene in-situ in a single step. He has four US patents (two granted and two provisional) on membrane and laser based graphene fabrication techniques. He has 19 journal articles (18 research articles and 1 review) in high impact journals such as ACS Nano, Materials Today, Applied Materials and Interface, Carbon, etc. At present, his research interests are membrane technology (water-energy nexus), nanotechnology (application in environmental remediation), quantum chemical modeling and fate & transport of the emerging pollutants.

ISEES Best Ph.D. Thesis Awardees (2020)

Om Prakash Sarkar
Thesis Title: Acidogenic Biorefinery for Renewable Energy and Platform Chemicals: Upscaling and Sustainability Analysis
Institute: CSIR-Indian Institute of Chemical Technology (CSIR-IICT), Tarnaka, Hyderabad-500007

Sharabani Kaushik
Thesis Title: Cyanobateria Based Photosynthetic Microbial Fuel Cell: Development and Application for Sensing Alcohol
Institute: Indian Institute of Technology Guwahati

Poonam Sundriyal
Thesis Title: Fabrication of Nanoscale Materials and Surfaces for Energy Storage Devices and Adhesion Bonding Applications
Institute: Indian Institute of Technology Kanpur

Rajesh Kumar Prasad
Thesis Title: Fabrication of Nanoscale Materials and Surfaces for Energy Storage Devices and Adhesion Bonding Applications
Institute: Indian Institute of Technology Kanpur

ISEES Best M.Tech Thesis Awardees (2020)

Shashank Singh
Thesis Title: Realisation Of Multi-Agent System For Residential Demand Response Under Smart Grid Paradigm
Institute: National Institute of Technology (NIT) Tiruchirappalli, India

Tushar Agarwal
Thesis Title: Development of Port Fuel Injected Methanol (M85) Fuelled Two – Wheeler Prototype
Institute: Indian Institute of Technology Kanpur, India

LIST OF SPEAKERS OF IV SEEC

Abhay B. Fulke	CSIR-National Institute of Oceanography
Adani, Fabrizio	University of Milan, Milan, Italy
Aguilar, Cristobal	Universidade Autonoma de Coahuila, Coahuila, Mexico
Amit Agarwal	IIT Bombay
Amitava Dutta	Jadavpur University
Anderson, Robin	Southern Plains Agri Research Center, Texas, USA
Anil Kumar Patel	Korea University, Seoul, Korea
Anjan Ray	Director CSIR-IIP Dehradun
Archana Sarkar	NHIR
Arun Kansal	TERI
Atul Dhar	IIT Mandi
Awasthi, Mukesh K	Northwest A&F University, Yangling, China
B M Reddy	CSIR-IICT Hyderabad
Bhuvanesh Srinivasan	National Institute for Materials Science (NIMS), Japan
C S Gopinath	CSIR-NCL
Christakopoulos, Paul	Lulea University of Technology, Lulea, Sweden
Chrysa Voidarou	University of Ioannina, Greece
Cortes, Jose Sandoval	Universidad Autónoma de Coahuila, Coahuila, México
Darina Smrzova	Institute of Inorganic Chemistry of the CAS, Czech Republic
Deepak Pant	Central Univ, Dharamshala
Dhananjay K. Srivastava	IIT Kharagpur
Fawzia Tarannum	TERI-SAS
Ganti S Murthy	Oregon State University, Corvallis, Oregon, USA
Hiroshan Hettiarachchi	UNU-FLORES, Dresden, Germany
Hisahiro Einaga	Kyushu University, Kasuga, Japan
K.B Mishra	IIT Roorkee
K K Pant	IIT Delhi
K S Reddy	IIT Madras
Kim, Sang Hyioun	Yonsei University, Seoul, Korea
Koutinas, AA	Univeristy of Patras, Greece
Lens, Piet	IHE Delft Institute for water Education, The Netherlands
Mamata R. Lanjewar	RTM University, Nagpur
Maria Kanellaki	University of Patras, Greece
Mangesh Madurwar	VNIT Nagpur
Martínez Hernández, JL	Universidad Autónoma de Coahuila, Coahuila, México
Moqtik Bawase	ARAI
Neeraj Sharma	Senior Princ. Sci., CSIR-CRRI, New Delhi
P Mullai	Annamalai University
P.A Laxminarayana	Simpson, Chennai
Prof. P.K Bose	N.I.T Agartala
Papamichael, EM	University of Ioannina, Greece

Parmjit S Panesar	Sant Longowal IET, Longowal
Patrick Drogui	INRS, Quebec, Canada
Petra Ecorchard	Institute of Inorganic Chemistry of the CAS, Rez. Czech Republic
Piyali Das	TERI
Prathish K. P.	CSIR- NIIST
Praveen Kumar	Arunai Engg. College, Thiruvannamalai
Pravesh C Shukla	Indian Institute of Technology Bhilai
Raj Bordia	Clemson University
Raja Banerjee	IIT Hyderabad
Rajeshwar Tyagi	INRS, Quebec, Quebec, Canada
Rajiv Weginwar	Rajiv Gandhi College of Engineering, Chandrapur
Ramaraj Boopathy	Nicholls State University, LA 70310 USA
Rashmi Urdhwareshe	Director ARAI Pune
Rova, Ulrika	Lulea University of Technology, Lulea, Sweden
S Venkata Mohan	IICT, Hyderabad
S. Devotta	Former Director, CSIR-NEERI
S.S. Thipse	ARAI, Pune
Sanjay Bajpai	DST Delhi
Satwasheel Powar	IIT Mandi
Shubhangi Umbarkar	National Chemical Laboratory, Pune
Shantanu Bhattacharya	IIT Kanpur
Shihabudheen M. Maliyekkal	IIT Tirupati
Shishir Sinha	IIT Roorkee
Sudarshan Kumar	IIT Bombay
Suman Lata Jain	CSIR-IIP, Dehradun
Swarnendu Sen	Jadavpur University
Swati Bhogle	TIDE, Bangalore
Tarun Gupta	CE, IIT Kanpur, India
T. Sundararajan	IIT Madras
V Ganesan	IIT Madras
V K Garg	Central Univ Punjab
V.M. Motghare	Maharastra Pollution Control Board
Vijayanand S Moholkar	IIT Guwahati
Vivek Kumar	IIT Delhi
Vivek Polshettiwar	TIFR Mumbai
Yogesh Sharma	IIT BHU
Zhang, Guangming	Renmin University of China, Beijing, China
Zhang, Zhengquiang	Northwest A&F University, Yangling, China

BIOGRAPHY OF PLENARY SPEAKERS

Dr. V K Saraswat
Former Secretary Defence R&D
Member, NITI Aayog,
DRDO Guest House, Development Enclave,
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Dr. Vijay Kumar Saraswat, India's most gifted scientist and an accomplished researcher with more than four decades of experience spaning over several fields and areas in both basic and applied sciences of defence research. Apart from being a scientist, he is a rare combination of an innovator, technologist and visionary. Born at Gwalior on 25 May 1949, Dr. Saraswat completed his engineering from Gwalior; Master of Engineering from IISc Bangalore followed by Ph.D from Osmania University. During his illustrious career, from Scientist to Scientific Adviser to Defence Minister, Director to Director General DRDO and Secretary to Dept of Defence R&D, Dr. Saraswat has been credited with development of Liquid Propulsion Rocket Engines and missiles namely PRITHVI, DHANUSH, PRAHAAR indigenously. He is the principal architect of the Ballistic Missile Defence programme which included major technology breakthroughs. The successive interceptions of incoming target ballistic missiles at Exo and Endo atmospheres are a testimony to his dedicated efforts and exploitation of limited technological resources. With this India joined the select nations that have the capability to develop BMD systems. Dr. Saraswat brought new dimensions to the strategic defence scenario through successful test firing of AGNI-5, SHOURYA, Initial Operational Clearance for Light Combat Aircraft TEJAS and induction of INS Arihant. Thus, today nation can boast of reaching any shores in the world with the nuclear capable missiles with different strike ranges. Under his leadership, DRDO provided the technologies developed by them for societal benefits namely Solar Powered Modular Green Shelters, Bio-Digesters, AAHAR programmes, explosive detection kit, Diagnostic Units for Dengu and Chickengunia etc. Dr. Saraswat's pioneering efforts have taken shape into establishment of Research & Innovation Centre at IIT Madras; MILIT-Centre for Training needs of armed forces on S&T ; CERT for reporting, auditing and handling emergency response of Information Security Incidents; CHESS - futuristic technology Centre for High Energy Laser and Microwave devices; Kyrgyz-Indian Mountain Bio-Medical Research Centre at Kyrgyzstan; The new international airport and Aerospace SEZ at Hyderabad and Advanced Combustion Research Centers at IISc and IIT(M). Till recently, Dr. Saraswat was DAE Homi Bhabha Chair and initiated development of technologies for Energy Security namely Bio-Mass, Solid Waste Management, Fuel Cells, Concentrated Solar Power, Multi Junction Photovoltaic Cells, Clean Coal Technologies etc., in the country at various Industrial and Academic Institutions in addition to bringing new dimensions to Aerospace Manufacturing. Honoris Causa was conferred upon him by more than 18 Universities including Andhra University (Visakhapatnam), NIT Surat. He has also authored and presented several papers for at National & International level journals / conferences and guided eight Ph.D Scholars. Dr. Saraswat presently is the Member NITI Aayog and shouldering many honorary positions in Government and Academic Institutions.

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Mrs. Urdhwareshe has a distinguished academic career. Master's in Electronics Engineering, Certified Quality Auditor (ASQ), Certified Six Sigma Black Belt (ASQ), Diploma in Corporate Directorship (WCCG). Mrs. Urdhwareshe serves as the Chair / Vice Chair of various national bodies like Chair- Transport Engineering Division Council (TEDC) of Bureau of Indian Standards (BIS), New Delhi, Chair-AISC (Automotive Industry Standards Committee), which formulates Safety Standards in India.

Vice Chair of Working Party on Pollution and Energy (GRPE) at the Global Forum under UN-ECE at Geneva during period 2014-2017,Senior Vice- President SAE-India.She is Co-author of Book on Total Quality Management.She is a recipient of several awards like "Woman Excellence Award 2015" (by Rotary International, Pune), "Distinguished Alumnus" award, "Engineering Excellence Award- 2017 (SAE-India Foundation), "Lifetime Achievement Award-2018" (ODSER Trust), "Industry Custodian of the Year-2018 (E-Mobility+) etc.Mrs. Rashmi's other interests are instrumental music, reading and travelling.

PANELISTS

Dr. V. K. Saraswat
NITI Ayog

Dr. Rakesh Kumar
CSIR-NEERI Nagpur

Dr. R. R. Sonde
Thermax Ltd.

Dr. Anjan Ray
CSIR-IIP Dehradun

Prof. Avinash Kumar Agarwal
IIT Kanpur

Prof. R Srikanth
National Institute of Advanced Studies,
Bengaluru

BIOGRAPHY AND ABSTRACT OF INVITED SPEAKERS

Emerging Public Health Risks in Tropical Marine Beaches due to rising levels of Pathogenic Fecal Indicator Bacteria

Dr. Abhay B. Fulke

Abstract

Global estimates indicate that each year more than 120 million cases of gastrointestinal disease and 50 million cases of severe respiratory diseases are caused by swimming and bathing in wastewater-polluted coastal waters. The unregulated disposal of wastes and other materials into the ocean degrades marine and natural resources and pose human health risk hence, study was conducted to investigate the presence of pathogenic *Escherichia coli* in anthropogenically marred tropical beaches (Versova, Juhu, Mahim, Dadar, Girgaon, Erangal, and Silver beach, Dana pani, Marve and Aksa) of Mumbai, India. Out of 316 presumptive E. coli isolates, 118 were found to be pathogenic *E. coli* which was subjected to serotyping and antibiotic susceptibility test. The presence of virulence genes specific to diarrheagenic pathotypes namely EHEC, EPEC, ETEC and STEC was determined using a molecular approach. Diarrheagenic pathotypes ETEC and EPEC were found to be predominant among the studied sites. The presence of stx1, stx2, eaeA and hlyA genes was detected in 9%, 13%, 20% and 8%, LT1 and ST1 genes was detected in 9% and 11% of total 150 isolates. Erangal and Silver beach reported 26.6 % (4/15) of stx1and stx2 toxin genes, whereas, highest 62.5% of isolates were found hlyA positive in Marve beach compared to lowest 9% in silver beach. 100% of the isolates were Multiple Antibiotic Resistant with higher MAR indices. Therefore, coastal ecosystem and beach management should be implemented to ensure possible associated public health risk.

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Dr. Abhay B. Fulke has completed his PhD in Microbiology from CSIR-NEERI, Nagpur. His general scientific expertise is in the field of Environmental microbiology, Marine microbial ecology, Biotechnology and Climate change. Dr. Abhay B. Fulke supervised a large number of master students and also supervising couple of PhD thesis. Besides this, he has published 25 peer-reviewed papers in international and 7 national journals. He has given many Invited talks at conferences and guest lectures at college & universities including prestigious talk at Columbia University's Global Centre at Mumbai. His recent work on pathogenic *Escherichia coli* containing virulence gene as markers of tropical beaches of India is disseminated widely in press and electronic media. He received many awards for his scientific contribution.

Bioconversion of Giant Cane for Integrated Production of Biohydrogen, Carboxylic Acid and Phas in a Multi-Stage Biorefinery Approach

Dr. Fabrizio Adani

Abstract

Arundo donax L., common name giant cane or giant reed, is a plant that grows spontaneously in different kinds of environments and that it is widespread in temperate and hot areas all over the world. Plant adaptability to different kinds of environment, soils and growing conditions, in combination with the high biomass production and the low input required for its cultivation, give to A. donax many advantages when compared to other energy crops. A. donax can be used in the production of biofuels/bioenergy not only by biological fermentation, i.e. biogas and bio-ethanol, but, also, by direct biomass combustion. Both its industrial uses and the extraction of chemical compounds are largely proved, so that A. donax can be proposed as the feedstock to develop a bio-refinery. Nowadays, the use of this non-food plant in both biofuel/bioenergy and bio-based compound production is just beginning, with great possibilities for expanding its cultivation in the future.
A donax is a sterile plant, different clones show phenotypic differences suggesting a clone selection program was needed to find the best clones for energy and biorefinery purposes. Eight clones from 86 were selected and studied for potential sugar production after IL and enzymatic pretreatment, in collaboration with the JBEI. Results indicated that sugar yields after IL and enzymatic treatment were similar to those reported for feedstocks that are more common, e.g. switchgrass and corn stover. Glucose yield was found to be dependent on the clone selected, and a mechanistic approach revealed that both IL and enzymatic performances depended on the cell wall architecture, i.e. cell wall cross-linking, as measured by cell wall microporosity. S/G ratio modeled cell wall structure and agreed with MiS measurements. The two clones are now under study for DNA variations and differences related to both cellulose and lignin biosynthesis pathways come out. A first approach in using Giant cane for biorefinery was the production of sugar, organic acid and polyhydroxyalkanoates (Figure 1). The highly productive *Arundo donax* L. clone (Clone AD-20, UNIMI) was produced at full field to give 54.6 Mg total solids (TS) biomass Ha-1. Biomass was chemically and enzymatically pretreated, recovering 13.9 Mg Ha-1 of glucose and 3.6 Mg Ha-1 of xylose, i.e. 3.5-4.5 more than yield typically obtained from corn stover or switchgrass. The subsequent fermentation of the liberated sugars to organic acids (OA) by dark fermentation generated yields of 3,850 Nm3 Ha-1 of biohydrogen and 14.2 Mg Ha-1 of OAs. OAs were then used as a feed to produce polyhydroxyalkanoates (PHA), with 3-hydroxybutyrate the major monomer present (PHB > 95% PHA), from a biological process using mixed microbial culture (MMC) producing 5.04 Mg Ha-1 of PHA. An initial economic analysis indicated that this multi-stage biorefinery approach would result in a net revenue of 10,415 € Ha-1, which is ~9-fold greater than that obtained by a traditional biorefinery producing bioethanol.

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Dr. Fabrizio Adani is a professor at University of Milan from 1996. He has completed his Ph D from University of Milan from 1990 to 1993. His area of interest includes Biological wastewater treatment, soil waste management, Envionment pollution, and soil fertilizers. He is a member of Italain Commission. Soil and Environment of the National Standardization Body (UNI). Also, on 2016, Expert Group EIP-Agri FOCUS GROUP NUTRIENT RECYLCING – promoted by DG Agriculture and Rural Development Unit H5 - Research and innovation (EU). He is a Member of EU group for standardization CEN/BT/TF 151 "Horizontal standard in the field of sludgee, biowaste and soil". He has two patents registred on his name. He has published more than 200 reaserch papers. He is keynote speakes at various international conferences such as Join BioEnergy institute, Emeryville, CA (USA), 41A REUNIÃO ANUAL DA SOCIEDADE BRASILEIRA DE QUÍMICA Foz do Iguaçu, PR, Brazil (Brasil), Isituto federal Catarinense campus Araquari, Araquari (Brasil), College of Engineering, China Agricultural University, Beijing (China), Iranian Research Organization for Science and Technology(IROST) Tehran (Iran).
On 2012 he was appointed as UNIMI-delegate for Green Chemistry Cluster of Lombardy Region and on 2017, Adjunct Professor at National Center for International Research of BioEnergy Science and Technology (iBEST) China Agricultural University (China).

Enhanced Production of Biological Control Agents by Solid-State Fermentation of Agroindustrial Residues

Dr. Aguilar Cristóbal

Abstract

Around the world, agroindustrial companies generate huge quantities of wastes including husks, peels, leaves, etc. They are cheap and available sources with the potential to produce a great variety of added-value products. Through the solid-state fermentation process, agroindustrial biomass can be used as support and substrate for the growth of microorganisms. On the present work, corncob, sugarcane bagasse, and coconut husk were substrates evaluated for spore and cellulase production by *Trichoderma asperellum* under solid-state fermentation culture conditions. The best results were showed using corncob as substrate. The sporulation reached on corncob was $9.98x10^8$ spores/ g CS, and the values of enzyme activities were 2.08 and 2.28 U/g CS for endoglucanase and exoglucanase, respectively. According to the results obtained in this study, sugarcane bagasse and corncob without pretreatment are suitable materials for the production of cellulases and spores by *T. asperellum* T2-10 under solid-state fermentation.

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Prof. Cristóbal Noé Aguilar is Dean of the School of Chemistry at Autonomous University of Coahuila, México. He is Chemist (1992) by the same institution; his MSc Program in Food Science and Biotechnology (1995) was held in the Autonomous University of Chihuahua, México. His PhD Program in Fermentation Biotechnology (2000) was given by the Metropolitan Autonomous University, Mexico. He was working in a Posdoc stay (2001) at IRD-Marselle, France. Dr. Aguilar has published more than 210 papers published in indexed journals, more than 50 articles in Mexican journals; 16 book chapters, 8 mexican books, 7 editions of international books, 34 proceedings and more than 350 contributions in scientific meetings (His h index = 31 by Scopus & 40 by Google Scholar). Prof. Aguilar is member of the National System of Researchers of Mexico (S.N.I.) from 1998. He has awarded with several prizes including: National Prize of Research 2010 of the Mexican Academy of Sciences, the Prize-2008 of the Mexican Society of Biotechnology and Bioengineering, National Prize AgroBio-2005 and the Mexican Price in Food Science and Technology. CONACYT-Coca Cola México 2003. From 2014 is member of the Mexican Academy of Science. Prof. Aguilar has developed more than 21 research projects, including 6 international exchange projects. He has been advisor of 18 PhD thesis, 25MSc thesis and 50 BSc thesis. Prof. Aguilar is member of the International Bioprocessing Association, Mexican Academy of Sciences, Mexican Society for Biotech & Bioeng, Mexican Association for Food Science & Biotechnology.

Effect of Pulsation on Flow Characteristics of Free and Impinging Jet

Prof. Amit Agarwal

Abstract

In the present work, detailed particle image velocimetry (PIV) measurements and dye visualisation experiments are undertaken to understand the flow and heat transfer behaviour of steady and pulsating impinging submerged turbulent jets. The measurements are conducted over a large range of frequency and amplitude of pulsation, Reynolds number, and jet to surface distances. Data for mean velocity and turbulent normal and shear stresses are analysed in detail. The objectives of the work are to study the role of vortices in determining the boundary layer thickness and magnitude of the turbulent normal and shear stresses; to examine self-similarity with suitable scaling parameters in velocity and stress profiles, and to determine if an optimal frequency exists where the effect of pulsation on the flow is maximum. We find that pulse jet should operate between $0.14 < St < 0.93$ (where St is Strouhal number) which will provide better heat removal effect than a steady jet; the optimal effect of pulsing corresponds to $St = 0.44$. Further, it was observed that the evolution of primary vortex is responsible for flow separation (dip in heat transfer), a breakdown of primary and secondary vortices leads to flow reattachment on the surface, and generation of high turbulence is responsible for secondary peak in heat transfer distribution. The location of self-similarity of steady impinging jet depends upon the Reynolds number and surface spacing. It was also observed that outer scaling is not suitable parameter for Reynolds shear stress. A novel method to demarcate the turbulent/ non turbulent interface is proposed and used to understand the variation in properties across the interface. The study is particularly relevant because several contradictory reports on the effect of pulsation on the flow are available, and information on velocity field of such flows are almost non-existent. The advantage of the present approach employing a pulsatile jet is that pulsatile flow is midway between a steady jet and a synthetic jet. By studying pulsatile flow (with both mean and fluctuating components) one can understand both these flows, which form appropriate limiting cases of a pulsatile jet.

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Dr. Amit Agrawal joined the Indian Institute of Technology (IIT) Bombay in 2004 and is currently an Institute Chair Professor in the Department of Mechanical Engineering. His research interests are in Micro-scale flows, Development of novel bio-microdevices, Theoretical fluid mechanics, and Turbulent flows. He has graduated 23 PhDs and advised several postdocs and Master's students on these and related topics. Along with his students, he has published more than 175 journal articles, filed for a dozen patents, and authored a book (entitled Microscale Flow and Heat Transfer: Mathematical Modelling and Flow Physics). His primary contributions are in the development of a unique blood plasma separation microdevice and derivation of equations which (he believes) are more general than the Navier-Stokes equations. His work has appeared on the cover page of prestigious journals such as Journal of Fluid Mechanics and Physics of Fluids. He is Editor of three journals: Experimental Thermal and Fluid Science, Nature Scientific Reports and Sadhana, and elected Fellow of the Indian National Academy of Engineering (INAE) and the National Academy of Sciences India (NASI). He has been awarded the Department of Atomic Energy DAE-SRC Outstanding Investigator Award, Prof. K.N. Seetharamu Medal by Indian Society of Heat and Mass Transfer, Prof. H.H. Mathur Award for Excellence in Applied Sciences by IIT Bombay, and the Shanti Swarup Bhatnagar Prize for his work.

Mixture Preparation and PerformanceOptimization in Domestic LPG Cookstoves

Prof. Amitava Datta

Abstract

Liquefied Petroleum Gas (LPG) is widely used as a domestic fuel as it is clean and has high heating value. In many countries around the world, including India, the Government is promoting the use of LPG as the cooking fuel over traditional fuels, like biomass, coal and kerosene. As LPG has the fossil origin with limited reserve, increasing consumption of the fuel puts pressure on availability and increases the cost. Improvement in the performance of the devices using the fuel, i.e. the domestic cook stoves, becomes a challenge for the sustainability in using the fuel. In this endeavour, it is essential to clearly understand the working of the stove with all its technicalities and find out the opportunities to improve the performance. In an LPG cook stove, the fuel-air mixture is prepared in a self-aspirated burner which then burns as a rich premixed flame at the burner head. The mixture preparation is done in a mixing tube using the principle of jet entrainment in a semi-confined environment. The jet momentum and the positioning of the jet along with the geometry of the entrainment ports influence the mixture preparation. The choice of the equivalence ratio for the prepared mixture depends on the combustion parameters and performance of the flame impigment heat transfer to the load.The mixure burns as a rich premixed flame over the burner ports and the burning gets completed with the supply of secondary air around the falme.The heat released in combuston is transferred to the load through the flame impingement heat transfer helps to judge the overall performance of the cookstove.It also helps to identify the areas where further insight needs to be given for the improvement in performance of the stove

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Dr. Amitava Datta is a professor in the Department of Power Engineering of Jadavpur University. He completed his graduate education in Mechanical Engineering from Jadavpur University and his PhD from IIT Kharagpur. Dr. Datta is a recipient of Alexander von Humboldt Fellowship in Germany in the year 2000 and worked at Lehrstuehl fuer Technische Thermodynamik in the University of Erlangen Nuernberg. His research interests include combustion, atomization, energy, thermodynamic modeling and application of CFD in reacting flows. Dr. Datta has completed guidance of 14 PhD theses and several Masters theses. He has published 90 peer reviewed research papers in various International Journals and also presented and published several papers in National and International conferences. He also has authored one text book on Combustion. Dr. Datta has undertaken several sponsored research projects and has received awards and recognitions from different national and international bodies. He is also involved in various administrative responsibilities in his University. Presently Dr. Datta is serving as Head of Power Engineering Department. Dr. Datta is a Fellow of International Society of Energy, Environment and Sustainability and of West Bengal Academy of Science and Technology.

Amended Poultry Litter Composting Technology that Yields a Well Preserved, High Value Ruminant Crude Protein Supplement Free of Pathogenic Microbes

Prof. Anderson Robin

Abstract

Poultry litter is a byproduct produced in large amounts by intensive poultry production systems. Disposal of this byproduct can be environmentally challenging for producers as repeated application to land as fertilizer can cause excessive accumulations of phosphorous, potassium, and nitrogen into the soil or watershed. Moreover, poultry litter contains high numbers of bacterial pathogens such as *Salmonella, E. coli*, and *Campylobacter* that also may be disseminated into the watershed thus risking contamination of water used for irrigation, recreation and human consumption. Because poultry contains appreciable amounts of its nitrogen as uric acid it is an excellent crude protein supplement for feeds fed to ruminants whose rumen microbes can transform and thus upgrade the nitrogen in uric acid into high quality microbial protein. However, before poultry litter can be fed to ruminants it must be treated to kill the pathogens. Composting is a cheap and effective way to kill pathogens in poultry litter but risks diminishing its feed value because the composting microbes convert uric acid to ammonia which is subsequently lost due to volatilization or leaching. Research has shown that application of certain short chain nitrocompounds and natural plant compounds such as tannins and hop extracts as amendments to composting poultry litter can preserve the crude protein value of composted poultry litter by inhibiting uric acid biodegradation while promoting elimination of the pathogenic microbes. From a conservation perspective, this technology yields a safe, environmentally compatible and sustainable technology to recycle nutrients contained in poultry litter consistent with good agricultural practice.

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Dr. Robin Anderson received his Bachelor of Science in Animal Science at Colorado State University in 1989 and received his graduate degrees at Iowa State University, graduating with a Doctor of Philosophy in the dual majors of Animal Nutrition and Microbiology in 1995. Since 1996, Dr. Anderson has served as a Research Microbiologist at the USDA's Food & Feed Safety Research Unit in College Station, Texas and since 2000 has served as a Lead Scientist for this unit where he has worked with a multidisciplinary team of to develop preharvest interventions to reduce the carriage of foodborne pathogens in swine and cattle

Mixotrophic Microalgae Cultivation: An Emerging Sustainable Bioremediation and Biofuel Production Process from Organic Wastes

Dr. Anil Kumar Patel

Abstract

Mixotrophic Cultivation Strategy (MCS) of microalgae is gaining attention globally to economize algal-process for biomaterial and biofuels. Biofuel production is still not feasible from algal based process. This fascinating cultivation mode opens up new application avenue by which algae can also play role for effective organic waste remediation. Recent findings anticipated, MCS potentially can solve limitations of industrial growth linked to algal-process *e.g.* low growth rate and high extraction cost. MCS offers better specific growth rate and product yield than photoautotrophic and heterotrophic modes. Biofuels derived from algal-process offers high energy return than fossil fuel hence it reasonably be considered as green process. Moreover, it greatly improves carbon foot-print to develop a sustainable bioprocess once it is produced from wastes streams. If large-scale algorefinery industry fueled by industrial waste streams using MSC, would be promising for sustainable and cost-effective algorefinery in the future. My presentation would cover recent updates and challenges on mixotrophic microalgae applications for waste-to-wealth and environment protection.

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Dr. Anil Kumar Patel is currently working as Research Assistant Professor at Department of Chemical and Biological Engineering, Korea University, Seoul. Dr. Patel obtained his MSc degree in Biotechnology from Guru Ghasidas University, Bilaspur, India and PhD in Biotechnology from the North Maharashtra University, Jalgaon, India. His wide post-doctoral research was carried out in several overseas labs basically on waste-to-wealth. The area of his current work is mainly Environmental Bioengineering, broadly focused on waste to energy program utilizing bacterial, and algal systems. Under this project, his focus is to economize algal-bioprocess by improving mixotrophic yields via improving bioreactor design and growth conditions from dairy industry wastewater and crude glycerol for enhanced lipid production. All specific projects are on the conversion of Industrial liquid/solid waste into biofuels.

Previously he worked at HKBU, Hong Kong on solid waste management and University of Hawaii, USA on removal of sulfur from gaseous phase of treated SO_4-containing wastewaters by applying designer-biochar which was used for sulfur nutrition in plants. He gained experience in biohythane production using ethanol plant wastes at IndianOil (IOCL), R&D center, India, also on membrane bioreactor for continuous biohydrogen production as well as VFA separation from industrial waste at Institute Pascal, France. In these studies, both bench-scale and pilot-scale studies were undertaken with techno-economic analysis.

His current H-index is 22 and citation >2800. He has over 80 publications/communications, which include 04 patents, 38 original and review articles, 18 book chapters and 2 conference proceedings. He is the recipient of IBA-IFIBiop Young Scientist award for the year 2013 and 'DBT- Energy Bioscience Overseas Fellowship' from the Department of Biotechnology, Ministry of Science and Technology, Govt. of India in 2013. He has been conferred as Best Reviewer from Elsevier in 2012. He has delivered several invited lectures, chaired several scientific sessions, and conference communications as oral and posters in international conferences.

Adapting India to a Non-Fossil Fuel Diet

Dr. Anjan Ray

Abstract

Environmental challenges associated with fossil fuel use in India are sought to be addressed by a slew of regulations and tightening standards in recent years. It is important to critically examine performance, scalability, affordability and sustainability of proposed alternatives and mitigate roadblocks to widespread adoption. Analyses of key policy decisions in socio-economic contexts suggest that many new opportunities are being created. Technological innovations will need to integrate with existing and evolving value chains, as well as with new and revamped business models, to leverage these opportunities.

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Dr Anjan Ray received his Doctorate in Chemistry from the University of Pennsylvania under the guidance of Nobel Laureate Prof. Alan MacDiarmid. He then moved to the chemical industry and worked for over 25 year across functions ranging from Quality Control, Technical Service, R&D and Marketing to General Management, Mergers & Acquisitions and Corporate Strategy. His professional interests have spanned fields as diverse as surfactants, oleochemicals, paints, adhesives, textiles, cosmetics, pharmaceuticals, water treatment, energy efficiency, biofuels and renewable energy policy. Currently, he holds the position of Director, CSIR-Indian Institute of Petroleum, Dehradun. Apart from his professional career in chemical technology, Dr Ray has had an active interest in media, education, heritage and environmental conservation for over 3 decades.

Climate Change and Water Resources in India: Present Status, Future Impacts, Adaptation Options and Government Actions

Dr. Archana Sarkar

Abstract

Climate change is posing a challenge to the existing water resources and to those who are responsible for the management of the water resources. In recent time, several studies around the globe have shown that climatic change is likely to have s significant impact upon fresh water resources availability. The impact of future climatic change is expected to be more severe in developing countries such as India whose economy is largely dependent on the agriculture and is already under stress due to population increase and associated demands for energy, fresh water and food. Today, in most agro-climatic regions and river basins of India the hydrological cycle is being modified quantitatively and/or qualitatively, due to global warming as well as human activities such as changes in cropping pattern, land use pattern, over exploitation of water storage, irrigation and drainage. Changes in the amount of rainfall, rainfall patterns and intensity would affect stream flow and the demand for water. As such, the projected climate change resulting in warming, sea level rise and melting of glaciers will adversely affect the water balance in different parts of India. India released its National Action Plan on Climate Change (NAPCC) in 2008 to outline its strategy to meet the Climate Change challenge. This paper presents a brief review of the present state of water resources in India, climate change impact on the water sector, government actions to address the impacts and suggests some adaptive strategies and future research needs in India.

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Dr Archana Sarkar is a scientist with the National Institute of Hydrology, Roorkee, a premier R&D institute under the Ministry of Jal Shakti, Dept of Water Resources, RD & GR, Govt of India. By education, she is a civil engineer, the first female civil engineer from Rajasthan University in 1989. She has done her masters in CAD in Civil engineering from University of Roorkee (now IIT Roorkee) and PhD in water resources from Dept of Water Resources Development and Management, IIT Roorkee. She has also worked at the Water Resources department of Imperial College, London as a commonwealth Professional Fellow in 2006. She has a vast research experience of more than twenty-two years in the field of Hydrology and Water resources. She has been involved in various national/international research projects with more than ninety research papers/book chapters to her credit. She has co-supervised PhD, M.Tech and M.Sc students from various IITs, NITs and other universities. She has worked in collaboration with many international institutes of repute like SMHI & SEI in Sweden, Imperial College in London, Lancaster University in UK, CSIRO in Australia and organisations like IHP-UNESCO, UNDP, World Bank. She has visited many countries.

Metabolism Approach for Sustainable Cities

Prof. Arun Kansal

Abstract

This is an urban century and India itself is facing an unprecedented scale of urbanization. Hence it presents a unique opportunity to plan, develop and build a new India which is ecologically and economically sustainable. The urban approaches chosen, and the infrastructure decisions made will have severe consequences for generations to come. Cities are like a metabolic system that depend on the environment for resource extraction (e.g., water, energy) and emission absorption (wastewater, solid waste, and off-gas). The individual sectors of these systems (agriculture/forestry, industry, energy supply, buildings, transportation, and waste management) are linked with each other through physical flows of goods (e.g., resources, products, or emissions). The linkages between sectors has significant implications for climate change mitigation: interventions in any of these sectors have consequences for the other sectors and the environment. For example, the renovation or replacement of the building stock has consequences not only for direct energy demand and emissions, but also for industrial activity (e.g., materials production), waste management (e.g., urban mining of obsolete structures), which in turn shapes boundary conditions for primary resource extraction and energy saving through recycling or reuse. An adequate understanding of socio-metabolic systems is necessary in order to identify transformation pathways for human settlements that reduce overall GHG emissions while minimizing risks of declining access to resources and consequences of other emissions. A systemic view can provide policy makers with more robust information about long-term changes, relevant drivers, and consequences of alternative mitigation strategies, including potential co-benefits and trade-offs with strategies for urban development, industry, resource conservation, security of supply, and pollution control. This is illustrated through a case of water metabolism of Delhi City.

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Exhaust Heat Recovery from a 4-Stroke Diesel Engine using Electric Turbo-Generator

Dr. Atul Dhar

Abstract

About 30% heat from reciprocating engines is wasted as exhaust heat losses. Recovering some part of this heat is a promising method for improving the efficiency. This investigation shows that turbo compounding and coupling the second turbine to an electric generator produces substantial power. The second turbine is operated only at certain feasible operating conditions to enhance to performance of the engine. A brushless DC motor used for regenerative braking was rewired for high rpm applications and a speed reduction gear box was used to obtain 250 watts of electrical power. This heat recovered from the exhaust has increased the overall efficiency of the system and reduced the temperature of the exhaust gases. This power can be used for running the auxiliary components in the system or reduce the load on the battery thereby reducing its size.

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Effect of Black Soldier Fly Amendment on Succession of Pathogenic Bacteria Removal during Animal Manure and Sewage Sludge Composting

Dr. Mukesh Kumar Awasthi

Abstract

This study aim was to investigate the influence of black soldier fly larvae (BSFL) *Hermetia illucens* L. (Diptera: Stratiomyidae) on pathogenic bacteria (PB) survival in the chicken manure (CM), pig manure (PM), cow manure (COM) and sewage sludge (SS) compost. Three kinds of manure [chicken (T2), pig (T4) and cow (T6)] and SS (T8) were inoculated with BSFL (1.2:7 ratio on fresh weight basis) and without BSFL (T1, T3, T5 and T7) was used as control and experiment lasted for 9 days. The results indicated that BSFL amendment 90-93% of PB abundances (RAs) was significantly mitigate in CM and COM (T2 and T6), and 86-88% in PM and SS compost. However, relatively higher alive of PB was observed in the T4 and T8 treatments. Most of the PB pertain to *Proteobacteria, Firmicutes*, *Actinobacteria* and *Bacteroidetes* phylum and their community composition varied from phylum to species levels among the all treatments. The PB composition was significantly altered by BSFL amendment and also important role play to enhance in compost quality. Interestingly, *Bacillus* and *Clostridium* were significantly very less abundant present in BSFL applied (i.e., T2, T4, T6 and T8) treatments, but considerably higher population of these bacterial genus and its associated species were identifying from control or without BSFL applied (T1, T3, T5 and T7) treatments. Overall, without BSFL blended-all three kinds of manure-composts have comparatively greater PB abundance than with BSFL applied treatments, as the PB species *Listeria_monocytogenes_FSL_R2-503, Staphylococcus_aureus_M0406, Bacillus_anthracis, Listeria_ivanovii, Staphylococcus_aureus_C0673, Salmonella Bacillus_cereus_VD115, Mycobacterium_tuberculosis_FJ05194 and Pseudomonas_aeruginosa* had relatively greater RAs, followed by *Bartonella_bacilliformis_Ver075; Bordetella_pertussis_2356847; Brucella_melitensis_ADMAS-G1; Klebsiella_pneumoniae_LCT-KP182* and *Corynebacterium_jeikeium_K411* respectively. Thus, CM composting with BSFL addition is efficient technology for the organic waste recycling and conversion of sanitized matured compost with significantly less RBs of PB.

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Advanced Catalysts for Energy and Environmental Applications

Dr. Benjaram M. Reddy

Abstract

Environmental issues such as air pollution, water pollution, and excessive natural resources consumption represent some of the most formidable challenges facing the global humanity today. Recent developments in nanoscience and nanotechnology are playing a key role in addressing some of the environmental and energy related problems. Selection of a suitable material and an appropriate synthetic methodology ultimately determines the success or failure of a nanostructured material towards application, since the physicochemical properties are heavily dependent upon how they are synthesized. Ceria (CeO_2), an abundant rare-earth metal oxide, has attracted considerable research interest in recent years owing to its extensive utilization in environmental and energy related applications. The significance of ceria originates from its remarkable Ce^{4+}/Ce^{3+} redox couple and superior oxygen storage/release capacity (OSC). Ceria serves both as a promoter and as an active catalyst in three-way catalytic converters for abatement of hazardous exhaust emissions. As well, the catalytic activity of ceria for soot combustion has also been investigated recently and proven to be a potential material. Therefore, numerous studies were undertaken on the application of ceria-based materials for various reactions. Nevertheless, a significant limitation encountered with pure ceria is its poor thermal stability, resulting in the loss of surface area and OSC, hence poor catalytic performance. An ongoing challenge in this respect is to develop efficient and thermally stable ceria–based catalysts in order to meet more demanding requirements. There are two promising options available for improving the properties of CeO_2, namely, doping of a suitable rare-earth or transition metal ion into the ceria lattice and reducing ceria particle size into nanoscale. Our recent investigations revealed that incorporation of an appropriate dopant into the ceria matrix greatly enhances its redox properties and chemical reactivity. In particular, small ionic size and low valence state dopants show strong influence on the physicochemical properties of the resulting materials. More details of these studies will be elaborated in this presentation.

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During his long career at CSIR-IICT, he received various fellowships namely, JSPS, DAAD, CNRS, Brain-pool, and other to visit and work in several countries. Dr Reddy has authored or co-authored 280 SCI original research papers in refereed international journals, 11 book chapters, 12 reviews, 5 monographs, 2 edited books, and holds 8 patents. The h index of his publications now stands at 60 with total citations of more than 13,000. He has guided 40 PhD theses and more than 30 BTech/MTech/MSc dissertations. He has been serving as a member of the editorial board or guest editor of Journal of CO_2 Utilization, Applied Petrochemical Research, Emission Control Science and Technology, Catalysis Today, Industrial & Engineering Chemistry Research, Frontiers in Chemistry, and some other journals. In his honour, Elsevier Science Publishers' flagship journal "Molecular Catalysis" published a special issue titled 'Metal Oxides in Catalysis - Professor Benjaram M Reddy Festschrift' (Volume 451 in May 2018) on the occasion of his 60^{th} birthday Dr Reddy has received several awards and honours that include CSIR Young Scientist Award, CSI Young Scientist Award, Associate Fellowship of Third World Academy of Sciences, Sir C V Raman Fellowship of CSIR, Bronze Medal of Chemical Research Society of India (CRSI), and many more. He is an elected fellow of Indian National Academy of Engineering, the National Academy of Sciences India, the Royal Society of Chemistry, Andhra Pradesh Academy of Sciences, and Telangana Academy of Sciences. He has served or serving as the council member of International Association of Catalysis Societies (IACS), member of Asia-Pacific Association of Catalysis Societies (APACS), honorary secretary of Catalysis Society of India, and honorary treasurer of Telangana Academy of Science.

A Brief Overview of Thermoelectric Materials & Strategies

Dr. Bhuvanesh Srinivasan

Abstract

Exploitation of new types of clean energy has become paramount due to the severe depletion of non-renewable energy resources and the deterioration of the environment caused by human energy consumption. In this regard, thermoelectric (TE) materials and devices have drawn increasing interest and attention due to their potential to reversibly convert waste heat into electricity. The TE material's efficiency is quantified by a dimensionless figure of merit, $zT = S2\sigma T/k$ where S, σ, T and k are Seebeck coefficient, electrical conductivity, temperature and total thermal conductivity (sum of the electronic part, k_e and the lattice part, k_{latt}) respectively. The fact that these thermoelectric transport properties are highly interrelated, throws a greater challenge in enhancing zT. Advances in recent times show that it is feasible to enhance zT by a number of approaches: quantum confinement of electron charge carriers; synergistic nano-structuring; nano-inclusions which enable acoustic phonon scatterings; electron filtering; convergence of electronic band valleys; fostering resonant levels by impurities inside the valence band; alloying to create point defects; and complex crystal structures like skutterudites, Zintl compounds, hetero-structured superlattice thin-films and even semi-conducting glasses and utilization of magnetism. The presentation shall highlight some of these approaches that we have effectively applied on several kinds of materials, ranging from glasses and ceramics to several kinds of polycrystalline compounds; different synthesis and processing techniques, right from traditional melt processing to advanced flash-spark plasma sintering; distinct approaches like dopant induced glass crystallization, composition engineering, nanostructuring, electronic band structure engineering, etc., to enhance the thermoelectric performance. The presentation shall also touch upon the attempts that we have made to explore the pyrrhotites and thiospinel based compounds for potential applications at mid-temperature ranges.

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Dr. Bhuvanesh Srinivasan is currently a JSPS postdoctoral fellow (since April 2019) at the National Institute for Materials Science (NIMS), Tsukuba, Japan. At NIMS, he is hosted at the French-Japanese international platform, LINK, a joint research unit established in partnership between CNRS, Saint Gobain and NIMS. His research is focussed on thermoelectric materials and devices for energy harvesting applications. Prior to his tenure at NIMS, he was a Marie-Curie PhD fellow at the University of Rennes 1, France (Oct 2015 – Dec 2018). His PhD thesis was on developing novel chalcogenide-based glasses and ceramics for thermoelectric application. During his PhD, he had carried out secondment periods of few months at Nanoforce Technology Ltd., Queen Mary University of London and European Thermodynamics Ltd., U.K. He pursued his Erasmus Mundus Master program in Materials Science (Sep 2013 – Aug 2015) jointly from Technical University of Munich (TUM) and Ludwig Maximilian University (LMU), Munich, Germany. During his Erasmus Mundus Masters, he spent a couple of mobility/exchange periods at ETH, Zurich (3 months) and EPFL, Lausanne (6 months), Switzerland. Bhuvanesh obtained his Bachelor of Engineering in Materials Science from the College of Engineering Guindy (CEG), Anna University, Chennai, India.

Possibly Scalable Solar Hydrogen Generation by Thin Filmapproach

Dr. Chinnakonda S. Gopinath

Abstract

Solar hydrogen production by water splitting is one of the "holy grails" of chemistry listed in a special issue published by the Accounts of Chemical Research[1] on 1995 by Allan Bard et al. Water splitting to hydrogen is yet to be exploited, in spite of the large amount of research work in the past five decades. A wireless device based on quasi-artificial leaf concept, comprising Au on TiO_2 electrode sensitized by PbS and CdS quantum dots, was demonstrated to show sustainable solar hydrogen (490±25 μmol/h (corresponds to 12 ml H_2 per hour) from ~2 mg of photoanode material coated over 1 cm^2 area with aqueous hole (S^{2-}/SO_3^{2-}) scavenger.[2] Under one sun conditions, 4.3 mA/cm^2 photocurrent generation, 5.6 % power conversion efficiency, and spontaneous H_2 generation were observed at no applied potential. A direct coupling of all components within themselves enhances the light absorption in the entire UV, visible and NIR region (available in sunlight) and charge utilization. Thin film approach, as in DSSC, combined with porous titania enables networking of all the components of the device, and efficiently converts solar to chemical energy in a sustainable manner. A disadvantage in one area of science may become an advantage for another area. In contrast, a successful concept in one area could work for complementary area of research too. These two philosophies are successfully used for solar hydrogen generation and it underscores the necessity to connect relevant concepts.[3] In the next part of talk, we will discuss a quasi-artificial leaf device in a wireless configuration with TiO_2/Mn-CdS composite and NiCu as co-catalyst for possibly scalable as well as commercially viable solar hydrogen production under one sun conditions. The device works at no applied potential and generates 10.5mL/h $H_2$with NiCu alloy as co-catalyst, which corresponds to the power conversion efficiency (PCE) of 4.8%. While millisecond lifetime of electrons in Mn-CdS is known to help for white light emission, the same factor helps to greatly improve charge utilization for H_2 production in QuAL device. In contrast, reabsorption of emitted light is successfully utilized to enhance hydrogen yield in the present work. A simple comparison of solar hydrogen generation from thin film and powder based catalyst, demonstrates the former to outweigh the latter.[4] There is a very good possibility that this device can be scaled to bigger sizes to produce large amount of hydrogen. However, many more challenges are ahead and some of them will be discussed.

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Dr. C.S. Gopinath is Chair, Catalysis and Inorganic Chemistry Division, CSIR – National Chemical Laboratory Pune and well known material scientist. He has published several research articles with special emphasis on catalytic and energy materials. His contributions in this field are immense and students from his laboratory have spread across globe. His research group is focused in understanding the fundamentals of surface catalytic reactions on the real-world complex catalytic materials at a molecular level, and to suggest the ways to control the surface catalytic reactions based on the molecular level understanding. This has led to the development of highly active and/or selective catalysts, which might help to solve the critical issues of highly selective chemical processes in different catalytic reactions.

Valorization of Forest Biomass Cellulosic Fraction towards the Production of Prebiotic Oligosaccharides through Biocatalysis

Dr. Christakopoulos Paul

Abstract

Non-digestible oligosaccharides represent a group of carbohydrates that are resistant to gastrointestinal digestion, therefore they are considered as prebiotic candidates. Among them, cello-oligosaccharides (COS) can derive from the biomass cellulose fraction which is the most abundant carbohydrate on earth. Production of COS from forest lignocellulosic materials (birch and spruce) includes a complete process starting from physicochemical pretreatment and fractionation in order to obtain a cellulose-rich solid pulp, followed by controlled enzymatic hydrolysis, product recovery and purification and, eventually, evaluation of prebiotic activity. In this study, we evaluated different strategies for enzyme-mediated production of oligosaccharides, including the design of tailor-made enzymatic cocktails (cellulases and accessory enzymes), the modification of reaction conditions (pH, multi-stage hydrolysis with buffer exchange to abolish the end-product inhibition) and the fine-tuning of the performance of commercially available enzyme mixtures (addition of ß-glycosidase inhibitor). The produced oligosaccharides were recovered and separated from glucose through nanofiltration and their prebiotic potential was confirmed by the ability to stimulate the growth of different *Lactobacillus* strains. Our results demonstrate that controlled enzymatic hydrolysis combined with product recovery and purification can potentially support the sustainable production of food-grade prebiotic oligosaccharides from lignocellulosic biomass.

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Dr. Paul Christakopoulos works in the area of Biochemical Process Engineering focusing on the development of biochemical (Green Chemistry) processes for the production and refinement of chemicals, fuels and material from CO_2, either captured before it is emitted to the atmosphere (non biomass route) or by recovering it from the atmosphere via photosynthesis in the form of biomass (biomass route).

Paul has been appointed Chair Professor of Biochemical Process Engineering at Luleå University of Technology, Sweden, from February 2012. He has previously served as a Professor of Industrial Biotechnology at the School of Chemical Engineering, National Technical University of Athens, Greece and Visiting Professor at Center for Process Biotechnology, BioCentrum-DTU, Denmark and Chemical and Biological Engineering Department, Chalmers University, Sweden. During his postdoc studies he has worked as Senior Researcher at University of Ghent, Department of Biochemistry, Physiology and Microbiology, Belgium and Institute of Food Research, Protein Engineering Department, Reading, UK. He is author of over 260 scientific publications. Current h-index is 53 with about 9000 citations. Paul had served as an Associate Editor of World Journal of Microbiology and Biotechnology, Food and Bioproducts Processing, PeerJ, Frontiers in Microbiology, FEMS Microbiology Letters.

Quantitative Assessment of Certain Nitrogen Compounds in Environmental Water Samples by a Colorimetric Method

Dr. Chrysa Voidarou

Abstract

Fertilizers have been in usage to increase the yield of various crops throughout the 20th century and are still in intensive use for the same purpose. They represent the most important source for ammonium and nitrate ions, along with other sources of decomposing organic nitrogen compounds. Colorimetric methods are valid for the field assay of the ammonium and nitrate ions content of water and soil and their accuracy is similar to that of other methods. The interpretation of results with our colorimetric method is fast, user friendly, with minimal equipment. The method is semi quantitative with color index interpretation or quantitative in Electra m2 Unified Analyzer. It is an ideal tool for field analysis.

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Pectin/CNT based Electrochemical Sensor for Determination of Ascorbic Acid, Uric Acid and Dopamine

Prof. Cortés José Sandoval

Abstract

The aim of this work is to show the preparation of a nanomaterial based on the biopolymer pectin and industrial carbon nanotubes in order to get a nanomaterial to prepare electrodes for the independent determination of ascorbic acid, uric acid and dopamine.The typical vitreous carbon electrodes used in electrochemistry are no recommendable material to do simultaneous determination of some analytes with nearly electrochemical redox potentials, if you use this kind of electrodes the signals will be overlapped doing the direct quantification impossible. The strategy presented in this work involves the preparation of industrial carbon nanotubes into an aqueous commercial pectin solution to be used in order to modify the vitreous carbon surface. Once you get the modified electrode the resolution of the signals from ascorbic acid, uric acid and dopamine can be achieved, the magnitude of electrochemical oxidation signals al higher than those obtained with the bare electrode whit the possibility to construct calibration curves independently for each analyte. The dispersion of industrial carbon nanotubes whit commercial pectin is not the best reported in our research group but, in order to have an economic sensor to mass fabrication, the results using edible pectin from the market and cheap industrial carbon nanotubes are promising.

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Dr. José Sandoval-Cortés has received Bachelor´s degree Chemistry and Biology Pharmacist, Master in Analytical Chemistry and PhD in Electrochemistry at Universidad de Guanajuato, México. Professional experience in pharmaceutical industries in the quality control like Ely Lilly and Company, Glaxo-Wellcome, Smith-Kline Beecham. As a researcher their interests are focused in the development of new materials based in biopolymers and carbonaceous nanomaterials to be used as electrode for the specific recognition of analytes, that platforms formed by biopolymers and carbonaceous nanomaterials are the perfect support to include enzymes, metal and metal oxides nanoparticles, these molecular architectures allow to made the specific recognition and really sensitive quantification. Actually, he works in the Analytical Chemistry department at Autonomous University of Coahuila, he has the recognition as researcher by Mexican Federal Government throw the Ministry of Education and the National Research Council.

Adsorbents for Radionuclides Based on 2D Materials

Dr. Darina Smrzova

Abstract

Radionuclide-containing waste effluents and contaminated ground water are threats to environment and there is a need for effective treatment. Recent accident when radionuclides were released to environment happened in Fukushima Daiichi nuclear power plant in Japan in 2011. Carbon nanomaterials were studied for use in environmental applications. Graphene oxide (GO) with hydroxyl-, epoxy- and carboxyl surface groups can potentially interact with cations and anions. Romanchuk et al. reported that graphene oxide (GO) rapidly removed several toxic human-made long-lived radionuclides (233U, 239Pu, 234Th, 241Am, 152Eu, 237Np, 95mTc, 90Sr) with efficiency higher than other conventional sorbents, for example bentonite [1]. Coagulation of GO was observed. Several graphene oxide composites for radionuclide removal have been already reported, for example magnetic GO/chitosan [2]. Here we report sorption properties of GO prepared from ultrasound exfoliated graphene. Graphene was exfoliated in ethylene glycol in a pressurized reactor. Two configurations are available - static and flow set-up. The use of pressurized reactor in a batch set-up enables a quantitative yield; it is possible to prepare tens of grams of graphene per hour [3]. Graphene and graphene oxide samples were characterized by X-ray diffraction, scanning electron microscopy, transmission electron microscopy and atomic force microscopy. Sorption of radionuclides 137Cs and 85Sr was tested in aqueous solution. Effect of graphite source (natural vs. synthetic) on the sorption properties was investigated. Furthermore, GO was functionalized in order to improve radionuclide sorption properties; particularly promising seems to be enhancement with carboxylic groups. A method of quantification of the acidic groups by direct titration is available [4]. Moreover, ultrasound exfoliation of graphene inorganic analogues MoS2, WS2, BN, BCN and C3N4 was investigated.

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Environmentally Safe Recycling of Gold from Ewaste

Dr. Deepak Pant

Abstract

E-waste is a threat to the environment and traditional methods for its management are not sustainable. E-waste consists of precise metals like gold, if extracted properly can make a great contribution towards the e- waste recycling. There are hydrometallurgical methods for gold extraction from e-waste using acid leachants has many environmental limitations. Some other acid free methods involve the use of thiourea, cyanide, halides, thiosulfate leachant shows poor rate of leaching etc.
In this work $(NH_3)_2S_2O_3$/EDTA/$CuSO_4$/ $Na_2S_2O_3$ bioenzyme catalyze combinations were investigated to recycle gold from PCBs. The bioenzyme source selected in this study was Citrullus colocynthis (natively known as Garmunda plant) extract. Apart from the physical changes garmunda extract accelerate leaching process and save reaction time with high conc. of gold was leached out into solution. A possible mechanism for the use of plan is also investigated.

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Dr. Deepak Pant currently working as Professor and Dean, School of Chemical Sciences, Central University of Harayana (CUH), Mahendergarh, India was the recipient of Silver Jubilee Research Fellowship award for the year 2003 by Kumaun University, Nainital (India); UCOST Young Scientist Award 2009, INSA visiting fallow 2010, DST-SERC visiting Fallow 2010, DST- SERC Young Scientist Award 2011 and Visitor award 2017 by Hon'ble President of India for his research activities. This year also he was conferred by 8th National Award for Technology Innovation (2018) by Ministry of Chemicals and Fertilizers, Government of India by Hon'ble Vice –Precident of India. Dr Pant has 05 patents in the area of waste management by green techniques and authored 10 books, 45 research papers in various national and international journals. He has guided 02 M.Phil, 06 Ph. D. thesis and 150 M. Sc. dissertations. He is currently involved in important university assignments like Dean Student Welfare (DSW) and Chairman, Non-Teaching Grievance Redressal Committee. Prior to join to CUH he was working as Dean and Head, Environmental Science, Central University of Himchal Pradesh, Dharamshala, Himachal Pradesh.

Electro-Pneumatic Variable Valve Actuation System for Camless Engine

Dr. Dhananjay Kumar Srivastava

Abstract

Conventional internal combustion engines possess a mechanically operated cam-based valve actuation system which provides a constant valve motion with respect to the engine speed. Therefore, it is challenging to deliver a variable amount of air into the cylinders for a wide range of engine speeds and loads without wasting power in pumping losses. On the other hand, the variable valve actuation (VVA) system has been found in providing full freedom to vary the valve lifts, timings, and duration for different engine operating conditions. Several cam-based and camless VVA systems have been proposed by the researchers and implemented on the spark ignition as well as compression ignition engines. Cam-based VVA system is the most prominent technique used to govern the variable valve lifts, timings, and duration by modifications of the cam profiles. The significant benefits of cam-based VVA system are the durability and reliability. It shows improved performance at high engine speeds with less chance of piston and valve collisions due to the mechanical integrity. Multiple cam profiles are generated by multi-cam mechanisms have played a vital role in shifting the valve lifts accompanying the engine speed variations. Further, valve timings can be varied through a cam phaser mechanism. There are few cam-based mechanisms which have the flexibility to vary valve lifts and timings simultaneously. However, the presence of mechanical linkages allow only for discrete engine operating condition. Mechanical complexity makes the system more expensive while consumes higher power because of additional friction losses. Therefore, replacing the traditional cam with camless VVA systems have been found the standard practice for engine researchers as well as automotive sectors.

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Inclusive Governance for Water-Energy-Food Nexus Sustainability

Dr. Fawzia Tarannum

Abstract

The nexus approach to governing the three critical domains, namely, water, energy and food, dates to the World Economic Forum in 2008, where the global challenges associated with economic development were first viewed from the water-energy-food nexus perspective. The interconnectedness of these sectors can be vividly witnessed in various developmental initiatives and have resulted in significant water, food and energy security issues both in global south and north. According to a report published in The Guardian in 2018, farmers in drought prone California were forced to fallow their fields, reducing the food supply, and reduced water availability for energy production. The problem shall further get exacerbated due to climate change induced migration coupled with rapid increase in the population, urbanization and industrialization in the coming years with report from the International Renewable Energy Agency published in 2015 indicating that the demand for water, energy and food is expected to increase by more than 50% by 2050 in comparison to the 2015 levels. The impacts of water-energy-food insecurity are disproportionately felt by different sections of the society depending on the region, socio-economic status, age and gender. Empirical evidence reveals that the threat associated with the variability are contextual, and equitable and sustainable governance demands a multi-stakeholder approach, which is characterized by an array of crosscutting social, economic, political and environmental variables.

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Biofuels, Bioproducts or Biofertilizers…What Can We Sustainably Produce from Algae?

Dr. Ganti S. Murthy

Abstract

Algae have been proposed as a sustainable feedstock for producing everything from cosmetics to jet fuels. Despite several technological innovations, policies and funding support, the algal biofuels industry is still in its infancy. A systems analysis of the algal feedstock based bioeconomy will be presented to assess technical feasibility, economic viability, resource sustainability and environmental impacts of algal biofuels and bioproducts. Challenges in realizing some of the traditional pathways for algal biofuels and bioproducts and alternative solutions to address these challenges will be discussed. A comparative analysis of biodiesel, biocrude and biofertilizer production from algae will be presented from a system perspective. Experimental findings illustrating advantages and disadvantages of various technologies, techno-economic feasibility studies, resource assessments and environmental impact studies will be synthesized to present a holistic picture of algae-based bioeconomy. The principle idea is to offer a systems perspective to catalyze a wide-ranging discussion on ideal pathways for achieving a sustainable algal bioeconomy.

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Dr. Ganti S. Murthy is a professor in Biological and Ecological Engineering Department at Oregon State University. He completed his B. Tech in Agricultural Engineering from NERIST, Arunachal Pradesh and M. Tech in Dairy and Food Engineering from IIT-Kharagpur, India. He then went to pursue PhD in Agricultural and Biological Engineering at Univ. of Illinois at Urbana–Champaign and obtained his PhD in Dec., 2006. He joined Oregon State University in 2007.

Dr. Murthy's research is broadly focused on sustainable bioprocessing. For any proposed technology or policy, Murthy group seeks to answer the question: "Is this approach technically feasible, economically viable, resource sustainable and has lower environmental impacts compared to alternatives? If not, how can we make it so?" His group employs a combination of experimental and theoretical approaches using control theory, systems biology, process modeling, economic analysis and life cycle assessment (LCA) techniques to conduct molecular, cellular, industrial scale and systems level analyses of technologies to establish a sustainable bioeconomy. Recently, Murthy group started researching the nutrient-energy-water nexus at regional and global scale with a particular focus on building the resilience of agro-ecological systems to pulse and pressure disturbances.

Circular Economy: Closing the Loop with Tweaking the Policies

Prof. Hiroshan Hettiarachchi

Abstract

The centuries-old linear economic model that we practice today, let us "take" from nature to "make" things and "use" them to finally "trash" as waste. Increased demand due to increased population or consumption habits, forces us to borrow more and more from nature. This has resulted in not only extreme resource depletion, but also mounds of waste that we have not being able to manage well so far, leaving us two major problems to solve. What if we turn one of the problems into a solution to the other? Interestingly, this is exactly how the circular economy works. The material that we trash as waste is recovered and channeled back to the production in a circular economy to alleviate the resource scarcity. Increasing circularity depends very much on how innovative we can be to propose new methods to unlock the hidden value in waste. Innovation should not be limited to the technology; there is a great deal of innovation needed in the policy arena as well. Most policies we have in place now are not necessarily helpful in our quest for circular economy. This talk is about how policy adjustments can make our transition to a circular economy better and faster. Patterns and trends observed in successful policy changes are briefly discussed by taking examples from around the world.

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Prof. Hiroshan Hettiarachchi is a Civil Engineering Professor from the United States. He contributed to UNU-FLORES activities since 2013 and in 2014 he joined UNU-FLORES as the Head of Unit – Waste Management. He also took a leading role in establishing the UNU-FLORES Ph.D. The program which is offered jointly with the Technische Universität Dresden, Germany, and was the Program Coordinator until 2016. Before joining UNU, Prof. Hettiarachchi previously served at the Lawrence Technological University, in Michigan, USA, where he held the position of Director of Civil Engineering Graduate Programs from 2010 to 2013. He was also a Visiting Professor at the University Calgary, Alberta, Canada in 2013.
Prof. Hettiarachchi's current research focus is mainly on sustainable management of solid waste and wastewater. His past research has resulted in the number of publications covering geotechnical properties and behavior of soils and waste and settlement behavior of landfills.

Design of Manganese-Based Catalysts for Plasma and Microwave Assisted Catalytic Oxidation Processes

Dr. Hisahihro Einaga

Abstract

Air pollution with volatile organic compounds (VOCs) has been a significant environmental problem in Asian countries. Catalytic oxidation processes are important pollution control technologies for VOC abatement. When catalytic processes are applied to air quality control, however, one should pay attention to the diversity of pollutants and emission sources because the concentrations of organic pollutants and gas temperature were much different depending on the kinds of stationary sources. Therefore, catalytic oxidation processes should be customized and optimized to remove VOCs from flue gases in high efficiency.

Manganese-based catalysts

Manganese is one of the most frequently used elements for oxidation catalysts. Due to the facile change of oxidation state of manganese, it can promote complete oxidation of organic compounds and inorganic pollutants (NOx and CO). For the treatment of flue gases polluted with VOCs, Mn-based oxides are especially useful under various conditions. They can be used for various kinds of VOCs, such as hydrocarbons, aromatic compounds, and oxygen-containing compounds. The redox properties and thermal stability of the Mn-based catalysts depend on the composition, structure and supporting materials.

Microwave heating process

In the thermal oxidation processes, Mn-incorpolated perovskite oxides (LaMnO3 and La1-xSrxMnO3) and spinel type oxides (CuxMn1-xOy) have been investigated. These catalysts exhibit benzene oxidation activity at temperature higher than 250°C under normal heating conditions, but they showed the activity at lower temperatures (< 200°C) under microwave irradiation. The heating properties and catalytic properties of perovskite oxides can be easily controlled by changing the constituent elements. The microwave heating process has advantage over normal heating in that rapid temperature rising and drop, which can improve energy efficiency. The apparent activation energy under microwave heating process is generally lower than that under normal heating condition.

Nonthermal plasma-chemical process

For the treatment of low concentration of VOCs (< 100 ppm), plasma-catalytic reactions are suitable from the standpoint of energy efficiency. In the nonthermal plasma reactions, accelerated electrons (e-) impact molecular O2 to form active oxygen species O(3P) and O3. The combination of catalyst materials with the nonthermal plasma reactor utilizes these active oxygen species. Highly dispersed Mn oxides on SiO2-based zeolite and mesoporous materials exhibited the catalytic activity for VOC oxidation at relatively lower temperatures (< 100°C). The efficiency for ozone utilization is a key factor affecting the energy efficiency of nonthermal plasma-catalytic oxidation processes.

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Alternative Fuel Blends of Biodiesel, Ethanol and DTBP for Emission Control in Diesel Engines

Dr. Kirti Bhushan Mishra

Abstract

A high dependence of modern transportation systems on the fossil fuels and its limited quantity combined with the technological risk of higher emission led to the promotion of usage of alternative fuel such as biodiesel. However, biodiesel alone may not meet the energy demand and emission norms unless it is blended with an appropriate Cetane improver. Present work addresses such valuable information on the type and amount of additives (DTBP: Di-tert-butyl peroxide and ethanol) in biodiesel and their effect on the performance and the emissions from a laboratory-scale diesel engine. Detailed measurements of performance parameters along with exhaust gas concentration are carried out. The major revelation of the present study is that addition of ethanol and DTBP in waste cooking oil biodiesel reduced emissions (NO_X, CO, HC and smoke) and improved efficiency (up to 10%) at the same time when compared with conventional diesel fuel. The study suggests that these blends can be foreseen as an alternative fuel in heavy-duty engines without the need of any appreciable design modification.

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Clean Conversion Approach for Recovery of Metals from Waste Electrical and Electronic Equipment (WEEE)

Prof. K. K. Pant

Abstract

There has been observed a significant increase in the generation of waste electrical and electronic equipment (WEEE) during past decade. There is an annual growth rate of approximately 3-5% waste electrical and electronic equipment, which makes it one of the fastest growing waste streams along with plastic waste. These waste material contain significant amount of copper along with several other precious metals like gold and silver along with rare earth metals and hence become a rich source of metals and energy. The efficient disposal of electronic waste has become a challenge due to its large amount and efforts are being made globally for recovery of metals from the waste. Hydrometallurgy, which requires high temperature and strong acids is one of the common methods for the recovery of metals however, the process is not eco friendly and sustainable for electronic waste management. The present study demonstrates a green and sustainable technology to produce energy and recover metals from the e-waste. This process involves a relatively low-temperature pyrolysis of e waste in a temperature range upto 6000 C in a fixed bed system. Under optimized operating conditions, approximately 30 wt.% combustible gases, 10 wt. % liquid product and 60 wt.% solid was obtained under optimal conditions. The gaseous products mainly consisted of a mixture of CH4 , H2 , CO, and CO2 which has the approximate heating value 28 MJ/Kg whereas, the solid powdered product contained a mixture of base and precious metals along with carbonaceous materials. Treatment of the solid materials mixture was done by ultra sonication process, which resulted more than 90 wt.% recovery of metals, thereby leaving behind carbonaceous materials. The characterization of the different product streams and metals was done by various techniques suchas Microwave Plasma Atomic Emission Spectroscopy (MP-AES), Thermogravimetric Analysis (TGA), Fourier Transform Infrared Spectroscopy (FTIR), Raman Spectroscopy, X-ray Diffraction Analysis.

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Development of Indigenous Concentrating Solar Thermal Systems for Sustainable Energy and Environment

Prof. K. S. Reddy

Abstract

Limited fossil resources and environmental problems associated with them have emphasized the need for sustainable energy supply options that uses modern innovative renewable energy technologies. Solar energy can be used for wide range of applications such as power generation; potable water production; cooling and heating. High Performance solar thermal technologies have emerged as matured energy technologies. Extensive thermal analyses of these technologies using computational heat transfer may result in efficient and indigenous energy systems for energy secure economy and climate resilient future. Solar energy can be used for wide range of applications such as power generation; potable water production; cooling and heating. This research work presents the design and developmental aspects of various solar energy systems that are used widely. Design and development of concentrating solar power systems for estimation of heat loss and heat gain characteristics is very import to arrive an effective design and cost effectiveness. Modelling and optimization solar thermal concentrating systems, solar thermal storage systems, solar desalination systems and solar flux measurements are non-linear in nature. Mainly convective and radiative heat transfer occurs in these solar thermal systems. These modes of heat transfer contribute both heat energy gain and loss from the system. Hence, estimation of optimum configuration of solar thermal power systems for maximum heat gain and minimum heat loss is necessary for optimal design of solar thermal system. High Performance solar thermal technologies have emerged as matured energy technologies. Extensive thermal analyses of these technologies using computational fluid dynamics (CFD) may result in efficient and indigenous energy systems for energy secure economy and climate resilient future. The solar energy systems considered here include solar desalination system, Integrated Collector Storage system, Linear Fresnel Reflector System, Concentrated Photovoltaic system, solar parabolic dish system and Solar Thermal Storage systems for CSP applications. These indigenously developed solar technologies may be used to evolve technologies for sustainable energy and environment solutions in India.

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Prof. K. Srinivas Reddy obtained his PhD from Indian Institute of Technology Delhi in Energy Studies in 1999. He then joined National Institute of Technology Warangal in June 1999, after a brief service of about 4 years at NITW, he joined IIT Madras in April 2003 as an Assistant Professor. Presently, Dr. Reddy is a Professor of Mechanical Engineering at IIT Madras and he is also an honorary professor at University of Exeter, UK. He also served as an Adjunct Professor at CEERI-CSIR, Chennai during 2014-17. He has 8 patent applications and more than 242 publications of which, 127 papers in reputed international journals, including five review articles on solar energy systems and energy storage. His co-authored book on "Sustainable energy and the environment: a clean technology approach" Prof. Reddy is actively involved in the implementation of solar thermal technologies for power generation and process heat applications through "Design-Development-Demonstration-Deployment (4-D)" approach. His research project are related to solar energy and energy & environment funded by various national and international agencies such as DST, MNRE, AICTE, RCUK, EPSRC, UKIERI and ICIMPACT. In recognition of his research work, Dr. Reddy received several awards such as WSSET Innovation award, Shri J.C. Bose Patent award and twice, the Bhagyalakshmi and Krishna Ayengar Awards, young teachers from AICTE in 2003. Very recently, He received the Mid-Career Level Institute Research and Development Award (IRDA)-2018. He is an expert committee member in various selection/ review committees and the Visitor's nominee for IIT Delhi.He supervised over 176 UG, PG and Ph.D.

Perspective and Challenges in Anaerobic Digestion of Korea

Prof. Kim Sang-Hyoun

Abstract

The government of the Republic of Korea banned the direct landfill of any kind of organic solid waste. For example, food waste, the greatest proportion of organic waste in the country (5,256,000 ton/year in 2016), has been separately collected and mostly recycled as animal feed and compost. However, the market value of the recycling products is low due to quality issues and high operation cost. Furthermore, composting and animal feed production discharge process wastewater containing pollutants equivalent to more than half of the original food waste. Therefore, anaerobic digestion (AD) has recently been extensively adopted for the treatment of food waste and its process wastewater. Anaerobic digestion can recover chemical energy of food waste into heat, electricity and biomethane. Also, the technology is well-suited to the non-sterile, ever changing, complex environment of food waste. However, there are several operational issues which may hinder successful digestion of Korean organic solid waste. Furthermore, careful management of effluent is required because it would add external pollutants into public wastewater treatment stream. This presentation introduces the current state of anaerobic digestion and the perspective in Korea.

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Novel and Matured Biotechnologies in Food Bioprocessing Based on Micro and Nano Tubular Cellulose

Prof. Koutinas Athanasios

Abstract

In this investigation two novel and two matured bio-processes based on nano and micro-tubular cellulose will be discussed**.** One new and novel technology focuses on production of carbohydrate nano-tubes (CNTs), which are competitive to carbon nano tubes, with the use of nano and micro-tubular cellulose (TC) as a raw material. Carbohydrate nano-tubes are obtained by treating the tubes of TC with cellulasses enzymes. Samples taken during hydrolysis of TC at various time intervals were collected and freeze dried. The obtained CNTs were studied with TEM, X-ray and porosimetry analysis. The results show production of CNTs with pores that belong in the nano area. Another new bioprocess is a two-layer cell factory that is capable of fermenting starch in a single batch. The results of the cell factory preparation and subconsequent starch fermentation in a single batch will be reported. Furthermore, matured technologies of wine making in domestic refrigerator and brewing in domestic refrigerator will be reported. New methods in wine making, and brewing will also be discussed. Wine and beer are produced in the domestic refrigerator, with the use of mixtures of freeze-dried TC supporting psychrophilic yeast AXAZ-1 combined with freeze dried grape must or wort. The kinetics of fermentations at extremely low temperatures as well as productivities, volatiles concentrations, determined with GC and GC-MS, and results of taste tests will be discussed. [Authors acknowledge support of this work by the project "Research infrastructure on Food Bioprocessing Development and Innovation Exploitation –Food Innovation RI" (MIS 5027222), which is implemented under the Action"Reinforcement of the Research and Innovation Infrastructure", funded by the Operational Programme "Competitiveness , Enterpreneureship and Innovation" (NSRF 2014-2020) and co-financed by Greece and he European Union (European Regional Development fund)].

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Professor Koutinas promoted successfully from the post of Lecturer to Full Professor and now is active Professor Emeritus of Food Biotechnology in the Department of Chemistry, University of Patras, Greece. He published 182 papers in international journals, 6 patents, 5 books of which 4 text books for students, 13 chapters in books, 128 presentations in International conferences and 39 in National, more than 3800 citations and h-index 33. Supervised 21 PhD Graduates and from the Food Biotechnology Group established and headed by him, graduated 32 PhD and about 50 masters scientists. Presented three technologies in Innovation conference held in Washington DC, June 18-21, 2015 of which one achieved award. Professor Koutinas invited to teach Graduate courses by Universities in Portugal, Spain and Poland in the fields of GMO Foods, Dairy Technology and DNA Economy. His research has been funded by about 6.000.000 Euros total budget including companies' budget of consortia.

Solventogenesis from H_2/CO_2 and Syngas by Anaerobic Granular Sludge at Different Temperatures

Prof. Lens Piet

Abstract

Granular sludge from an industrial wastewater treatment system was tested as inoculum for ethanol production via non-phototropic fermentation at psychrophilic (25°C), mesophilic (37°C) and thermophilic (55°C) conditions using H_2/CO_2. The highest ethanol concentration (17.11 mM) was obtained at 25°C and was 5-fold higher than at 37°C (3.36 mM). Methane was mainly produced at 55°C, while neither acetic acid nor ethanol was efficiently produced. Ethanol production was linked to acetic acid production with the highest ethanol to acetic acid ratio of 0.514 at 25°C. Ethanol was produced when acetic acid reached 15 mM and the pH was lower than 5, suggesting that ethanol was produced via the acetate pathway. The undissociated acid (nonionized acetic acid) accumulation rate constant at 37°C (0.145 h^{-1}) was 1.39 fold higher than at 25°C (0.104 h^{-1}). The carbon recovery was 115.7%, 131.2% and 117.1%, while the electron balance was almost closed (97.1%, 110.1% and 109.1%) at 25°C, 37°C and 55°C, respectively. The addition of bicarbonate inhibited ethanol production both at 25°C and 37°C. *Clostridium sp.* were the prevalent species at both 25 and 37°C at the end of incubation, which contributed to ethanol production. *Caloramator sp.* and *Thermoanaerobacterium sp.* were the dominant bacteria at 55°C.

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Prof. Dr.ir. Lens is established professor of New Energy Technologies at National University Ireland Galway. He is also Professor Environmental Biotechnology at UNESCO-IHE (Delft, the Netherlands), adjunct professor at Tampere University of Technology (Finland) and was previously on the faculty of the Sub-Department of Environmental Technology at Wageningen University (1999-2006), where he still has a zero nomination. Prof. Lens trained in Environmental Sanitation, then obtained his Ph.D. in Environmental Engineering at University Gent (Belgium). He is founding Editor-in-Chief of the Review Journal "*Re/Views in Environmental Science and Bio/Technology*" and founding editor of the IWA Publishing series "*Integrated Environmental Technology*". He is the initiator of the Marie Curie Training Site "*Sulfur and Metals* – HEMEP", the Erasmus Mundus Joint Doctoral programme "*Environmental Technologies for Contaminated Soils, Sediments and Solid Waste* - (ETECOS^3)", the Marie Sklodowska-Curie European Joint Degree "*Advanced biological waste-to-energy technologies* –Abwet", the Erasmus Mundus Master Course "*International Master of Science in Environmental Technology* - IMETE" and joint MSc degree programmes with the Asian Institute of Technology (Bangkok, Thailand) and University of Valle (Cali, Columbia). Besides innovative research, he is also a leader in education and capacity-building, organising numerous study-days, conferences, summer schools and short courses. He has (co-)authored over 550 scientific publications and edited nine book volumes.

Nuclear Analytical Techniques: Neutron Activation Analysis (NAA) and Isotope Dilution Analysis (IDA) for Environmental Samples

Prof. Mamata Lanjewar

Abstract

Reliable analytical measurements of environmental samples are essential ingredients of sound decisions involving many facets of society including safeguarding the public health, improving the quality of environment and facilitating advances in technology. Neutron activation analysis (NAA) and Isotope dilution analysis (IDA) are amongst the most revolutionary techniques which strode past to other analytical methods. NAA is an extremely sensitive, selective and precise method which yields wealth of information on major, minor and trace constituents of just few milligram samples of all kind of matrices. An advantage of NAA its abilities to simultaneously determined most elements in the Periodic table with low detection limit.NAA and IDA has been widely used for geological, biological, environmental, industrial, archaeological and forensic samples. These have been used as standard techniques for the characterization of Standard/ Certified Reference materials at the National Institute of Standard and Technology (NIST, USA), International Atomic Energy Agency (IAEA), Vienna and other such agencies. Basic principle of NAA is to irradiate the material with neutrons resulting in the production of Radioactive nuclide with the emission of ß- and ϒ-radiations. The elemental concentration was calculated using the respective gamma ray energies. In the present study we have employed NAA and IDA for the multi-elemental (~40 elements upto ppm and ppb level) analysis of large number of natural systems such as water, soil, fugitive and ambient dust particulates matter from industrial establishments and several other samples of environmental importance using 113 cm-3 HPGe detector (PGT, Germany). Also several Environmental Standard/ Certified Reference Materials were analyzed for quality assurance of our data as well as a part of Interlaboratory comparison study. An attempt has been made to attribute the elemental contents to possible sources of origin.

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Whey Exploitation

Prof. M. Kanellaki

Abstract

Whey is the liquid effluent of the dairy industries and therefore it is produced in large capacities worldwide, creating serious environmental pollution problems. However, intense recent research attempts try to deal with the problem focusing on the development of technologies that employ whey as raw material to produce foods or chemicals of added value. To the direction of whey utilization and reduction of environmental pollution, five technologies have been developed by our research group: (a) novel dairy starter cultures, such as kefir, L. casei wet and dry, (b) novel probiotic and antimicrobial whey beverage by using L. casei immobilized on mastic gum (Pistacia lentiscus via chia), (c) whey protein as carrier of starter cultures for feta-type cheese production, (d) alcoholic fermentation of whey by using promoters, such as mollases, orange juice, orange peel and others, (e) new generation biofuel from whey based on ethyl esters produced after esterification of ethanol and organic acids. (We acknowledge support of this work by the project “Research Infrastructure on Food Bioprocessing Development and Innovation Exploitation – Food Innovation RI” (MIS 5027222), which is implemented under the Action “Reinforcement of the Research and Innovation Infrastructure”, funded by the Operational Programme & quot;Competitiveness, Entrepreneurship and Innovation" (NSRF 2014-2020) and co- financed by Greece and the European Union (European Regional Development Fund)).

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An Improved Pozzolana from Agro-Industrial Waste for Sustainable Construction

Dr. Mangesh Madurwar

Abstract

The rapid industrialization, urbanization, has placed a huge demand on the building materials, which has ultimately causing a chronic shortage of the building materials. The effective solid waste management is another big challenge in the developing countries like India, due to the huge amount of waste is generated from the agro-industrial production activities. This accumulated waste affects the environment badly by polluting the air, water, and land resources. Now, it has become increasingly important to adopt the sustainable development practices for recycling and converting the waste materials into reusable products. In the present study, the agro-industrial waste sugarcane bagasse ash (SCBA) was identified as a principal raw material and utilized to develop the sustainable and energy efficient construction products. The reviewed optimum replacement range of SCBA showed a large variation which reflects the need to investigate the true optimum content of SCBA in concrete production. The present study also investigates the methodology for improving the pozzolanic characterization of raw SCBA. The treated SCBA was used for various concrete applications viz. panels, pavers etc. The developed products were tested for its physico-mechanical, permeability-related, durability, and thermal performance-related properties. The result shows that the devised mechanical and thermal treatment significantly enhanced the pozzolanicity of raw SCBA. Further its life cycle assessment was also carried out. The research study serves the purpose of effective solid waste management and the development of innovative sustainable construction materials.

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Potential Use of Agoindustrial Products as Support for Fungal Jasmonic Acid Production Under Solid-State Fermentation, Alternatives Substrates

Prof. Martinez Hernandez Jose Luis

Abstract

The need to have environmentally friendly products, which can contribute to the protection of plants, the increase of agricultural yields, the formulation of food, medicines and cosmetic products, is a demand of today's society. One of these products is the jasmonates to which for many years multiple benefits have been found in these sectors. However, new processes with higher productivity and lower costs that allow the extensive use of jasmonates are required. The microbial pathway from the fungus Botryodiplodia theobromae and through a fermentation process in solid medium offers the opportunity to develop more productive processes and the use of industrial waste, which in many cases constitute environmental problems. The bioproducts for agricultural use have emerged as an alternative, inside them jasmonic acid (JA), which can be obtained industrially through fermentation processes, with the need for better productivity. We present study of potentiality of agroindustrial residues as possible supports in the solid-state fermentation of the fungus *Botryodiplodia theobromae* (Bth) for JA production. *Bth* was the microorganism used during the study. Orange waste and bagasse from sugarcane were used as supports, provided by different Mexican industries. It was found that in sugarcane bagasse the main components were the total fibers and carbohydrates, while in the orange waste were the carbohydrates. The factors studied had a significant influence on the JA productivity. JA productivity with orange waste was higher than the productivity obtained with sugarcane bagasse. These agoindustrial products present a biotechnological perspective in the production of JA by solid-state fermentation.

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Emission Factors and Source Profiles of In-Service Vehicles in India

Moqtik Bawase

Abstract

Quantity and chemical nature of the particulate matter from the vehicle exhaust is dependent on engine technology, fuel type, engine capacity. While source apportionment methods can be applied to assess the impact of source emissions on ambient levels, scientific data on PM emissions are limited and often not representative of reality. It is, therefore, important to have particulate emission and characterization data, in Indian context, for air quality modeling. Availability of Emission factors of vehicle exhaust in Indian context is one of the most critical step for generation of correct/ representative emission inventory from transport sector. Similarly, source profiles of vehicle exhaust particulate matter provides information on distribution of various chemical species in terms of mass fractions.Emission factors for post 2005 vehicles was generated, using standard mass emission test method on chassis dynamometer, for in-service vehicles of different fuel types (Gasoline, Diesel and CNG), of different vehicle categories (2W, 3W, Cars, LCV, HCV) and of different engine capacities representing the fleet of vehicles plying on road. The collected particulate matter filter-samples were analyzed for Ions, Carbon fractions and elemental content to generate source profiles. This database of emission factors can be utilized as an input for generation of emission inventory for transport sector which is used for dispersion modeling. Source profiles can be used as an input for receptor modeling for identification of source contributions.

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Estimation of Idling Fuel Losses and Corresponding Emissionss at the Signalised Intersections

Dr. Niraj Sharma

Abstract

According to Petroleum Conservation Research Association (PCRA) [Ministry of Petroleum & Natural Gas (MoPNG), Govt. of India] recommendations, every motor vehicle at the traffic intersection, idling for more than 20 seconds, is expected / advised to switch off their engines to reduce the idling fuel losses and corresponding vehicular emissions there. These idling emissions generally results in "pollution hot spots" at these traffic intersections, where air pollution levels generally exceed the national ambient air quality standards specified by Central Pollution Control Board (CPCB). Apart from high air pollution levels at various traffic intersections, idling of motor vehicles also results in monetary losses due to wastage of fuel. The estimation of idling fuel consumption and corresponding emissions at any signalized intersection have two components: (i) estimation of fuel consumption (or fuel losses) of vehicles idling at the signalized traffic intersection (ii) converting the estimated idling fuel consumption/losses as estimated in step (i) into corresponding emissions by employing appropriate (i.e fuel/energy based) emission factors (i.e. IPCC) by using various other input parameters collected from primary surveys or secondary sources .A study entitled 'Awareness Campaign at 100 Signalized Intersections of Delhi and Related Studies' sponsored by Petroleum Conservation Research Association (PCRA), was undertaken by CSIR-CRRI in year 2018. The study was aimed at finding the impact of the "Awareness Campaign" regarding switching-off by vehicle users [Two Wheeler, Three Wheeler (Auto) and Car commuters] at the 100 busy signalized intersections (as indentified by the Delhi Traffic Police) in Delhi, if the red phase of the signal is more than 20 seconds, as recommended by PCRA. The study was carried out in three phases i.e., "Before", "During" and "After" the campaign. There was ~22% reduction in idling fuel losses for petrol fuel between "before" and "after" campaign phase. The study also found significant reduction in tCO_2e of emissions at these selected 100 signalized intersections It is estimated that there was approximately Rs.1.71 Crore per day fuel loss was occurring due to the idling of vehicles at these 100 selected intersections "before" awareness campaign which reduced to Rs.1.39 Crore (~24% reduction) "after" awareness campaign, which on an average estimated to result in savings of fuel losses worth ~ Rs. 32 Lakhs per day at these 100 signalized intersections. The study further recommended various measures viz., synchronization of traffic signals, timer installation at traffic intersections and their visibility to the motor vehicle drivers and providing motor vehicles with hybrid engine technologies viz., auto on-off of the engines at the signals etc. reduce idling fuel consumption and related emissions.

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Dispersion and Performance Prediction in A Hybrid Upflow Anaerobic Sludge Blanket Reactor Treating Fermentation Based Pharmaceutical Wastewater

Prof. P. Mullai

Abstract

The flow pattern in bioreactors is different from those of ideal reactors like the plug flow and the perfectly mixed flow reactors. The flow patterns have a great influence on the performance of the bioreactors. A closer look at a hybrid upflow anaerobic sludge blanket (HUASB) reactor on the startup and steady state operation indicate that its fluid flow can be explained with an axial dispersion model. The performance of the HUASB reactor was found out using this model. For four different OLRs such as 5.85, 11.46, 13.8 and 24.28 kg COD m-3d-1, the values of dispersion number obtained were 0.13, 0.23, 0.2 and 0.54, respectively. Further, for the said OLRs, the values of theoretical COD removal efficiencies respectively were 92.4, 82.0, 63.0 and 41.7%. As the values of percentage error calculated were less than 11%, the dispersion model was found to be a good representation of the flow in the HUASB reactor.

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Alternatives to Gasoline and Diesel Fuels

Dr. P.A. Lakshminarayanan

Abstract

Stoichiometric combustion of gasoline fuel can be cleaned up in the exhaust with a three-way catalytic converter, if only evaporation and mixing can be perfect before the end of the inlet stroke. The process is incomplete in transient conditions and during starting from cold. Therefore, substantial effort is spent during engine development to reach the ideal. However, the mixing of air and gaseous fuel is impeccable during the intake and with the existing fuel injection technology it is possible to exceed futuristic emission standards when natural gas is used as fuel in a spark ignition engine. By virtue of its high resistance to knock, turbocharging a natural gas engine to a high bmep similar to a diesel is not very difficult, leading to lower fuel consumption and carbon dioxide emissions. The innovations in diesel engine have been towards abating nitric oxides and particulate matter resulting from lean droplet combustion, without compromising on its legendary fuel consumption efficiency and high torque, by progressively increasing injection pressure and precisely controlling multiple injections and using more sophisticated after treatment systems. The remarkable increase in injection pressures triggered a newer form of emissions, namely sub 2.5-micron particulates to which human respiration system is transparent. Dimethyl ether synthesized from methyl alcohol is a liquid only at pressures above seven bar at room temperature enabling handling it like LPG in a diesel type compression ignition engine. Since it easily vaporizes and is oxygenated, both the difficulties of a diesel engine, namely particulate mass and its number are absent. A fuel injection equipment operating at 700 bar and exhaust gas recirculation can meet the standards for nitric oxides.

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With his teams, he has developed more than eight diesel and CNG engine platforms and 150 engine types commercially successful for efficiency and cost effectiveness. Two engine designs received prizes from the Institute of Directors (India). He has authored 54 research papers in journals and conferences of international repute. Four of them received the prizes for integrity and quality of contents from the SAE (Arch Colwell Award), Combustion Society (India), AVL (Graz) and AVL (India) in 1983, 1993, 2005 and 2011. He has co-authored two books titled "Modeling Diesel Combustion" (Springer 2010) and "Critical Component Wear of Parts in heavy Duty Engines" (John Wiley 2011) and co-edited a handbook "Design and Development of Heavy-Duty Diesel Engines" (Springer, 2020). He is elected to the fellowships of SAE (2009), INAE (2013) and ISEES (2018).

Biodiesel from Micro Algae: The Future of Sustainable Fuels

Prof. P.K Bose

Abstract

Global warming, increased energy consumption, increasing agricultural demand, and new air and water pollution regulations that have been adopted for diverse and integrated waste to energy solutions to meet the needs of community and the environment. In regard to this, the topic of biofuels has gained a lot of interest since they seem to have great potential in reducing the negative environmental impact by acting as a partial or full substitution to fossil fuels. Biofuels tend to be more environmentally friendly than fossil fuels due to several factors, such as their renewability and lower pollution, which is why we have chosen to investigate them further. Biodiesel is a renewable fuel that has the potential to improve people's lives through energy independence and reduced environmental impacts. Algae have significant potential to support an advanced biofuels industry. The potential applications of algae have been known for many years, but there have been complications in regards to the development of the technology to use algae on a larger, industrial scale, and it is only in recent years that we have gained enough knowledge about algae to really work with them and utilize them for various purposes, such as the production of biofuels. Biofuel from algae is considered carbon-neutral, which means that the algae consume as much CO 2 when grown as they release when burned. The greenhouse gas footprint from biodiesel produced by algae are 93 % lower than that of traditional petroleum diesel. Algae as feedstock for biofuel refers to a diverse group of organisms that include microalgae, macroalgae (seaweed), and cyanobacteria (formerly called "blue-green algae"). Algae occur in a variety of natural aqueous and terrestrial habitats ranging from freshwater, brackish waters, marine, and hyper- saline environments to soil and in symbiotic associations with other organisms. Earlier sources of biofuel relied on using food crops for oil production, which meant that fuel production would tap into food production, both in regard to the space used for growing crops, and in regard to choosing how to use these crops. The conversion of algae to feasible fuel takes a number of steps. Some processes for the conversion of algae to liquid transportation fuels require pre-processing steps such as harvesting and dewatering. Algal cultures are mainly grown in water and can require process steps to concentrate harvested algal biomass prior to extraction and conversion. These steps can be energy-intensive and can entail sitting issues. Three major components can be extracted from algal biomass: lipids (including triglycerides and fatty acids), carbohydrates, and proteins. Once a sufficient amount of algae has been produced, the next stage in converting them to biofuel is separating the biomass from the liquid and drying it. This can be executed by centrifuging the algae cultivation to end up with biomass containing minimal amounts of water. When the algae are dry, it is ready for extraction of lipids. These lipids mainly consist of mainly triacylglycerols. A traditional way of extracting lipids from biomass is solvent extraction. A commonly used solvent for this purpose is hexane. An alternative approach to extracting one component from another is by using supercritical fluid (SCF) as the extracting solvent. Once the oil has been extracted from algae, it is converted to biodiesel by transesterification process, which is a process that can convert the oil into the biodiesel that can now serve a purpose as fuel. Transesterification is a nucleophilic substitution reaction that consists of three reversible reactions. First, the triglycerides are converted into diglycerides, which are further converted into monoglycerides. Lastly, the monoglycerides are converted into glycerol.

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Sustainable Production of a New Generation Biofuel: A Lipase-Catalyzed Esterification of Fatty Acids from Liquid Industrial Wastes

Prof. Papamichael Emmanuel M.

Abstract

Nowadays the substitution of fossil fuels, by biofuels, acquires of worldwide increasing interest. Alternative fuels, might be synthetic esters of fatty acids. Hence, we suggest the advantageous solution of lipase-catalyzed synthesis of esters using low molecular mass fatty acids, which can be produced by acidogenesis of inexpensive liquid industrial wastes. The aforesaid idea surmounts the dilemma, foods *vs.* fuel, and it is performed through fermentation promoters acting, simultaneously, as immobilization carriers (c-alumina, kissiris etc). Herein, the suggested methodology consists of suitable experimental design, low-cost sustainable and environmentally friendly biofuel production process, which is compatible with the market demands. Subsequently, a new generation biofuel was produced using fatty acids formed via acidogenesis of industrial wastes; these fatty acids were esterified catalytically with selected alcohols, by immobilized *Candida Antarctica* Lipase-B. Considerable reactor parameters along with selected reaction conditions were studied through experimental design, suggesting novel esterification processes. The vast importance of continuous removal of produced water has been confirmed, among others, by the economical biofuel production. We achieved high ester yield (<97%) in augmented concentrations (3.35 M) in the reaction mixtures, at short times of esterification. After ten cycles of reuse, the immobilized lipase maintained over 90% of its initial esterifying ability

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Biotechnological Strategies for the Valorization of Agro-Industrial Waste

Prof. Parmjit Singh Panesar

Abstract

Agro-food industries are one of the largest growing sectors in the world that play a significant role in connecting farmers with the consumers. These industries generate huge quantities of biodegradable solid (peels, pomace, seeds etc.) and liquid wastes which is becoming a global concern. It has been estimated that approximately 45-50% of agro-industrial wastes is generated from food processing industries. These wastes carries high moisture content and organic load which is difficult to handle and results in environmental pollution if disposed directly without any treatment. Despite of being an environmental burden, these wastes are a rich source of high value compounds such as carbohydrates, proteins, polyphenols, essential oils, pectin etc. These compounds can be recovered by employing variety of extraction techniques which can be utilized for numerous applications in food, pharmaceutical or cosmetic sector. Moreover, due to the presence of high carbohydrate content, these wastes can be utilized as a substrate for its conversion into a broad spectrum of bio-products such as chemicals, fuels and energy via biotechnological pathways. With the considerable advancement in the biotechnology research, different bioprocesses have been developed for the valorization of different agro-industry byproduct and residues. By using these byproducts as substrates, useful products, such as organic acids, ethanol, biopigments, bioflavors, single cell proteins etc have been produced. In addition, technologies have also been developed for the value addition of the various agro-industrial wastes for the production of enzymes, prebiotics, exopolysaccharides and biofuels via anaerobic digestion, fermentation and vermicomposting technologies using suitable microorganisms. The concept of biotransformation of food waste into novel products is gaining popularity across the globe and has significantly contributed in the proper utilization of food waste while maintaining the sustainable waste management techniques and valorization processes. Therefore, in order to address this persistent problem, sustainable valorization strategies are currently being explored for the reuse, recycle and proper management of agro-industrial wastes. Further research is being focused on the development of the potential technologies with an aim towards the zero-waste concept, which would not only have a significant impact on the environmental management, but would also economize the production

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He has successfully completed 7 research projects funded by DBT, CSIR, MHRD, AICTE, New Delhi. He has published more than 130 international/national scientific papers, 50 book reviews in peer-reviewed journals, 31 chapters and has authored/edited 07 books. He has guided 10 Ph.D. students & 6 students are under progress. He is a member of the editorial advisory boards of several national/international journals including *'International Journal of Biological Macromolecules*' and "*Journal of Food Science & Technology*'. He is now serving as a member of the National level Scientific Panel on "*Water & Beverages (alcoholic/non-alcoholic)"* constituted by Food Safety and Standards Authority of India (FSSAI). He is also serving as Member in the international collective of experts of Foundation for Science and Technology (FCT), Portugal. In 2016, Prof. Panesar has been offered visiting professorship of Tehran University of Medical Sciences, Tehran, Iran for the period of three years.His research is focused in the area of food biotechnology especially value addition of agro-industrial wastes, food enzymes, prebiotics, probiotics, Biodegradable films, green extraction of bioactives.

In recognition of his work, he was awarded "Fellow Award 2018" by The Biotech Research Society of India (BRSI.Prof. Panesar has more than 3100 number of citations & h-index 28 (Google scholar).

MBR Treatment of Leachates Originating from Waste Management Facilities: A Study of the Design Parameters for Efficient Treatment

Prof. Patrick Drogui

Abstract

Waste-originating leachates are considered highly complex wastewaters and are generally characterized by high concentrations of ammonium (NH_4^+) and recalcitrant dissolved organic substances (e.g. fulvic- and humic-like acids). Conventional approaches for the waste-originating leachates consists in their transportation to the municipal sewage treatment system (co-treatment), or their on-site treatment by a conventional activated sludge process or aerated lagoons. With the co-treatment approach, studies have reported significant biological treatment inhibition caused by high ammonium loading rates from the leachate. An emerging process that addresses these issues and has gained interest over the last decade is the membrane bioreactor (MBR). A majority of the previous studies on leachate-treating MBRs reported contaminant removal efficiencies in terms of percentage notwithstanding their loading rates, which can lead to a misinterpretation of the process capacities. The main objective of this study was to define the interaction between the SRT and the contaminant loading rate on a MBR's efficacy in removing contaminants frequently detected (COD, NH_4^+, total phosphorus and metals) above the discharge criteria in waste-originating leachates. Over a period of 152 days, SRTs of 28 and 47 days and HRTs of 13, 25, 36 and 52 hours were studied using a real leachate with a constant composition. Results showed that MBRs can efficiently treat > 1 850 mg COD L^{-1} d^{-1} of highly to moderately biodegradable COD, with the SRT having no significant impact on the removal of recalcitrant COD. Overall ammonium removal rates of > 740 mg NH_4-N L^{-1} d^{-1} can be achieved as long as a residual alkalinity of 200 mg CaCO3 L-1 and an adequate dissolved oxygen concentration (6-7 mg L^{-1}) are both maintained. Overall phosphorus removal rates are independent of the phosphorus loading rate. However, the highest overall phosphorus removal rate (39±2 mg P g TSS^{-1}) was obtained at the lowest SRT (28 days) due to an increased extracellular polymeric substance production. Finally, MBR's metal removal capacity is mostly dependent on the metals' affinity to both the leachate's recalcitrant COD as well as sludge concentrations.

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Professor Drogui's research interests focus on the development of new pollutant removal technologies (inorganic and organic). Among these techniques are electrotechnologies, processes that take advantage of electrochemical properties and techniques. These techniques can be used effectively to improve existing municipal and industrial wastewater treatment systems, or to replace conventional, inefficient technologies for the removal of specific inorganic or organic contaminants. The interest of these techniques lies in their non-polluting aspect and their ease of automation. These characteristics are favorable to the development of industrial and urban waste decontamination processes. At present, there are very few single-step processes that can simultaneously remove toxic inorganic and organic pollutants.

Adsorbents of Radionuclides

Dr. Petra Ecorchard

Abstract

The interest of our research is to find effective and selective adsorbents of radionuclides mainly for 137Cs and 85Sr or uranium. We previously studied graphene oxide (GO) composites with the polymeric matrix.1 The graphene oxide used for preparation of composites was prepared by high intensity ultrasound exfoliation of graphite which seems to be the most suitable method. The adsorbent contains two or three components where the third component could be hydroxyapatite. The amount of active part was optimalized together with the choice of the polymeric matrix as polystyrene, polyamide PA66 etc. The composites of GO-polymers seem to be effective adsorbents of radioactive ions. It is assumed that the radioactive ions could coordinate between the sheets of GO. The active functional groups of GO are carboxy and alcoxy. It means that increasing amount of these groups could increase the adsorption capacity. The adsorption of uranium radionuclide is more complicated while the form of uranium is changing with pH. 2 Therefore our interest was extended also to other type of adsorbent based on zeolites. The zeolite itself is very good adsorbent and the combination with exfoliated graphene based material could be improving the adsorption activity. All composites were characterised by X-ray diffraction, FTIR and Raman spectroscopy. The morphology of the prepared composites was characterised using high resolution transmission electron microscopy, scanning electron microscopy and atomic force microscopy. Adsorption-desorption isotherm of nitrogen was used for determination of surface area and porosity. The adsorption activity was tested on the adsorption of for 137Cs and 85Sr or uranium in aqueous environment.

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Bio Crude Co-refining: The Untapped Opportunity for India

Dr. Piyali Das

Abstract

Refinery integration of pyrolysis oil/bio–crude could provide higher degree of national energy security in environmentally friendly and sustainable manner by supplementing conventional energy resources. It will reduce dependence on imported fossil fuels. The co-refining study of bio crude in Indian refinery set up is of critical importance for correct assessment of techno-economic feasibility for sizeable replacement of petro-crude in India. Recently published IEA data shows that bio–crude co-processing upto 5 % is economically feasible in near term and upto 10% is feasible with progress in industry and technology. It also indicates that low biomass cost and pyrolysis R&D to further reduce bio crude production cost will accelerate large economical deployment of this technology. It estimates the global potential of over 40 billion litter biofuels with 10% pyrolysis oil/bio crude integration in refinery FCC units. However, the study also reveals that there would be an optimal hand off point between the bio refinery and the petroleum refinery. More data for co-processing of bio crude and partially upgraded bio crude are needed to further investigate this optimization.The major questions for bio-crude refinery integration seems to be the correct assessment of the trade-offs for co-processing conventional petroleum feeds with biomass derived crude, degree of up-gradation required to co-process bio crude into refinery, the technical risks and finally how the future economy looks like based on the pilot scale techno-economic assessment studies. The presentation will cover the key findings from some significant pilot scale studies on bio crude co-refining conducted globally. This will also cover the technology status of pyrolysis processes for bio crude production in India and its co-refining prospects including the technology developed in TERI. This will also throw light on the R&D need to drive commercial deployment of the pyrolysis technology in India. Additionally, TERI's other research initiatives on liquid biofuels i.e. UCO based Biodiesel, Algal biofuels and Biojet fuel will be briefly shared.

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Open Burning of Municipal Solid Wastes in India & Dioxin Emission Monitoring

Dr. K.P. Prathish

Abstract

India generates about 150 million tonnes of Municipal Solid Wastes (MSW) every year and faces a crisis in its management due to the absence of organized waste collection, transportation, treatment and disposal systems in many cities. With no alternatives in place, citizens are forced to find their own solutions to dispose waste such as open burning. About 80 million tonnes of MSW is getting openly burned per year in India. Waste burning is a major source of unintentional production of dioxins and furans, which are highly toxic and persistent in the environment. It is reported elsewhere that the emission of dioxins and furans are much higher during open burning of wastes in comparison to well-engineered high-temperature waste incinerators. Apart from residential waste burning, largescale dumpyard fires like the recent incident at Brahmapuram solid waste treatment plant, Kochi are of great concern. No reports were available in India on the emission factors of dioxins caused by open burning till the latest report by CSIR-NIIST came into being in December 2018. CSIR-NIIST has the state-of-the-art sophisticated analytical testing facilities and technical know –how on the monitoring of dioxins and furans. We had conducted a study on the "Determination of emission factors of dioxins from open burning of municipal solid wastes in Kerala" funded by Kerala State Pollution Control Board. The study was carried out by burning known quantities and compositions of typical municipal solid wastes in a laboratory scale simulated combustion chamber termed "Burn Hut". The stack and residual ash samples were quantitatively collected as per standard procedures. The average total emission factor of dioxins from typical Kerala MSW open burning is found to be 39.81 µg PCDD-F TEQ_{WHO}/ ton of waste. Based on the determined emission factor and the total annual open burning activity reported elsewhere, the estimated annual emission of dioxins in India is 3240.5 g TEQ per year. It is a significant quantity as the maximum tolerable monthly intake of dioxins for adult human is 70 pg TEQ/ kg body weight. The salient aspects and findings of the study will be presented.

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Dr. K.P. Prathish, Scientist at Environmental Technology Division, CSIR- National Institute for Interdisciplinary Science & Technology (CSIR-NIIST) is leading the Dioxin research and monitoring activites at CSIR- NIIST. A state-of-the-art sophisticated dioxin analysis facility has been established at CSIR-NIIST under his leadership. The Ministry of Environment and Forests (MoEF) has recommended CSIR- NIIST as a referral laboratory for dioxin analysis for environmental clearances. The first study on the emission factors of dioxins from open burning of municipal solid wastes in India was carried out by CSIR- NIIST. The final report has been submitted to funding agency, Kerala State Pollution Control Board (KSPCB) and other concerned stakeholders such as CPCB, MoEFCC & MoHUA for facilitating policy decision on scientific MSW treatment in the country. A study on the dioxin emission during an accidental fire breakout incident at Brahmapuram waste dumpyard at Kochi during February 2019 has been voluntarily taken up by NIIST and study report has been submitted to all stakeholders. CSIR-NIIST has obtained NABL accreditation as per ISO/IEC-17025: 2005 for the analysis of dioxin and dioxin-like PCBs in environmental samples such as industrial stack, ambient air, ash, soil, sediment and in residues in food and food products.

Comparative Analysis of Different Heterogenous Nanocatalyst in the Production of Biodiesel

Prof. Praveen kumar

Abstract

Alternate fuel become a prime concern due to the limitations in the availability of energy resources. Identification of suitable new and renewable sources for bioenergy production and their cost economical conversion techniques has become interest of researchers in this field. Traditionally vegetable oils and oils from other sources were used as raw materials for the production of biodiesel, later microalgal oil was found to be suitable for production of biodiesel. The availability of microalgal oil in large quantities has become a challenge, however technologies for mass production of the microalgae are emerging. On the other hand, Nanocatalysts were found to be promising in the transesterification of microalgal oil. This paper deliberates a comprehensive review on the heterogenous nanocatalysts used in the transesterification of microalgaloil, the comparative analysis on effect of various heterogenous catalysts in transesterification process were also discussed.

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Prof. R. Praveen Kumar is working as Head of the Department in Department of Biotechnology, Arunai Engineering Colleg. His area of research includes biorefineries, renewable energy from biomass and municipal waste. He is having more than 50 research publications, 8 book chapters, co-author of 5 books and provisional registration for 4 patents. He had organized various National and International Conferences and served as Scientific Advisory Committee member in several National and International events. He has chaired sessions and delivered invited talks in various National and International conferences. He is a life member in various professional societies which includes BRSI, IICHE, IFIBiop, BigFin, ISTE, EWBIndia. He currently serving as Management council member in Biotech Research Society of India (BRSI) and Vice-President in "Engineers Without Borders – India (EWB-India)" Chennai chapter. He is a recipient of various awards which includes the prestigious "ISTE-Syed Sajid Ali National Award for Outstanding Research work in the field of Renewable Energy" for the year 2017.

Bioethanol Production from Agri-Produce and its Potential for Transportation Utilization

Dr Pravesh Chandra Shukla

Abstract

The total production of food grain in Chhattisgarh state is 80-120 lakh million tons per annum. During the National workshop on Biofuel from Agri-produce held in Raipur (May, 2019), it is projected that at least 15 lakh million tons of grain in access. The proposal aims at the development of enhanced ethanol from agricultural waste. Process optimization for the production of ethanol from Agri-produce will be performed through the compositional engineering/cocktail of the enzyme to produce degradable starch to ethanol from rice paddy and husk. CBDA and IIT Bhilai will conduct a detailed research study to characterize and design the various processes involved in the production of Bio-ethanol from Agri-produce. This will support the full-fledge bio-ethanol production plants at various place in Chhattisgarh. The work will involve some field work as well, to collect rice paddy from many locations of Chhattisgarh. Further, this work will target to develop the compact mobile units to have rural access. Seasoning study of the rice paddy will be carried out to verify the effect of environment on ethanol production from seasoned rice paddy. This proposal is also expected to open many job opportunities in the field of biofuel research and its production such as field supervisor, research associate etc.

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Dr. Pravesh Chandra Shukla is Assistant Professor in the Department of Mechanical Engineering at Indian Institute of Technology Bhilai. Dr. Shukla received his PhD from Indian Institute of Technology Kanpur. He has also worked as Senior Research Associate (SRA, Pool Scientist) at IIT Kanpur. Prior to joining IIT Bhilai, he was a post-doctoral researcher in the Division of Combustion Engines, Department of Energy Sciences, Lund University, Sweden. He briefly worked in Ecole Centrale de Nantes, France in the field of dual fuel combustion. He is recipient of Young Scientist Award from the International Society for Energy, Environment and Sustainability.

Dr. Shukla mainly works in the field of Internal Combustion Engines and Alternative fuels for transportation. He worked on the development of additives for high compression ratio heavy duty engines fueled with alcohol. He is involved in investigating the emission characteristics for alternative fuels like biodiesel, HVO and alcohols for conventional and advanced heavy duty compression ignition engines. During his doctoral, he was mainly involved in physico-chemical characterization of diesel engine exhaust using non-noble metal based mixed oxides diesel oxidation catalysts. Till now, he has published more than 20 technical articles in international journals and conference proceedings.

Materials for Energy Storage – Key Enabler for Low Carbon Energy Future

Prof. Rajendra Bordia

Abstract

Energy storage is the key enabler for renewable energy technologies such as wind and solar which are intermittent but critically important in our progress towards a zero or ultra-low carbon footprint economy. The key challenges for energy storage are (i) low cost and (ii) methods and approaches that are sustainable. The presentation will provide an overview and roadmap for various high energy density electrochemical storage systems applicable for both automotive and grid applications. Critical technical challenges and barriers towards achieving high performance as well as cost will be discussed. The second part of the talk will cover a few specific examples of battery electrodes and materials from the point of view of optimization of ion-transport and microstructural control to enable high energy density that eventually reduces the cost at gravimetric and/or volumetric bases. Energy efficient approaches towards battery materials synthesis and processing including recycling methods will be presented.

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Bordia is currently a Professor in the Materials Science and Engineering Department at Clemson University in Clemson, SC. Before this, he was a faculty member in the Materials Science and Engineering Department at the University of Washington (UW). From 1998 to 2005, he was the Chairman of his Department at UW. He worked as a Research Scientist in the Central Research and Development of DuPont Co. from 1986 to 1991. He has also had Visiting/Guest Professor appointments at the Indian Institute of Technology, Kanpur, India; Indian Institute of Science, Bangalore, India; and Friedrich-Alexander Universität, Erlangen-Nürnberg, Germany. He received his undergraduate degree from Indian Institute of Technology, Kanpur and his M.S. and Ph.D. from Cornell University in Materials Science and Engineering.

His research is at the intersection of materials and mechanics and is focused on fundamental and applied studies in the processing and properties of complex material systems for energy, environmental, and medical applications. Current emphasis is on ceramics, composites, multilayered, and porous materials. He has authored or co-authored over 120 peer-reviewed technical publications and has presented over 250 invited lectures and seminars.

Production of Extracellular Polysaccharides by an Isolated Bacterial Strain and Application to Treat Compost and Landfill Leachates

Prof. Rajeshwar D Tyagi

Abstract

Wastewater sludge disposal employs two significant steps- sludge settling, and dewatering using synthetic polymers. These synthetic polymers are deemed expensive and toxic. Thus, there is a need to find ecofriendly, and economical biopolymers (e.g. sodium alginate, chitosan, and microbial flocculants) to replace synthetic polymers. Extracellular polymeric substances or exopolysaccharides (EPS) play a significant role in pollutant removal, bio-flocculation, settling, and dewatering of the activated sludge. Many bacterial strains dwelling in natural niche environment like wastewater mixed liquor produce EPS. In this study, EPS-producing microbial strains (BS01, BS04, BS08, and BS10), previously isolated from municipal wastewater, were tested along with a newly isolated microbial strain BRD10 from pulp and paper wastewater activated sludge for their potential to produce EPS. This study compared glucose and crude glycerol as a carbon substrate for EPS production. Further, using crude glycerol, EPS production for all the strains was compared. The results present in this study suggested that crude glycerol is more suitable carbon substrate for EPS production as compared to glucose. Further, among the five strains, BRD10 resulted in highest EPS concentration (37.1 g/L). While comparing crude glycerol with pure glycerol, highest EPS concentration was achieved with pure glycerol (39.65 g/L) indicating some inhibition to EPS production by the impurities present in crude glycerol. The application of the eco-friendly bioflocculant shall be presented ad discussed.

Some Perspective on Using Butanol as an Alternative Fuel for IC Engines

Prof. Raja Banerjee

Abstract

Among the different forms of alcohols being proposed for blending in diesel and gasoline engines, butanol shows significant promise as an alternative fuel. This is because its thermo-physical properties are closer to petro-fuels and blends well in proportions with both diesel and gasoline thereby requiring little or no changes in the existing engine design. The current work will highlight both experimental and modelling work performed at IIT Hyderabad related to butanol combustion for both SI and CI Engines.

Fundamental spray and in-cylinder combustion studies were performed inside an optical Gasoline Direct Ignition (GDI) engine to understand combustion characteristics of butanol under SI engine-like conditions. It was found that butanol atomizes poorly compared to iso-octane and has longer penetration lengths and larger droplet diameter statistics. Due to this, there is a tendency for butanol to wet the piston wall in GDI engine when injected at early crank angles of the intake stroke. However, flash boiling of butanol was observed at elevated fuel temperature which in turn aids in improved atomization of the fuel. Compared to that, iso-octane flashed more vigorously at the same temperature resulting increased sooty flame due wet the piston walls.

Combustion studies for butanol blended diesel fuel in CI engine showed reduced NOx emission. A chemical kinetic model was developed to analyze the role of combustion chemistry in NOx and soot emission. A simplified homogeneous reactor model based on this kinetic model revealed that nbutanol acts as a sink for OH radicals delaying OH induced hot ignition peak. The corresponding decrease in flame temperature results in suppression of NOx emissions. Detailed 3D CFD spray combustion modelling was also done which revealed that butanol blending up to 20% showed little effect on fundamental combustion characteristics like ignition delay and lift-off length suggesting that it is an ideal “drop-in” fuel up to that composition.

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Dr. Raja Banerjee is a Professor in the Department of Mechanical and Aerospace Engineering of IIT Hyderabad. He obtained his Bachelor's degree in Mechanical Engineering from University of Rewa (1995), Master's degree in Cryogenic Engineering from IIT Kharagpur (1998) and PhD in Mechanical Engineering from University of Missouri Rolla (2001). Following his PhD, he worked as a Senior Research Engineer in Mark IV Automotive Inc., USA for close to 8 years before returning to India and joining IIT Hyderabad. His primary research interest is in multiphase flow with particular focus on liquid spray and atomization, turbulence and parallel computing for CFD applications. He has co-authored several papers on these topics which are reported in leading journals and conference proceedings.

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Prof. R. D. Tyagi is an internationally recognized Professor of Biochemical Engineering at University of Quebec, INRS-ETE, Canada. He is also Adjunct Professor at University of Missouri Columbia (USA). He is the member of Hall of Excellence of University of Québec and a member of European Academy of Sciences and Arts; Academician, European Academy of Sciences & Arts.

He conducts research on water/wastewater treatment, wastewater sludge treatment/disposal, bioconversion of wastes into value added products (biopseticides, bioplastics, biodiesel). Prof. Tyagi has authored 20 books, 92 book chapters, 325 peer reviewed articles, 60 conference proceedings, 10 patents, 75 invited conferences and plenary, 229 other conference presentation, 22 research reports, 118 gene bank submission, chaired many sessions in national and international conferences. He also established a fermentation/bioprocessing pilot plant to cater the need of industries and universities for scale-up study.

He has voluntary served on the Boards of several professional organizations and on the panel of several granting agencies. International Water Association, board of specialist group on, 'Appropriate Technology for Developing Countries'. He is currently on the Executive Committee of the Canadian Association on Water Quality He has supervised 21 M.Sc. and 60 Ph.D. student. He is Associate Editor of "Practice Periodical of Hazardous, Toxic & Radioactive Waste Management-Am.Soc.Civil Engineering" and serves on the editorial board of "Process Biochemistry" and Bioresource Technology.

His research on «bioconversion and bioprocessing to value added products» has been recognized internationally and has received many National and International Awards.

The Unique Multitracer Technique: Its Application to Environment, Chemistry, Biochemistry and Biology

Dr. Rajiv Ganapatrao Weginwar

Abstract

We established radiochemical procedures for preparing multitracers, which are extensively utilized for simultaneous tracing of a number of elements in various chemical, environmental and biological systems. Metal foil targeted (typically, Au, Ag, Fe) are irradiated with C, N, or O ions accelerated to 135 Mev/nucleon in the RIKEN Ring Cyclotron. Radiochemical procedures have been developed to remove the target material leaving various radionuclides in multitracers solutions. The multitracers enables efficient tracing of a number of elements, and comparison of their behavior under strictly identical experimental condition .The subcellular distribution of radionuclides in Glycine amx Merr.(soyabean) and Cucumis sativus L.(cucumber) and translocation of plant absorbed radionuclides with growth in soyabean were studied. More than 60% of cellular incorporated Rb, Sr, Co, Nb, and Seremained in the supernanant fraction; 55% and 20% of Cr was bound to soyabean and cucumber cell wall fractions respectively; 70% or more Be, Y and Fe was fixed in the chloroplast fraction; and aprox.10% of Sc,Fe, V and As were fixed in mitochondrial fraction. Translocation of nuclides within the soybean plant at different stages of growth has been determined. Vanadium, Y, Be, Se, nb, Sc, Cr and Zr were predominantly accumulated in the root. Although the total percentage of plant uptake of Sc, Zr, Nb, and Cr was high, because of low mobility and translocation to shoot, their accumulation in the fruit fraction was negligible. The translocation of mobile nuclides in plants was demonstrated clearly by Rb, Zn and Fe. Data on the nuclide fraction mobilized from vegetative parts into edible parts was used to assess the percentage of accumulated radionuclides in plants that may reach humans through beans The radioactive multitracers technique was applied to the simultaneous determination of the uptake of 17 trace elements (Be, Na, Sc, V, Cr, Mn, Fe, Co, Zn, As, Se, Rb, Sr, Y, Zr, Nb and Ru) in the liver, kidney and blood of hyper cholestelomic model mice. The uptakes of Be, Na, Sc, V, Cr, Fe, As, Rb, Y, Zr, Nb and Ru in liver increased with an increasing feeding period of a cholesterol rich diet, whereas the uptakes of Zn and Se decreased. Feeding of diet resulted in a marked increase in serum cholesterol, triglycerides and low density lipoprotein cholesterol. The metabolism of trace elements between cholesterolemic mice and normal mice was compared with respect to their serum cholesterol levels. A significant positive correlation was found between the concentration of serum triglycerides and liver uptake of Cr, Fe and As and negative correlation was found for the uptake of Zn. The results suggest that cholesterolemic have some specific effects on the metabolism of some elements
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Dr. Rajiv Ganapatrao Weginwar is presently working as professor and Head of the Department, Department of Applied Chemistry Rajiv Gandhi college of Engineering, Research and Technology. He was research fellow at Institute of Physical and Chemical Research (RIKEN) Saitama Japan for 2 years.He worked as Principal at Guru Nanak Science College, Ballarpur for 5 years .Along with the he served on the post of Chairman Board of Studies, Subject Chemistry, Faculty of Science and Technology Gondwana University Gadchiroli. He presented papers in 15 International conferences and 35 national conferences, Published 35 research papers in Scopus/SCI journals , 10 international reports in RIKEN reports 1 international and 2 national books.Dr Weginar supervised 2 Phd and 6 M.Phil students.Currently 6 students are pursuing their doctorate degree under his guidance.He has received 2 best paper presentation awards in National Conferences

Use of Agricultural Residues in Microbial Lipids Production as a Potential Biofuel

Dr. Raj Boopathy

Abstract

Energy security, environmental concerns, and unstable oil prices have been the driving trifecta of demand for alternative fuels in the United States. The United States' dependence on energy resources, often from unstable oil-producing countries has created political insecurities and concerns. As we try to gain energy security, unconventional oil becomes more common, flooding the market, and causing the major downshift of the usual unstable oil prices. Meanwhile, consumption of fossil fuels and the consequent CO_2 emissions have driven disruptions in the Earth's atmosphere and are recognized to be responsible for global climate change. While the significance of each of these three factors may fluctuate with global politics or new technologies, transportation energy will remain the prominent focus of multi-disciplined research. Bioenergy future depends on the price of oil. Current political climate in the USA heavily favors petroleum industry and it is a setback for bioenergy sector. In this talk, current energy scenario, environmental concern, development of various biofuel, and the current trend in microbial lipids as a potential biofuel will be discussed in detail.

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Dr. Raj Boopathy is an Alcee Fortier Distinguished Service Professor of biological sciences at the Nicholls State University, USA. He received the Jerry Ledet Foundation Endowed Professorship in Environmental Biology in 2002 and John Brady Endowed Professorship in 2012. In 2008, Dr. Raj Boopathy received the Nicholls State University's Presidential Award for Teaching Excellence. He has more than 30 years of research experience in the area of bioremediation and bioprocessing. His research involves bioremediation of hazardous chemicals including oil spills and explosives, biological treatment of wastewater, antibiotic resistance genes in the environment, and bio-ethanol production. He has published 167 research papers in peer- reviewed journals and 17 book chapters. He edited one book. His research work has been cited more than 7,000 times with h-index of 47. Dr. Raj Boopathy reviewed research grants for National Science Foundation, Department of Defense, US Environmental Protection Agency, Department of Energy, and numerous private agencies and foreign governments including South Africa, Switzerland, Indonesia, and Israel. He is the editor of International journal of Biodeterioration and Biodegradation (IBB), Current Pollution Reports, and the Journal of Applied Sciences (Section, Environmental and Sustainable Science and Technology). He also serves as a senior editor of the Journal, Renewable Bioresources and is on the Editorial Boards of various International journals including Bioresource Technology and the International Journal of Soil and Sediment Contamination. Dr. Raj Boopathy received Fulbright scholarship and spent six months teaching and conducting research at the Institute of Technology (ITB) in Bandung, Indonesia in 2007. He also received European Union-US biotechnology Fellowship and Leverhulme commonwealth fellowship. He has been elected as a Fellow of various societies including International Union of Pure and Applied Chemistry (IUPAC), Society for Industrial Microbiology and Biotechnology (SIMB) and the International Forum on Bioprocessing (IFBioP). Dr Raj Boopathy was selected as a Fulbright Senior Scholar Specialist to visit various countries for next five years by the US State Department and he recently visited Malaysia and Indonesia as a Fulbright Specialist. Dr. Boopathy received Dr. Waksman Award from SIMB for his contribution in Microbiology Education in 2017. Dr. Boopathy is the recipient of the World Class Professor (WCP) award from the Government of Indonesia.

Automotive Technology to Meet Sustainability Goals

Mrs. Rashmi Urdhwareshe

Abstract

Automobiles are considered as the basic building blocks of progress and play an important role in country's economy. However, automobiles are one of the major sources of air pollution in urban areas. Automobiles, as a technology, have come a long way in terms of reducing tailpipe emissions from pre-regulatory times to the upcoming BS-VI regulations. This is evident from the fact that there is more than 90% reduction in emissions of almost all pollutants through progressive tightening of emission limits. Innovations in technology and adopting the same periodically made it possible to create sustainable products to some extent. Sustainability, not only in terms of economics and competitiveness but also with respect to social and environmental aspects. Technologies, policies, measures which have helped to achieve reduction in emission levels and meet the prevalent emission limits include improvement in engine technologies; light-weighting through alternate materials, improved processes and designs; use of alternate energy sources.The Government policies and trends suggest that share of electric vehicles will increase at greater pace and the source of power generation for charging of vehicles will play important role in faster adoption of E-vehicles and in reducing environmental impact. Though, the new fleet of vehicles is going to be cleaner, there are challenges to be addressed, in Indian context, like emissions from in-service vehicles, recycling / scrappage of end-of-life vehicles, emissions of volatile organic compounds, non-exhaust emissions, etc. With the research and technology progress going on in India, and committed efforts in future, hopefully, these challenges would be addressed effectively for achieving sustainability goals.

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Mrs. Urdhwareshe has a distinguished academic career. Master's in Electronics Engineering, Certified Quality Auditor (ASQ), Certified Six Sigma Black Belt (ASQ), Diploma in Corporate Directorship (WCCG).
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Vice Chair of Working Party on Pollution and Energy (GRPE) at the Global Forum under UN-ECE at Geneva during period 2014-2017,Senior Vice- President SAE-India.She is Co-author of Book on Total Quality Management.She is a recipient of several awards like "Woman Excellence Award 2015" (by Rotary International, Pune), "Distinguished Alumnus" award, "Engineering Excellence Award- 2017 (SAE-India Foundation), "Lifetime Achievement Award-2018" (ODSER Trust), "Industry Custodian of the Year-2018 (E-Mobility+) etc.Mrs. Rashmi's other interests are instrumental music, reading and travelling.

Microbial Assisted Production of Nutraceuticals from Organosolv Pretreated Forest Biomass

Prof. Rova Ulrika

Abstract

The global demand for essential polyunsaturated fatty acids (PUFAs) such as EPA and DHA has been growing rapidly and expected to keep on growing in the future. The largest PUFAs market segments by applications are respectively dietary supplements, nutraceuticals, infant formula and functional foods. As their production from fish oils is environmentally unsustainable and unsuitable for large vegetarian population, there is a demand for new vegetarian sources of PUFAs. Among various microorganisms, oleaginous microalgae are considered as microscopic bio-factories for PUFAs production. The aim of the present study was to establish a microalgal platform to produce nutraceutical-value PUFAs from forest residual biomass and more specifically Norway spruce (*Picea abies*), and birch (*Betula pendula* and *B. pubescens*) due to their abundance in Sweden. Based on their metabolism, microalgae can grow photoautotrophic, photoheterotrophic, mixotrophic and heterotrophic. To this end, the mixotrophic growth of the marine microalgae *Phaeodactylum tricornutum* on birch and spruce hydrolysates was compared to autotrophic cultivation. The highest EPA production (256 mg/L) and productivity (19.69 mg/L/d) were observed when this alga was cultivated mixotrophically on spruce hydrolysates (2 g/L; glucose). However, this strain doesn't have ability to grow in dark under heterotrophic condition3. Heterotrophic PUFAs production is expected to be more advantageous concerning to utilize both forest biomass hydrolysates with high concentration of glucose (up to 120 g/L), hence, optimization of high-density cultivation of two microalgae *Crypthecodinium cohnii* and *Schizochytrium limacinum* SR21 growing on these two renewable substrates from forest were studied for enhanced productivity of docosahexaenoic Acid (DHA).

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Prof. Ulrika Rova is Professor in Biochemical Process Engineering at Luleå University of Technology, Sweden. Prof. Rova´s research is focused on biomass pretreatment/fractionation and conversion to chemicals and fuels using enzymes. Prof. Rova is also the Deputy scientific leader of Bio4Energy, a Swedish strategic biorefinery center with emphasis on research that uses forest as a raw material for sustainable production of energy, new materials and biofuels. Ulrika has been the National representatives in the FP1306 Cost action "Valorisation of lignocellulosic biomass side-streams for sustainable production of chemicals, materials & fuels using low environmental impact technologies" where she also has been the leader for the working group "Preatreatment/fractionation of lignocellulosic biomass". She currently heads the projects; Food-grade prebiotic production, merging marine and forest resources for moving up the cellulose value-chain, Bark-derived bio-adhesives for engineered wood panels, Use of organosolv lignin hydrophobic nanoparticles as biodegradable selective flotation collectors, Electricity-driven microbial symbiosis for the production of complex CO2-neutral chemicals. Prof. Rovais also PI in several other projects financed by EU's Horizon 2020, the Swedish Energy Agency, Formas, VINNOVA and the Swedish Research Council.

Self-Sustained Closed Loop Systems Based on Photosynthetic Machinery for Sustainable Development

Dr. S Venkata Mohan

Abstract

Rapid growth of the global population has been a major challenge causing a significant threat to the finite fossil resources as well as environment. To counter the existing linear economy model, requirement of an alternative resource to meet our energy and material needs that are renewable and sustainable is essential. Biorefineries with a self-sustained design will be going to play a key role in coming days. In this realm, photosynthetic machinery known for its self-sustainable nature is emerging processes to be considered for its sustainability. It transforms solar energy to renewable biomass and other value-added products, symbiotically releasing oxygen by CO_2 fixation. CO_2 fixation also forms an important mechanism on which the closed loop mode was operated. Photosynthetic products play a major role in storage of high energy molecules without much of external input of resources. Biomass is being considered as one of the potential and alternative feedstock for biobased economy. As the circular bioeconomy is gaining momentum around the globe, biorefinery will play a key role in the framework of sustainability as integral component. A self-sustainable photosynthetic based refinery will form an alternate and sustainable solution to the fossil-based refinery. However, optimized integrations of unit operations across closed loops are much needed with process intensification strategy in the context of resource recovery efficiency as well as sustainability index. At attempt is made in this communication to discuss some of models with self-sustainable closed loop mode.

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Dr Mohan has done his B.Tech (Civil Engineering), M.Tech (Environmental Engineering) and PhD from Sri Venkateswara University, Tirupati. He was a Kyung Hee International Fellow, South Korea (2018), Visiting Professor at Kyoto University (2005) and Alexander von Humboldt (AvH) Fellow at Technical University of Munich, Germany (2001-02). Dr Mohan authored 340 research articles, 70 chapters for books, edited 4 books and has 9 patents. His publications have more than 15,600 citations with an h-index of 68 (Google Scholar). He has guided 27 PhDs, 2 M.Phils and more than 100 M.Tech/ B.Tech /M.Sc. students. Dr Mohan is recipient of the coveted 'Shanti Swarup Bhatnagar (SSB) Prize' in Engineering Sciences. He also received several awards and honors, which include, 'DBT-Tata Innovation Fellow 2018' by, VASVIK Award for the year 2018 in the category of 'Environmental Science and Technology', 'Most outstanding Researcher' in the field of Environmental Science-2018 by Careers 360, 'DBT-National Bioscience Award-2012', SERB-IGCW Award 2017 for 'Biohydrogen Technology', 'Environmental Engineering Design Award-2017' by NDRF, etc. He is Fellow of National Academy of Engineering, Biotech Research Society of India, Telangana and Andhra Pradesh Akademy of Sciences, International Society for Energy, Environment and Sustainability, etc. He is National Editor for Science Portal (EVS), subject Editor for Journal of Energy, Associate Editor for Frontiers in Energy Research and is on the Editorial board of Bioresource Technology.

SDGs for Sustainable Energy & Environment and Their Challenges for India

Dr. Sukumar Devotta

Abstract

Under UN Sustainability Development Goals (SDGs) totalling 17, the following GOAL 3: Good Health and Well-being, GOAL 6: Clean Water and Sanitation, GOAL 7: Affordable and Clean Energy, GOAL 9: Industry, Innovation and Infrastructure, GOAL 11: Sustainable Cities and Communities, GOAL 12: Responsible Consumption and Production, GOAL 13: Climate Action and GOAL 17: Partnerships to achieve the Goal, have relevance to the theme of the conference. These goals are inter-related to energy and environment. India is also defining its various missions to achieve its own goals in consonance with SDGs. There are various options to achieve Sustainable Energy & Environment. The lecture will address some of the options including Clean Energy (Coal, H_2 and Fuel Cell), Carbon Capture and Utlisation (Carbon Capture from thermal power stations, including biological processes and their utilisation), Zero Liquid Discharge – ZLD (recovery of water from industrial wastewater using membrane separation and Multiple Effect Evaporator - MEE), and Affordable Low Carbon Cooling (Low GWP and energy efficient ACs) with respect to India. Each of the options will be illustrated with current live examples to exemplify the sustainability challenges in each case.

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Dr. Devotta is a chemical engineer with a brilliant academic record throughout the career in the University of Madras. After a stint as a Post-Doctoral Fellow at the University of Salford, UK (1979-84), he began his scientific research career at CSIR-NCL Pune in 1984 and rose to the position of Director Grade Scientist. Later he was the Director, CSIR-NEERI, Nagpur during 2003-08. At NEERI, he was extensively involved in the variety of environmental issues and their mitigations. During his research career, he has immensely contributed to the fields of Energy, Environment and Green Chemical Technologies.Currently he is a consultant to some organisations and mentoring on variety of areas including EIA, Montreal Protocol and Climate Change, Industrial Wastewater Treatment (Zero Liquid Discharge). He has served and continues to serve in many prestigious National & International Committees.As a member of IPCC, Dr. Devotta received the citations from IPCC, which was awarded the Nobel Peace Prize in 2007. He Dr. Devotta was also awarded the US EPA "Stratospheric Ozone Protection Award" for 1997. Dr. Devotta has guided 25 research students for Ph.D. and ME/M. Tech. in Chemical, Environmental & Mechanical Engineering. He has also co-authored many books and many chapters in books and more than 200 research papers in international journals.

Clean Fuel Regulations and Their Effect on The Automotive Sector In BS-VI Era

Dr. S. S. Thipse

Abstract

Use of Alternative fuels is the need of the hour in the automotive sector post BS-Vi era considering environmental pollution and rising fossil fuel prices. Alternative fuels are cheaper and provide increased margins for automakers to meet stringent emission norms. India is looking to reduce its dependence on fossil fuels by 20 % by the year 2022. Post Bs-VI, most of the fossil fuel technologies are expected to exhibit a declining trend and clean fuel technologies are expected to increase their mobility share. Availability of alternative fuels remains a concern and steps are being taken in that direction by the Ministry of petroleum and natural gas. Ministry of Road Transport has notified several alternative fuels over the past few years. Gaseous fuels like CNG and biofuels like Ethanol are being promoted aggressively. Some progressive OEMs have developed dedicated vehicles for the same. End consumer awareness is still low resulting in lower market penetration so far. At the same time competition with electric mobility remains a concern. This talk will cover the present scenario of alternative fuel regulations in India and their effect on automotive sector in the post BS-VI automotive era.

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Enabling Research Led Smart Environmental Innovations and Solutions

Dr. Sanjay Bajpai

Abstract

The vision of providing clean water to all households by 2024 would require multi-prolonged approach. It would require forward looking interventions on the policy front. Also, India is committed to renewable energy led growth and has raised the ambition manifold. Scaled up renewable energy and energy efficiency target coupled with National Cooling Action Plan, National Clean Air Programme and other national initiatives underline the importance of research led innovation. At the same time, it would need changing 'business as usual' scenario, which is possible through application of advanced science and technology. The talk would cover the policy and instruments of Government of India for promoting Research, Development and Innovation in the area of Environmental technologies. It will also highlight the efforts made by the Government for development and application of advance Science and Technology for sustainability and augmentation of environmental resources for empowering communities. The talk will also touch upon application of new technique on Internet of Things (IoT) and Artificial Intelligence (AI) that can enable the current systems with more sophistication and introduce smartness to bring greater effectiveness and efficiency.

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He has specialized in the area of management of Technology Development, Demonstration and Commercialization Programmes as well as socio-economic programmes requiring application of Science & Technology. He has conceptualised, crafted and implemented research, development and demonstration programmes in energy and water domain for accelerated innovations. He is currently Head of Technology Missions Division (Energy, Water and all others) of Department of Science and Technology (DST), Ministry of Science and Technology, Government of India.

Techno-Economic Analysis of Different Architectures of Perovskite Solar Modules

Dr. Satvasheel Ramesh Powar

Abstract

The techno-economic analysis is an essential tool in the industry to track emerging technologies and its impact on the existing market. Perovskite solar cells are considered to be an emerging disruptive technology in solar photovoltaic domain. The perovskite solar cell technology has been demonstrated at the lab scale and considered to be ready for commercialization. Research reports have demonstrated different solar cell architectures implemented for the perovskite solar module fabrication at the lab scale. The talk covers a detailed techno-economic analysis of different architectures of perovskite solar modules and its potential manufacturing cost in India. The primary focus for the analysis is on carbon-based Perovskite module manufacturing. The screen-printing technique makes these architectures cost-effective and adds ease of manufacture.

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Dr. Satvasheel Powar is an Assistant Professor in the School of Engineering, IIT Mandi since June 2015. He received a Bachelor of Production Engineering from Shivaji University in 2003. He served Bipin Engineers Pvt Ltd, India for a year before his M.Sc (Mechanical Engineering) from the Dalarna University, Sweden. He then served Greatcell Solar S.A., Switzerland, and G24i, the UK for about four years in total with a work focus on process development for Dye-sensitized Solar Cells. He received his Ph.D. from the Monash University, Australia in 2013. Before his joining at IIT Mandi, he served two and half years at the Nanyang Technological University, Singapore as a postdoctoral research fellow. His Principal Field of Activities includes Solar Energy, Waste management, Food processingHis primary areas of research are Perovskite Solar Cells and solar thermal utilization. He was awarded Bhaskara Advanced Solar Energy fellowship in 2017 by Indo-US Science and Technology Forum (IUSSTF) to visit Lawrence Berkeley National Laboratory, University of California, Berkeley, USA for three months.

Hydrocarbon/Hydrogen SCR of Nox Using Ag-Au/Al_2O_3 Catalyst for Diesel Engine Exhaust Treatment

Dr. Shubhangi B. Umbarkar

Abstract

Removal of NOx from automobile diesel engine exhaust is challenging due to stringent emission control norms. Selective catalytic reduction of NOx using unburnt hydrocarbon as reductant (HC-SCR) is promising alternative for treatment of diesel engine exhaust for some India specific applications like three wheeler goods carrier. Installation of urea-SCR technology is difficult due to space constraint and LNT/NSR technology due to cost constraint. Bimetallic AgAu/Al_2O_3 catalyst was developed in our group for HC-SCR of NOx wherein hydrogen is generated in situ by steam reforming of higher HC. An optimal balance between oxidative and reductive surface properties was achieved by tuning the synthesis procedure by successive impregnation of Ag & Au on high surface area Al_2O_3 and its pretreatment procedure. The bimetallic composition has shown promising SCR activity in terms of wider temperature window (200-500ºC) and complete selective conversion to nitrogen. The detailed investigation revealed steam reforming of unburnt hydrocarbons from exhaust stream leading to in situ generation of hydrogen which is very efficient reductant for NOx specially at lower temperatures. Better low temperature activity was co-related to re-dispersion processes of Ag species on Au/Al_2O_3 under reaction conditions as confirmed by detailed characterization of fresh and aged catalysts

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Fabrication of Metal Oxide Semiconducting Nano Materials and Composites for Gas Sensing and Water Remediation Applications

Prof. Shantanu Bhattacharya

Abstract

Fabrication of devices and structures in the nano-meter length scale is entailed by the rapid growth in miniaturization needs of the industry. Most of this nano-fabrication particularly done on large area substrates is carried out by use of industry grade standard processes like deposition, lithography, etching, implantation etc. or processes related to fabrication by hydro-thermal synthesis where a combination of nucleation, growth and self assembly techniques are deployed to obtain various nano-structures and topologies. Such fabrication of materials, devices, and products bestows a relatively high level of functionality and complexity. For example, 1D, 2D and 3D nanostructures (such as CNT, Graphene, quantum dots, etc.) have specific properties that are quite different from the properties of the materials when present in bulk state. In this context a very important class of materials has been the Metal oxide semiconductors (MOS) whose functional properties are highly dependent on size domain and also geometry of structures. This work delves into the use of hydro-thermally assisted growth techniques for obtaining a variety of nano-structures related to material systems like Vanadium Pentoxide, Zinc Oxide etc. and are performed over substrates with a specific window of surface energies. The structures resulting from this process are either upstanding, solid and hollow dense nano-structures or structures oriented like nano-stars and nano-rods etc. The advantages provided by these structures are many like the presence of surface defects, vacancies etc. and the easy availability of majority charge carriers across their surfaces/interfaces along-with their easy reversibility. The material is heavily explored by us as a sensitive element for room temperature detection of trace gases like Helium, Hydrogen etc. Further for increase in performance related to the sensitivity, various dopants like noble metals as well as Graphene compounds are also explored and the changes in responses owing to their presence is thoroughly studied and reasoned out. In yet another application domain of these material structures their performance for photo-catalytic removal of dyes in textile effluents are studied in detail. MOS generates electrons and holes in the presence of sunlight which takes part in secondary redox processes creating hydroxyl radicals (•OH). The '•OH' is a highly oxidizing species that degrades complex organic dye molecules which are present in textile effluents. A theoretical model has been developed to simulate the degradation of dye by using Fick's first and second law in combination with the Beer–Lambert's law. While, the Langmuir–Hinshelwood (L–H) model has been utilized to describe the single layer adsorption of the dye molecules over the catalyst films of the MOS. The attenuation of irradiated light is observed by using Beer-Lambert law and through a coupled effect the rate kinetics of dye degradation in the thin film of absorbed effluent is utilized to design a pilot scale plant of capacity 10 KL per day. The plant uses and array of perforated filters in GI substrates which facilitates thethrough-flow of the wastewater corresponding to the solar cycle which causes the dye degradation. Using the equation for diffusion flux, variation of fraction adsorbed with hole density can be predicted. We observed that the thin-film catalysis with an array of holes improves the degradation efficiency. The plant also contains a pre photocatalysis coagulation and floculation step and a post photo-catalysis carbon filtration step through which it converts the discharged textile effluents into Inland discharge water standards.

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Prof. Shantanu Bhattacharya is currently holding the Dr. Gurumukh T. and Veena M. Mehta Chair at the Department of Mechanical Engineering at the Indian Institute of Technology Kanpur. He also heads the Interdisciplinary program of Design in the same place. Prof. Bhattacharya has been intricately associated with many R&D activities in the broad domain of Advanced Engineered Materials with domain expertise in Nano-engineering and Technology, Biomedical Micro-devices, Water treatment, Sensors and actuators, fabrication solutions for electronic devices, design and development of products etc. He has been involved with the design and development of a Dengue detection paper microfluidic platform which can recognize the infection of dengue patients early on, a 10KLD water treatment filtration unit which cleans textile effluents and processes them to Inland water discharge grade. He is also well known for design and development of acoustic meta-structure through 3-D printing solutions which today find their way into the Boeing technology roadmap. He has several credits to his honor which includes the IEI young engineers award, the ISSS young scientist Award, NDRF design award of IEI, Boeing outstanding technical leadership award, Fellow grade memberships in IEI and ISEES etc. He has many international peer reviewed journal publications, conference proceedings, books and monographs to his credit.

Sustainable Biopolymer Nanocomposites: Application in Purification of Water

Dr. Shihabudheen M. Maliyekkal

Abstract

Adequate availability of safe water at the point of use is essential for the sustenance of human life and the ecosystem. However, the negligence and mismanagement of water bodies have endangered the accessibility of clean water significantly. The practice of open defecation, poor awareness, and mishandling of wastes have further threatened the quality of the limited and dwindling water reserves. Among the pollutants, pathogens need special attention owing to their widespread occurrence and potential to cause health hazards. Though there has been remarkable progress in the control and prevention of infectious diseases, microbial risks remain a leading cause of human mortality in India. Children are the worst affected, especially in rural areas and urban slums. Diarrhoea and pneumonia claim around one-third of children lives below five years. In this context, developing an affordable and safe solution to control pathogenic organisms is the need of the hour. The focus of this presentation is to summarise our recent efforts in developing affordable and eco-friendly polymer nanocomposites and their application in the point of use treatment of water. The ability of the composites to treat water will be presented, giving particular emphasis to microbial disinfection. The concepts, synthesis, working mechanism of the treatment unit will be discussed.

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Complete Mineralization of Tannery Wastewater using Dimensionally Stable Electrode

Prof. Shishir Sinha

Abstract

Mineralization of real tannery wastewater has been performed using dimensionally stable electrodes (DSA) in a flow through reactor. Ti/RuO2 electrode has been used as anode while graphite felt (GF) was used as a cathode. The characterization of electrodes has been performed through SEM micrography and EDX spectroscopy. The RuO2 nanoparticles was found to be deposited uniformly over the Ti substrate. The electro oxidation of wastewater has been performed for different treatment time ranging from 20 min to 300 min at three different pH (4, 7, and 10) at a constant cell potential. The quality of treated wastewater was examined through COD and color analysis through UV- Vis spectrophotometer. It has been observed that the proposed setup can effectively remove the organic compounds from wastewater at all pH levels. The in-situ generation of hydrogen peroxide increases the effectiveness of process. It has been found that the prepared Ti/RuO2 anode can effectively remove the organic contaminants at higher rates than that of bare Ti metal electrode in lesser time.

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Prof. Shishir Sinha is currently Professor and Head at Department of Chemical Engineering, IIT Roorkee. His area of specialization is Blended Polymer Composites, Polymer Surface Modification, Polymer Composites, Nano Composites, Ion Exchanger, Ion Exchangers. He did his B.Tech. in Chemical from H.B. Technological Institute Kanpur in year, 1993. Then, he completed his M. Tech.in Chemical from H.B. Technological Institute Kanpur in year 1995. further he finished his Ph.D. in Chemical Engineering from Indian Institute of Technology Kanpur, Kanpur in year 2000 and joined as Lecturer at Thapar Institute of Engineering and Technology, Patiala in year 1999 while pursuing Ph. D at Indian Institute of Technology Kanpur, Kanpur. He joined the department of Chemical engineering as Assistant Professor in 2006 at Indian Institute of Technology, Roorkee. He has experience of more than 20 years in teaching, research and consultancy in different aspects of Chemical engineering.

Lessons from Laminar Burning Velocity Measurements And Modeling At High Pressure and High Temperature Conditions

Prof. Sudarshan Kumar

Abstract

Externally heated diverging channel method helps accurate and direct measurement of laminar burning velocities at elevated temperatures. This method has been extended to higher pressures to evaluate the combined effect of pressure and temperature on the propagation of premixed methane-air flames for different equivalence ratios are reported for a pressure range (1-5 atm), and elevated temperatures of 350 – 650 K. A non-monotonic behaviour for temperature exponent, α is obtained with a minimum value for slightly rich mixtures (ϕ = 1.1). This non-monotonic behaviour of α continues even at higher pressures (2 – 5 atm) as well. Predictions from GRI-Mech 3.0, Aramco 2, FFCM-1 kinetic models are employed to compare with present experiments. Predictions using Aramco-2 mechanism match very well with the present measurements at various elevated pressures and mixture conditions. The variation of pressure exponent, ß follows a bell-shaped curve with maximum value for slightly rich mixtures (ϕ = 1.1) and a peculiar non-linear behaviour for very rich mixtures (ϕ ≥ 1.3). Based on the detailed analysis of experimental results, a new modified power-law correlation considering the α and ß variations is proposed: $S_u = S_{u,o}(\frac{T_u}{T_{u,o}})^{\alpha_o+\alpha_1(1-\frac{P_u}{P_{u,o}})}(\frac{P_u}{P_{u,o}})^{\beta_o+\beta_1(1-\frac{T_u}{T_{u,o}})}$. Analysis of the flame structure at high-pressure conditions indicates that the reaction layer thickness is reduced with an increase in pressure.

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Photocatalytic Carboxylation of Organic Substrates with CO_2 under Mild Reaction Conditions

Dr. Suman L. Jain

Abstract

Use of carbon dioxide (CO_2) as readily available, safer and sustainable C_1 source for the production of high-value chemicals has gained considerable interest in recent decades. Owing to its higher stability both thermodynamic as well as kinetic, activation of CO_2 is tedious and highly energy intensive. However, the single electron reduction of CO_2 through photocatalytic approach is feasible that has been extensively studied for artificial photosynthesis. Although, photocatalytic carboxylation of unsaturated hydrocarbons involving single electron reduction under ambient conditions is an ideal approach, albeit a very few reports are known in this aspect. During the present investigation we developed hybrid photocatalyst comprising molecular complex and semiconductor for the carboxylation of unsaturated hydrocarbons with CO_2 under visible illumination. The carboxylation of a range of aromatic hydrocarbons and olefins afforded excellent product yield under 1 atm pressure of carbon dioxide without adding any additive/ co-catalyst. Importantly, in case of styrenes, insertion of CO_2 took place at the benzylic C-H; whereas in normal olefins it occurred at the terminal site selectively. Moreover, the developed photocatalyst was highly stable that could be recycled successfully for subsequent runs with almost consistent efficiency.

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Dr. Suman L. Jain obtained her M. Sc. from Univeristy of Rajasthan, Jaipur in 1998 with first class first and received gold medal. After completion of the Ph. D from CSIR-Indian Institute of Petroleum, Dehradun, she moved to Germany for post doc as a Humboldt Fellow. In 2011 she got permanent position as Senior Scientist in Chemical Sciences Division at CSIR-Indian Institute of Petroleum, Dehradun. Her research interests include homogeneous catalysis, photocatalysis, CO_2 utilization, and green chemistry. She is a receipient of many awards like, INSA-Young Scientist Medal, MRSI-award, CRSI-medal, NASI-Platinum Jubilee Young Scientist Award, CSI- Young Scientist Award, SERB-Women Excellence Award and founder member of INYAS. She is also served as an Associate Editor of New Journal of Chemistry, RSC. She has published more than 225 publications in SCI- journals of Chemistry and 7 book chapters. Also she has 21 patents (6 granted in US and 4 in India) in her credit.

Colour Based Prediction of Lean Blowout (LBO) in Gas Turbine Combustors and Its Control

Prof. Swarnendu Sen

Abstract

Gas turbine combustors adopt lean combustion to reduce NOx emission. But, while adopting lean combustion, lean blowout (LBO) is considered as the main threat. LBO can also occur in aircraft engines during rapid speed or power reduction. So, LBO detection and control is a major concern in this area.Attention has been focused to detect LBO early in laboratory scale gas turbine combustor with different levels of premixing. A detailed investigation on the electromagnetic emission of the flame is performed in order to have the insight of the dominating chemiluminescence. The flame dynamics has also been studied using spectral signal obtained with spectrometer and CCD sensor. At lean condition of the premixed flame, three narrowband emissions in the visible (VIS) range, namely, blue, violet, and indigo colours, are observed. Primary parameters are defined based on these colours and their behaviours at different equivalence ratios are studied. The observed similarity between the results of camera and spectrometer infers that flame imaging with commercial color CCD sensors could be a low cost as well as simple tool for LBO prediction. A preliminary control strategy has also been delineated.

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Cooking on Traditional Wood Burning Stoves and Implications on Indoor Air Quality

Svati Bhogle

Abstract

Air pollution is estimated to contribute to about 5 million premature deaths each year across the world. Several recent investigations have estimated that household emissions from cooking fires are the single biggest source of outdoor air pollution in India. Studies conducted by various researchers project that complete mitigation of biomass as a household fuel and distribution of clean burning propane to rural areas would cut India's average annual air pollution to 38 ug/ m^3, just below the country's National Ambient Air Quality Standard of 40 ug /m^3. This could have a dramatic impact on the health of the country's residents. Improvement in indoor air quality, resulting in better health for women has been the genesis of the Ujjwala programme for provision of free LPG connections in India. But in spite of 80 million new LPG connections, more than 160 million households continue to cook at least partially, on solid fuels such as fuel wood, dung-cakes, crop-residue or other types of biomass. This presentation summarizes research on cooking patterns and emissions from cookstoves in India and argues that while some data is indeed available on household emissions, there are large data gaps on biomass burning especially for non cooking applications in India – water heating, space heating, fodder preparation, institutional and commercial cooking, post harvest processing etc. The presentation also discusses innovations in biomass burning stoves and suggests that multiple approaches are required to improve air quality. It builds the case for a clean air strategy for India that is evidence based, capturing the entire gamut of biomass burning and emission events for different biomass based thermal energy applications throughout the year, using different fuels, in different regions. It argues that biomass burning must be viewed in the larger context of affordability and access to clean fuels for a range of uses without compromising on air quality considerations.

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Svati is associated with several organizations in India in the area of clean energy. Her area of work is largely in fuel efficient cookstove design and dissemination through local networks (in TIDE, a non profit organization) and from Sustaintech (a pvt. ltd company implementing a business model for institutional and commercial stoves designed by her). She is the Chair of Clean Energy Access Network, (a network of practitioners in the decentralized renewable energy. She has implemented several successful projects in clean energy, especially for rural industries. She has studied Chemical Engineering and is an alumnus of Indian Institute of Technology Bombay. She has played a crucial role in shaping the space around sustainable technology innovation and dissemination, grassroots entrepreneurship models and associated policy initiatives through TIDE and Sustaintech.

Lab to Market: Aerosol Measurement Devices

Prof. Tarun Gupta

Abstract

Dr. Tarun has been working towards enhancing the indigenous capabilities within the country to develop inexpensive, portable and readily deployable aerosol measuring instruments including inertial impaction based portable air samplers to accurately collect size-resolved fine and submicron aerosol, customized 2-stage bioaerosol sampler, and a non-selective membrane based single annular tube diffusion denuder employed to separate co-pollutant gases from the aerosol of interest. These samplers have been utilized to collect ambient particles that were subjected to chemical analyses to unravel the information about dominant unknown sources responsible for polluting the ambient environment. These have also been employed to understand the fundamental mechanism of fog formation both in terms of photochemical oxidation of primary organic and metal mediated dark reactions to produce secondary organic aerosol. A submicron aerosol sampler designed, developed and evaluated at IIT Kanpur has been commercialized by a Delhi based company (Envirotech) and this instrument is sold as PM_1 sampler, Model: APM 577 in 2015. Dr. Tarun has made a technology transfer to BARC, Mumbai as part of a sponsored project from BRNS where an existing high volume PM10 sampler was retrofitted into a high volume PM2.5 sampler with only minor operational changes. The presentation will provide a glimpse of these technologies from their conception to field deployment and finally commercialization.

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Prof. Tarun Gupta is serving as Professor in department of Civil Engineering at IIT Kanpur. He has done doctorate from Harvard University & M.Tech from IIT Bombay. He has authored more than 120 ISI indexed journal publications, 5 edited books, 10 book chapters, 4 patents, reviewer of more than 36 journals. He has guided 6 PhD and 34 M.Tech. theses. A submicron aerosol sampler designed, developed and evaluated by him at IIT Kanpur has been commercialized by Envirotech (Delhi). He has developed a high volume fine PM sampler and transferred technology to BARC. This frugal innovation was protected by filling an application for Indian patent (*2088/DEL/2014* on 23.07.2014). He was awarded P K Kelkar research fellowship and is a selected member of INYAS and an INAE Associate. He has won INAE Innovator and Entrepreneur Award (2018), VNMM award (2017), NASI-SCOPUS Award (2015), INSA Medal for Young Scientist (2011), INAE Young Engineer Award (2009) and IEI Young Engineer Award (2008). He is currently N.C. Nigam Chair Professor.

Sustainable Solar Thermal Solutions for Energy, Water and Clean Environment

Prof. T. Sundararajan

Abstract

Concentration of solar energy can generate high pressure superheated steam (~ 40 bar, 400 oC) which can be used for power generation as well as for process heating applications such as water desalination and cold storage. A solar collector field based on linear Fresnel reflectors has been set up with support from the Department of Science and Technology, Government of India at the Pathashala, Vallipuram, Tamil Nadu. Fresnel mirrors coupled with secondary concentrator are employed to focus solar radiation on a coated stainless steel receiver tube of 70 mm diameter. The collector system directly generates superheated steam at about 45 bar and 400 oC. The receiver tube is covered with borosilicate glass, with the annular space evacuated to reduce heat losses. Theoretical studies have been carried out to optimize the secondary concentrator profile and to assess the heat losses from the solar collector. Compound-parabolic, trapezoidal and segmented-parabolic configurations are considered for the secondary concentrator. It is shown that a segmented parabolic configuration can provide high optical efficiency as well as nearly uniform flux distribution on the receiver tube. After expansion of steam in the turbine, waste heat utilization units such as Multi-Effect Desalination system and a steam-ejector based evaporative cooling system are employed, to utilize the steam for the purpose of desalination and a cold storage system. Efforts are also on, to produce hydrogen by splitting water thermo-catalytically at about 1000oC by concentrating solar energy.

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Thirumalachari Sundararajan obtained his B.Tech from IIT Madras in Mechanical Engg in 1978, and later MS & PhD degrees (in Mechanical Engg & Applied Mechanics) from the University of Pennsylvania, Philadelphia, USA in 1980 and 1983 respectively. He worked as a postdoctoral fellow at the University of Pennsylvania from 1983-1984. He joined as Assistant Professor at IIT Kanpur, India in 1985. Presently, he is a full Professor at IIT Madras in the Department of Mechanical Engineering. He has published 189 well-cited journal papers and presented more than 150 papers in various conferences. He has also published a textbook on computational fluid dynamics. He has guided 41 PhD and 35 MS scholars in their thesis work. He has been nominated as a Fellow of Indian Academy of Engineering (FNAE) in 2003 and received the Astronautical Society of India Award for Rocket Technology in the year 2006. His areas of research include: combustion & propulsion modeling, nano-fluid heat transfer, coal gasification, fuel cells, two-phase flows, nuclear thermal hydraulics and solar thermal power generation. He has been awarded the Institute Chair Professorship from June 2017.

Dr. T. Sundararajan has held various posts such as the Chairman/Vice Chairman for GATE, Advisor for Alumni Relations, HOD of Mechanical Engineering and Member of the Board of Governors for IITM. He has been the Secretary for professional bodies such as the Indian Society for Heat & Mass Transfer, Combustion Institute (Indian Section) and Vice President for the Indian Society for Science & Engineering, ISSE Chennai-Sriharikota Chapter. He has been a reviewer for several journals and the Principal Coordinator for many projects funded by DST, ARDB, DRDL, IGCAR and ISRO.

Effect of Oxygenated Fuels on Regulated and Unregulated Emissions – A review

Prof. V Ganesan

Abstract

The pollutants emitted from I C Engines are mainly regulated, though some subtle unregulated emissions are also present in the exhaust. Over the years a lot of experimental work have been carried out to study the effect oxygenated fuels on emissions characteristics of IC engines. However, there is a lack of a comprehensive review study about the definition and type of emissions, both regulated and unregulated Therefore, it is proposed to present this literature review study to bridge the gap. It is noticeable that a diverse effect of oxygenated fuels (alcohols) application in blended mode compared to fumigation mode on regulated emissions except PM. For unregulated emissions, it was found a reduction of BTEX (benzene, toluene, ethylbenzene and o-xylene, m/p-xylenes) in blended mode in most cases, polycyclic aromatic hydrocarbons (PAHs) in blended mode in major experiments and 1,3-butadiene, ethyne and ethene in both modes in all tests with using alcohols compared to fossil fuels. On the other hand, it was seen an increase of unburned ethanol and methanol and total carbonyls in both modes in all tests. And, an increase of formaldehyde and acetaldehyde which are the predominant carbonyls in the exhaust for vehicles was recorded in most and major experiments, respectively for both modes.

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Prof. V Ganesan is currently working as Professor of eminence in the dept. of Mech. Engg., Anna University, Chennai.He joined IIT Madras in 1967 immediately after his B E, and worked in various capacities at IIT Madras for 48 years. During his tenure he has guided 41 Ph D Scholars 18 M S and has published 441 papers in various National and International Conferences and Journals.He has authored 6 books the latest one being Thermodynamics apart from editing 12 conference proceedings. He has received so far 52 awards.

Environmental Monitoring for a Nuclear Power Project

Dr. Vinod Kumar Garg

Abstract

Baseline studies are mandatorily carried out at all proposed nuclear facility sites. These baseline studies include estimation of radionuclides in different environmental matrices including water, soil, air; transfer factor of radionuclides from soil to crops and fodder, ground and surface water quality and demographic studies. Based on the data health risks to the population living in the vicinity are predicted. This study has been conducted within 30-km radius area of the proposed Gorakhpur Haryana Anu Vidyut Pariyojana (GHAVP), and the study area stretches into Fatehabad and Hisar districts of Haryana, India. The data generated in this work for proposed nuclear power plant site have been used to predict radiological dose from different matrices to the population of the area. Baseline levels of natural and artificial radioactivity in soil were assessed by detecting activity of ^{40}K, ^{238}U, ^{232}Th, ^{137}Cs and ^{90}Sr in soil samples. Activity of ^{90}Sr was below detectable limit in all the soil samples. The order of different radionuclides activity was $^{40}K > ^{238}U > ^{232}Th > ^{137}Cs$. The contribution of ^{137}Cs activity to annual effective dose equivalent ($\sim 10^{-1}$ μSv y^{-1}) and outdoor excess lifetime cancer risk ($\sim 10^{-5}$) from background radiation is negligibly small. The calculated dose rate from natural activity in soil samples was found equivalent to the Indian average of 64 nGy h^{-1}. The average outdoor excess lifetime cancer risk due to natural radioactivity in soil samples collected from different locations was slightly less than that of the world average (0.29×10^{-3}). The data revealed that ^{40}K, ^{226}Ra and ^{232}Th activities were detectable in most of the grain and fodder samples. ^{40}K and ^{226}Ra activities were detectable in edible portion of all type of collected vegetables while ^{232}Th activity was found detectable only in leafy vegetable, green mustard. Activity of ^{90}Sr was below detectable limit in all the agricultural produce samples. ^{137}Cs was detectable in 58% of the analysed agricultural produce samples. The maximum Transfer factor (TF) of ^{137}Cs was in mustard and pearl millet give an idea about use of these crops as indicator samples for future studies. Total cumulative annual effective dose and excess lifetime cancer risk due to presence of different radionuclides in locally grown agricultural produce were much lower than the permissible limit of 1.0 mSv y^{-1} for general public. Hence there is no carcinogenic risk by ingestion food items grown in the area. Radioactive dose analysis revealed ingestion of locally grown wheat, rice and vegetables safe for general public. Uranium concentration in drinking water has also been quantified at different locations in the study area.

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The Star Rating Programme

Dr. Vidyanand M. Motghare

Abstract

Maharashtra is one of the most industrialised state in India, with more than 1,20,000 industries. Industrial emissions are a key source of air pollution affecting the residents of Maharashtra. To empower the residents in the air pollution debate, the Maharashtra Pollution Control Board initiated the Star-rating programme, which publishes pollution information about large scale industries in Maharashtra in a manner which is easy to understand; and through a website which can be easily accessed by people – mpcb.info. The most polluting industries are assigned 1-star and the least polluting industries are assigned 5- stars. The objective of the programme is to reduce pollution from point sources, make industries aware of their pollution rankings and make the citizens of Maharashtra aware of the major polluters in their region. The Board organises report card distribution workshops regularly to intimate industries about the historical pollution data used for assigning their star rating. Additionally, the board has also initiated regulatory action based on the programme. Industries have responded to this with a commitment of compliance to emission norms and upgradation of air pollution control devices. There are currently more than 400 industries participating in the program. More industries are expected to qualify for the programme, as and when additional manual stack samples are collected by the Board. The effectiveness of the programme is being evaluated by professors at J-PAL South Asia, EPIC and Harvard University.

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Mechanistic Features of Oxidative Desulfurization Using Sono-Fenton–Peracetic Acid System

Prof. Vijay S. Moholkar

Abstract

This study has tried to establish the links between the chemistry of oxidative desulfurization and cavitation physics for an ultrasound-assisted oxidative desulfurization (UAOD) process using Fenton–peracetic acid as the oxidant. The model system employed was dibenzothiophene (as a model sulfur compound) and toluene (as a model gasoline/diesel). H_2O_2 was found to be the key component of the oxidant that balances between several competing pathways and reactions in overall oxidative desulfurization process. Addition of Fe^{2+} to peracetic acid has a beneficial effect, whereas excess H_2O_2 has an adverse effect on the process. Transient cavitation is revealed to play a negative role in the desulfurization process, whereas ultrasound has a positive effect. The former effect is a consequence of the scavenging of $HO_2^{\cdot}$ radicals in the aqueous phase by radicals generated by cavitation bubbles, whereas the latter effect is attributed to the generation of a fine emulsion between the oxidant and toluene phases as a result of strong micromixing generated by ultrasound. The results of this study clearly point out that less scavenging and effective interphase transfer of $HO_2^{\cdot}$ radicals are more crucial to the utilization of $HO_2^{\cdot}$ radicals for desulfurization than mere generation.

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Black (nano) Gold to Combat Climate Change

Dr. Vivek Polshettiwar

Abstract

Global warming is a serious threat to the planet and the living beings. One of the main cause of global warming is the increase in the atmospheric CO_2 level. The main source of this CO_2 is from the burning of fossil fuels in our daily lives. By using the techniques of nanotechnology, we have transformed yellow gold to black gold, by changing the size and gaps between gold nanoparticles. We achieved this by the concept of plasmonic coupling. Black gold absorbs light over the entire visible region as well as in the near-infrared region of the solar spectrum. Notably, black gold generates a large number of "hotspots" which can be used for CO_2 methanation reaction. Similar to the real trees, which uses CO_2, sunlight, and water to produce food, the developed 0black gold acts like an artificial tree that uses CO_2, sunlight and water to produce fuel. Notably, black gold can also be used to convert seawater into drinkable water using the heat that black gold generates after it captures sunlight. This work is a way forward to develop "Artificial Trees," which capture and convert CO_2 to fuel and useful chemicals. Although at this stage, the production rate of fuel is low, in coming years, we may be able to convert CO_2 to fuel using sunlight at atmospheric condition, at a commercially viable scale, possibly using less expensive metal and CO_2 may then become our main source of clean energy. I will discuss these results in my talk.

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Prof. Vivek Polshettiwar after his Ph.D. in 2005 worked as a postdoc in France and USA for few years, before starting his own independent group at KAUST in 2009. In 2013, he moved to TIFR, and his group here working on development of novel nanomaterials as catalysts to tackle "climate change". He has published nearly 100 articles with h-index 52 and around 11000 citations in reputed journals. He is recipient of prestigious ORISE Research Fellowship at US-EPA. He was awarded as Top-25 cited author in 2011 by Tetrahedron and Young Scientist Award at DSL-2012. He also received Asian Rising Star lectureship at 15th Asian Chemical Congress (ACC), Singapore (2013), from Nobel Laureate Professor Ei-ichi Negish. In 2015, he was admitted as a Fellow of Royal Society of Chemistry (RSC), United Kingdom. He was awarded Bronze medal by CRSI, India. He was also recognized as emerging investigator-material science and 175 faces of chemistry by RSC, UK. Recently he was awarded prestigious Materials Research Society of India - MRSI Medal 2019.

Application of Nanoadsorbents in Treatment of Wastewaters

Prof. Yogesh Chandra Sharma

Abstract

In today's world, nanoparticles (NPs) and nanotechnology have attracted attention of the scientific community globally and have emerged as a fast developing and fascinating area of research. Nowadays research on toxicity In December 1959, Nobel Laureate Richard Feynman gave an infamous lecture entitled "There's plenty of room at the bottom" at the California Institute of Technology during a meeting with the American Physical Society. At this meeting he first mentioned the process which could potentially manipulate individual atoms and molecules and hence advance the field of synthetic chemistry. He was one of the first to recognize the potential of nano-scale materials for our industrial society. This type of technology would later be officially termed "nanotechnology" in 1974 in order to describe the process of moving or manipulating atoms at the nano-scale (1-100 nm). Nanotechnology can be defined as follows:

"Nanotechnology is the design, characterization, production and application of structures, devices and systems by controlling shape and size at nanometer scale".

Nanoparticles NPs, the building blocks for nanotechnology, are engineered materials with at least one dimension less than 100 nm. Nanoparticles may be having one (e.g., nano-layers), two (e.g., nanowires and nanotubes) or three dimensions on the nanoscale (e.g., nanoparticles (NPs), quantum dots, metal nanoparticles (MNPs) and fullerenes). In general, these NPs can be categorized into carbon-based materials such as fullerenes and carbon nanotubes: single walled carbon nanotube (SWCNT) and multiwalled carbon nanotube (MWCNT) and inorganic nanoparticles including the ones based on metal oxides (TiO_2, ZnO and Al_2O_3, Fe_3O_4, Fe_2O_3, CeO_2, etc.), metals (gold, silver, aluminium, and iron),quantum dots (cadmium sulfide and cadmium selenide), dendrimers (which are nano-sized polymers built from branched units capable of being tailored to perform specific chemical functions) and composites, which combine nanoparticles with other nanoparticles or with larger, bulk-type materials.

Environmental pollution, especially water pollution has been an important topic and pollution of water by heavy and toxic metals has always attracted attention of scientific workers. There have been several important advancements in treatment of metal rich effluents and one of the important advancements in water and wastewater treatment where our group carried out pioneer work in the area. Present article focusses on the latest work carried out in this area.

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Prof. Yogesh Chandra Sharma is presently full professor at Department of Chemistry, Indian Institute of Technology (BHU) Varanasi. He did his Ph.D. (1991) from IT BHU and Doctor of Science (D.Sc.) in Chemistry from CCS Meerut University in 2010. He has a brilliant academic career and pursued scholastic work in the broad domain of Monitoring and Control of Pollution of River Ganges, Water Pollution Control and research, Naonoadsorbents for water remediation. He explored critically the factors and analytically developed many insights with superior results through exhaustive experimentation. His current research interests are focused in the broad area of Renewable Energy and his exploratory findings have been reported in top notch journals covering this field. He has authored articles in majour journals of American Chemical Society, Royal Society of Chemistry, etc. He has been author of articles which are highly cited. Recently he has been admitted as Fellow of Royal Society of Chemistry (FRSC). His SCOPUS h index is 51 and 11700 citations.

The research work of Professor Sharma has been in the broad areas of water pollution control where he has done significant work on water remediation by using non conventional adsorbent materials. He has used clays and clay minerals for the remediation of water containing metallic pollutants, dyes and colours, and fluorides and nitrates. His main contributions have been in terms of synthesis of a large number of activated carbons which he has used for de-colouration of waters and removal of metallic species from waters. He has also done significant work on application of macrophytes and 'root zone technology' for removal of metallic pollutants from contaminated water. Looking into the problems of 'nitrates' and 'fluoride' contamination of water, also knowing the fact that there are scanty materials for removal of these ions from water, he synthesized an inorganic adsorptive media: hydrous bismuth oxide, HBO which proved to be very efficient.

The recent interests of Prof. Sharma are in 'Renewable Energy'. He has taken up the problem of synthesis and characterization of 'biodiesel' from different feed stock materials like non-edible oils, fats, and waste frying oils. In order to keep the cost of synthesis of biodiesel low, he has developed a number of catalysts from waste materials and then has used these catalysts in the process.

Professor Sharma has made significant contributions in water pollution Control and Biofuels and Renewable Energy. He has authored more than 200 research papers in internationals and national professional journals, conferences, and seminars. He has also authored five books, and 12 review articles in these area. Many of his articles have been the most cited articles.

Evaluation of Protein Production by Photosynthetic Bacteria from Various Wastewaters

Prof. Zhang Guangming

Abstract

As the shortage of protein resources has become a global issue, the development of microbial resources from wastes has garnered increasing attention. Photosynthetic bacteria (PSB) are non-toxic organisms that can treat various wastewaters while producing high-level microbial proteins. In this work, we investigated the quality of proteins produced by PSB from various wastewaters and evaluated the feasibility of PSB technology. The results indicate that PSB can produce proteins from three types of wastewaters efficiently (41.0–94.0 % content). The protein produced from sucrose, soybean, and brewery wastewaters have comprehensive nutrient because they possess 16 kinds of amino acids. A cost analysis indicates that recovering protein making PSB wastewater treatment has a more promising prospect than conventional wastewater treatments. These results reveal that PSB wastewater treatment with protein recovery has great productive and economic potential, thus narrowing the gap between experiments and practical applications.

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Prof. Zhang got her Ph.D. in environmental engineering from Purdue University, USA in 2001. Then she served as assistant professor, associate professor, full professor and registered engineer in Tsinghua University and Harbin Institute of Technology, China. Now she is a full professor in Renmin University of China. Her major research interests lay in water treatment, especially nutrients recovery from wastewater and catalytic oxidation of persistent pollutants. She has published 7 books, 160 peer reviewed papers, and 19 patents.

Realization of the Cleaner Composting Employing Mineral Additives

Dr. Zhang Zengqiang

Abstract

Microalgae have received notable attention for their various environmental Composting could transform the organic waste into sanitary and stabilized product (compost), which not only reduces the environmental pressure, but also recycles the organic resources cost-effectively. However, there are still some disadvantages for traditional composting, including nitrogen loss, low humification degree, high greenhouse gases emission and heavy metals mobility. The aforementioned issues could not only reduce the quality of compost but also cause secondary environmental pollution like edaphic, aquatic and atmospheric pollutions, and consequently affect adversely the acceptance and development of composting technology. In order to solve the problems, mineral additives had caused more attention due to the properties like availability, huge specific area, porosity, low-cost and strong adsorption capacity. Our research indicated that medical stone, bentonite, zeolite and diatomite had been applied to composting in a single form or combination. It was confirmed that the addition of mineral amendments could prolong the thermophilic phase (16-21 d), promote organic matter humification, reduce nitrogen loss through degreasing NH_3 by 10.41-65.35% and N_2O emissions by 26.89-97.3% as well as CH_4 emission by12.13-95.34% from composting mass. Additionally, adding the mineral additives could reduce actinobacteria abundance. Considering the engineering practicability, effective composting process and economic benefits, searching more minerals amendment is necessary. And further research is needed to explore the mechanism of mineral addition on composting and to evaluate the agricultural and environmental performances of co-composted mineral additives.

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Dr. Zengqiang Zhang is one of the leading personalities in the field of Environmental Science and Technology. His major research interests are in the areas of environmental microbiology, organic waste composting, bioremediation of heavy metal contaminated soil, and mitigation of greenhouse gases emission during the organic waste composting etc. which include 3 books, 12 technical reports, 12 book chapters, 326 original and review papers and 65 research communications in international and national conferences.

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Schedule of IV SEEC

Technical Schedule at a Glance

27th November 2019				
09:30-11:00AM	Inaugural Session/Award Ceremony			
11:00-11:30AM	*Tea Break*			
11:30-01:00 PM	Special Session: Awardee's Presentation Session			
01:00-02:00 PM	*Lunch*			
Venue	**Conference Room-1**	**Conference Room-2**	**Auditorium**	**CCDS**
02:00-03:30 PM	Session A-1: IC Engines-I: Fuels, Engine Technology and Emissions	Session B-1: Water & Wastewater Treatment-1	Session C-1: Biomass and Biotechnology-1	Session D-1: Sustainable Materials & Processes
03:30-04:30 PM	*Tea & Poster Session 1*			
04:30-06:00 PM	Session A-2: Coal & Biomass Combustion/Gasification	Session B-2: Automobile and other Environmental Applications	Session C-2: Waste to Wealth-1	Session D-2: Energy, Environment and Sustainability
06:00-06:30 PM	Plenary Session-1 (Ms. Rashmi Urdhawarshe, Director, ARAI)			
06:30-07:30 PM	Cultural Programme			
07:30 PM Onwards	Conference Banquet Dinner (Hosted by the Director CSIR-NEERI)			
28th November 2019				
09:00-10:30 AM	Session A-3: IC Engines-II: Fuels, Engine Technology and Emissions	Session B-3: Environmental Challenges & Sustainability	Session C-3: Microbiology	Session D-3: Technologies & Approaches for Clean Environment
10:30-11:30 AM	*Tea Break and Poster Session-2*			
11.30-01:00 PM	Session A-4: Atomization and Sprays	Session B-4: Nuclear Energy & Other Environmental Challenges	Session C-4: Biotechnological and Other Environmental Applications	Session D-4: Sensors and Materials for Environmental Applications
01:00-02:00 PM	*Lunch*			
02:00-03:30 PM	Session A-5: Combustion and Modelling	Session B-5: Clean Fuels & Other Environmental Challenges	Session C-5: Waste & Wastewater Management	Session D-5: Biological Processes
03:30-03:45 PM	*Tea Break*			
03:45-05:00 PM	Book Launch & Plenary Session -2 (Dr. VK Saraswat, Hon. Member, NITI Ayog)			
05:00-06:30 PM	Panel Discussion on "***Balancing Energy Security, Environmental Impacts & Economic Considerations: Indian Perspective***" **Panelists:** Dr. VK Saraswat, Dr. Anjan Ray, Dr. RR Sonde, Prof. Avinash Kumar Agarwal, Dr. R Srikanth and Dr. Rakesh Kumar **Moderator:** Dr. Nitin Labhsetwar			
06:30-07:30 PM	General Body Meeting of ISEES *(For ISEES Members only)*			
07:30 PM Onw.	Onwards Fellows Dinner *(By invitation only)*			
29th November 2019				
09:00-11:00 AM	Session A-6: Alternative Energy Resources-I	Session B-6: Water Pollution and Control	Session C-6: Biological Processes and Environmental Applications	Session D-6: Environmental Sustainability
11:00-11:30 AM	*Tea*			
11:30-01:00 PM	Rapid fire Presentations for Posters Session-A (Conference Room-1)	Rapid fire Presentations for Posters Session-B (Conference Room-2)	Rapid fire Presentations for Posters Session-C (Auditorium)	
01:00-02:00 PM	*Lunch*			
02.00-03:30 PM	Session A-7: Alternative Energy Resources-II	Session B-7: Environmental & Other Applications	Session C-7: Cleaner Technology & Environment	--
03:30-04:30 PM	Valedictory & Award Ceremony			
04:30-05:00 PM	*High-Tea*			

Detailed Technical Schedule

27th November 2019		
Special Session: Awardee's Presentation Session (Session Chair: TBD) (Venue: Auditorium)		
11:30-11:40 AM	**Young Scientist Awardee:** Dr. Swatantra P Singh	Laser-induced graphene membrane filters and electrodes for desalination and wastewater treatment
11:40-11:50 AM	**Young Scientist Awardee:** Dr. Sankar Chakma	The Role of Ultrasound in Chemical and Biological Processes for Degradation of Emerging Pollutants
11:50-12:00 Noon	**Young Scientist Awardee:** Dr. Samadhan A. Pawar	TBD
12:00-12:10 PM	**Best Thesis Award:** Dr. Rajesh K. Prasad	Development of Laser Ignition Engine
12:10-12:20 PM	**Best Thesis Award:** Dr. Om Prakash Sarkar	Scaling up of Biohydrogen Production Process from Waste Integrated with Biorefinery and Environmental Sustainability Analysis
12:20-12:30 PM	**Best Thesis Award:** Dr. Poonam Soundriyal	Printed energy storage devices for the next generation of flexible and smart electronics
12:30-12:40 PM	**Best Thesis Award:** Tushar Agarwal	The relevance of methanol in the two-wheeler segment for future mobility
12:40-12:50 PM	**Best Thesis Award:** Shashank Singh	Realization of Multi-Agent System for Residential Demand Response under Smart Grid Paradigm

27th November 2019		
Session A-1: IC Engines-I: Fuels, Engine Technology and Emissions (Session Chair: TBD) (Venue: Conference Room-1)		
02:00-02:30 PM	**Keynote:** Dr. Niraj Sharma	Estimation of Idling Fuel Losses and Corresponding Emissions at the Signalised Intersections
02:30-02:50 PM	**Invited:** Dr. Atul Dhar	Exhaust Heat Recovery from A 4-Stroke Diesel Engine Using Electric Turbo-Generator
02:50-03:10 PM	**Invited:** Dr. Dhananajy Kumar Srivastava	Electro-pneumatic variable valve actuation system for camless engine
03:10-03:20 PM	Ashutosh Jena, Akhilendra Pratap Singh, Avinash Kumar Agarwal	SEEC 6: Combustion Analysis using Optical Diagnostics
03:20-03:30 PM	Bhuvan Chennoju, Karan Hiranandani, Aravind B, Sudarshan Kumar	SEEC 129: Experimental Investigations On LPG/Air Flame Dynamics In A Preheated Micro Planar Channel
Session A-2: Coal & Biomass Combustion/Gasification (Session Chair: Dr. Santanu De) (Venue: Conference Room-1)		
04:30-05:00 PM	**Keynote:** Prof. Amit Agrawal	Effect of Pulsation on Flow Characteristics of Free and Impinging Jet
05:00-05:20 PM	**Invited:** Prof. V Ganesan	Effect of Oxygenated Fuels on Regulated and Unregulated Emissions – A Review
05:20-05:30 PM	Mohd M. Naved, Ankit Gupta, Ankeet Bobhate, Himanshu Kumbhare, Nitin Labhsetwar	SEEC 94: Laboratory and Field Measurement of PM2.5, CO Emissions and Thermal Efficiency from Traditional and Rocket Cookstoves
05:30-05:40 PM	Ranu Bande, Shripal Singh, Abhishek Singh	SEEC 88: Cleaning of Indian High Ash Coal for Clean & Sustainable Energy: Review
05:40-05:50 PM	Heena Dhawan, Durlubh Sharma	SEEC 123: Comparison of the organo-refining of Indian coals with inorgano-leaching process
05:50-06:00 PM	Anirudh Singh, Satvasheel Powar, Atul Dhar	SEEC 46: Computational Study on the Effect of Moisture and Oxidizer Content in Coal Gasification.
28th November 2019		
Session A-3: IC Engines-II: Fuels, Engine Technology and Emissions (Session Chair: TBD) (Venue: Conference Room-1)		
09:00-09:30 AM	**Keynote:** Dr. S. S. Thipse	Clean Fuel Regulations and their Effect on the Automotive Sector in BS-VI Era
09:30-09:50 AM	**Invited:** Dr. Pravesh Chandra Shukla	Bioethanol Production from Agri-Produce and its Potential for Transportation Utilization
09:50-10:00 AM	Utkarsha Sonawane, Avinash K. Agarwal	SEEC 10: Comparison of performance, combustion and emission for Methanol, Ethanol and Butanol Fuelled Spark Ignition Engine
10:00-10:10 AM	Ankur Kalwar, Avinash K. Agarwal	SEEC 140: Combustion And Emission Characterization of Primary Alcohols In Dual-Fuel Injection Mode In Direct-Injection Spark-Ignition Engine
10:10-10:20 AM	Raviteja S, Ramakrishna Pa, Ramesh A	SEEC 138: Hydrocarbon And Carbon Monoxide Emission Reduction In SI Engines Using Nitromethane As An Additive

10:20-10:30 AM	Anil Kumar B C, Ranjith Maniyeri, Anish S	SEEC 02: Experimental Investigation on the Effect of Decahedron Frustum Shaped Reflector on the Performance of A Cylindrical Box-Type Solar Cooker
Session A-4: Atomization and Sprays (Session Chair: TBD) (Venue: Conference Room-1)		
11:30-12:00	**Keynote:** Dr. Sanjay	Enabling Research led Smart Environmental Innovations and Solutions
12:00-12:20 PM	**Invited:** Dr. P. A. Lakshminarayanan	Alternatives to Gasoline and Diesel Fuels
12:20-12:40 PM	**Invited:** Prof. K B Mishra	Alternative fuel blends of biodiesel, ethanol and DTBP for emission control in diesel engines
12:40-12:50 PM	Harsimran, Vishnu Singh Solanki, Utkarsha Sonawane, Avinash Kumar Agarwal	SEEC 9: Macroscopic and Microscopic Spray Characteristics of gasoline and diesel using CRDI system
12:50-01:00 PM	Vishnu Singh Solanki, Avinash Kumar Agarwal	SEEC7: Development and experimental evaluation of Gasoline Compression Ignition (GCI) Engine Technology
Session A-5: Combustion and Modelling (Session Chair: TBD) (Venue: Conference Room-1)		
02:00-02:30 PM	**Keynote:** Prof. Swarnendu Sen	Colour Based Prediction of Lean Blowout (LBO) in Gas Turbine Combustors and Its Control
02:30-02:50 PM	**Invited:** Prof. Amitava Dutta	Mixture Preparation and Performance Optimization in Domestic LPG Cookstoves
02:50-03:00 PM	Tomesh Kumar Sahu, Pravesh C Shukla, Sumit Sarkar	SEEC 40: Combustion investigation in a single cylinder compression ignition agricultural engine fuelled with biodiesel derived from waste cooking oil
03:00-03:10 PM	Vikram Kumar, Avinash Kumar Agarwal	SEEC 11: Performance and Emission characteristics of a Diesel Engine Using Diesel-Alcohol Blends
03:10-03:20 PM	Hardikk Valera, Dhananjay Kumar, Avinash Kumar Agarwal	SEEC 108: 1-D Modelling And Simulation of Alco-251 Locomotive Engine Using GT-Power
03:20-03:30 PM	Mohit Singla, Vishavjeet Singh Hans, Sukhmeet Singh	SEEC 44: Heat Transfer and Friction Factor Characteristics of Evacuated Tube Solar Air Heater Roughened Artificially with Circular Rib Using Computational Fluid Dynamics
29th November 2019		
Session A-6: Alternative Energy Resources-I (Session Chair: Dr. R A Sohony) (Venue: Conference Room-1)		
09:00-09:30 AM	**Keynote:** Prof. Raj Bordia	Materials for Energy Storage – Key Enabler for Low Carbon Energy Future
09:30-09:50 AM	**Invited:** Dr. Piyali Das	Bio Crude Co-refining: The Untapped Opportunity for India
09:50-10:10 AM	**Invited:** Prof. Raja Banerjee	Some Perspective on Using Butanol as an Alternative Fuel for IC Engines
10:10-10:30 AM	**Invited:** Prof. Sudarshan Kumar	Lessons from laminar burning velocity measurements and modeling at high pressure and high temperature conditions
10:30-10:50 AM	**Invited:** Dr. Satwasheel Powar	Techno-economic analysis of different architectures of Perovskite solar modules
10:50-11:00 AM	Himanshu Kumbhare, Mohd Mubashshir Naved, Ankit Gupta, Snehal Korde, Nitin Labhsetwar, Ankeet Bobhate	SEEC 96: Up-Cycling of Water Hyacinth Waste to Produce Pellet Fuel
Session A-7: Alternative Energy Resources-II (Session Chair: Dr. Sadhana Rayalu) (Venue: Conference Room-1)		
02:00-02:30 PM	**Keynote:** Prof. K. S. Reddy	Development of Indigenous Concentrating Solar Thermal Systems for Sustainable Energy and Environment
02:30-02:50 PM	**Invited:** Prof. P K Bose	Biodiesel from micro Algae: The Future of Sustainable Fuels
02:50-03:00 PM	Mohammad Dilnawaz Azmi, Dr. Rajesh Maithani	SEEC 84: Thermo Hydraulic Performance Analysis Due to Angle of Attack In V-Rib with Symmetrical Gap Roughened Duct of Solar Air Heater
03:00-03:10 PM	Sushant Satputaley, Aniket Mandvikar, Rahul Kavishwar, Shardul Wadalkar	SEEC 115: Review on Investigation of Concentrating Solar Power A Sustained Solar Thermal Technology
03:10-03:20 PM	Pushpendra Kumar Shukla, P. Anil Kishan	SEEC 59: Experimental and Numerical Analysis of Double-Pass Solar Air Heater with Pcm Energy Storage for Space Heating
03:20-03:30 PM	Shebaz A Memon, Rajesh N Patel, Harshil Satasiya, Zeel Patel	SEEC 102: Sizing Optimization of Solar And Wind Based HRES Using Exhaustive Technique
27th November 2019		
Session B-1: Water & Water and Wastewater Treatment-1 (Session Chair: Dr. M P Patil and Dr. Jakir Hussain) (Venue: Conference Room-2)		
02:00-02:30 PM	**Keynote:** Prof. Shishir Sinha	Complete Mineralization of Tannery Wastewater using Dimensionally Stable Electrode

02:30-02:50 PM	**Invited:** Prof. P. Mullai	Dispersion and performance prediction in a hybrid upflow anaerobic sludge blanket reactor treating fermentation based pharmaceutical wastewater
02:50-03:10 PM	**Invited:** Dr. Archana Sarkar	Climate Change and Water Resources in India: Present Status, Future Impacts, Adaptation Options and Government Actions
03:10-03:20 PM	Yogendra Singh Solanki, Madhu Agarwal, Sanjeev Gupta, Pushkar Shukla, Prof. A. B. Gupta	SEEC 131: Analysis of Community RO Plants With Special Emphasis on Membrane Fouling of Bharatpur Area of Rajasthan, India
03:20-03:30 PM	Jyoti, Meena Khwairakpam	SEEC 122: Analysis of Soil Applicability of Water Hyacinth Compost by Performing Phytotoxicity Test
Session B-2: Automobile and other Environmental Applications (Session Chair: DR. R B Biniwale) (Venue: Conference Room-2)		
04:30-05:00 PM	**Keynote:** Dr. Benjaram M. Reddy	Advanced Catalysts for Energy and Environmental Applications
05:00-05:20 PM	**Invited:** Dr. Shubhangi B. Umbarkar	Hydrocarbon/hydrogen SCR of NOx using Ag-Au/Al2O3 Catalyst for Diesel Engine Exhaust treatment
05:20-05:40 PM	**Invited:** Prof. Tarun Gupta	Lab to Market: Aerosol Measurement Devices
05:40-05:50 PM	Tamilarasan K, Aswin Sidhaarth K.R, Perumal Pillai E.B.	SEEC 13: Effect of microwave assisted surfactant liquefaction on enhanced biofuel production from green marine macroalgal biomass
05:50-06:00 PM	Alisha Meshram	SEEC 78: Biodiesel production using non-edible Cassia tora seed oil
28th November 2019		
Session B-3: Environmental Challenges & Sustainability (Session Chair: Dr. Pawan Labhsetwar) (Venue: Conference Room-2)		
09:00-09:20 AM	**Invited:** Prof. Hiroshan Hettiarachchi	Circular Economy: Closing the Loop with Tweaking the Policies
09:20-09:40 AM	**Invited:** Dr. Fawzia Tarannum	Inclusive governance for water-energy-food nexus sustainability
09:40-10:00 AM	**Invited:** Dr. K. P. Prathish	Open burning of municipal solid wastes in India & Dioxin emission monitoring
10:00-10:10 AM	Yogyata Pathania, Gagan Preet	SEEC 145: Mechanical Properties of Nanoporous Phosphorene For Water Treatment Applications
10:10-10:20 AM	Nandini Moondra, R A Christian, N D Jariwala	SEEC 12: Advantages and Limitations of Phycoremediation in Wastewater Treatment
10:20-10:30 AM	Lekshmi Ashok, George K Varghese, Santosh G Thampi	SEEC 41: The Western Ghats Conundrum Formulated as A Game
Session B-4: Nuclear Energy & Other Environmental Challenges (Session Chair: Prof. D R Peshwe) (Venue: Conference Room-2)		
11:30-12:00 Noon	**Keynote:** Prof. Petra Ecorchard	Adsorbents of Radionuclides
12:00-12:20 PM	**Invited:** Prof. Vinod Kumar Garg	Environmental monitoring for a Nuclear Power Project
12:20-12:40 PM	**Invited:** Prof. Mamata Ratnakar Lanjewar	Nuclear analytical techniques: neutron activation analysis (naa) and isotope dilution analysis (ida) for environmental samples
12:40-12:50 PM	Geetha Divaakar, Rubini G, Dhananjeyan S	SEEC 65: Composting of Rice Husk and Their Effects on Soil Quality
12:50-01:00 PM	Sangita Goel, Sanket Mankar, Shashank Somwanshi, Rahul Vyawahare, Rajesh Gupta	SEEC 70: Assessment of Various Indoor Air Pollution Sources in Indian Household and Their Associated Health risk
Session B-5: Clean Fuels & Other Environmental Challenges (Session Chair: Dr. R. Srikanth) (Venue: Conference Room-2)		
02:00-02:30 PM	**Keynote:** Dr. Anjan Ray	Adapting India to a non-Fossil Fuel Diet
02:30-03:00 PM	**Keynote:** Dr. Sukumar Devotta	SDGs for Sustainable Energy & Environment and Their Challenges for India
03:00-03:20 PM	**Invited:** Dr. Moqtik Bawase	Emission factors and source profiles of in-service vehicles in India.
03:20-03:30 PM	Ankita Singh, Onkar Singh	SEEC 86: Comparative evaluation of combined power systems having SOFC-HAT and SOFC-HAT-CO2 power cycle
29th November 2019		
Session B-6: Water Pollution and Control (Session Chair: TBD) (Venue: Conference Room-2)		
09:00-09:30 AM	**Keynote:** Prof. Yogesh Sharma	Application of Nanoadsorbents in Treatment of Wastewaters
09:30-09:50 AM	**Invited:** Dr. Shihabudheen M.	Sustainable biopolymer nanocomposites: Application in purification of water

	Maliyekkal	
09:50-10:10 AM	**Invited:** TBD	TBD
10:10-10:20 AM	Jaimala Chahande	SEEC 60: Industrial and Domestic Waste Water Management
10:20-10:30 AM	Rao Faraz waris, Ashish Sengar, Izharul haq Farooqi	SEEC 30: Performance Evaluation of 144 MLD MBBR Based Water Treatment Plant at Sikandara, Agra
10:30-10:40 AM	Asmita Jadhav, Sunit Kumar Singh, Ahmed Sadeq Al-Fatesh, Nitin Labhsetwar	SEEC 89: Iron oxide based low-cost nanomaterials: Efficient adsorbent for selenium removal from water
10:40-10:50 AM	Amulya Prasad Panda, Mouli Giri, Usha Jha, Sanjaya Kumar Swain	SEEC 83: Development of Iron Ore Slime Incorporated A-Mno2 Microspheres (Iosm) For Effective Remediation of Arsenic Contaminated Groundwater
10:50-11:00 AM	Amala George, Haripriya S	SEEC 49: Enhanced chromium (VI) bioremediation and bioelectricity generation using metal organic framework anode in MFC based on day-today organic superfluous wastages
Session B-7: Environmental & Other Applications (Session Chair: Dr. G L Bodhe) (Venue: Conference Room-2)		
02:00-02:30 PM	**Keynote:** Prof. Hisahiro Einaga	Design of manganese-based catalysts for plasma and microwave assisted catalytic oxidation processes
02:30-02:50 PM	**Invited:** Prof. Vivek Kumar	TBD
02:50-03:10 PM	**Invited:** Dr. Mangesh Madurwar	An Improved Pozzolana from Agro-Industrial Waste for Sustainable Construction
03:10-03:20 PM	Tripti Moses, Smarika Lawrance	SEEC 03: Survey and Analysis of Awareness on Environmental Health and Sanitation in Rural and Urban Areas of Jabalpur Division of Madhya Pradesh
03:20-03:30 PM	Dhananjay Kumar, Akhilendra Pratap Singh, Avinash Kumar Agarwal	SEEC 8: Particulate Matter Investigation of different blend of hydrogen Enriched CNG Laser ignited Engine

27th November 2019		
Session C-1: Biomass and Biotechnology-1 (Session Chair: Dr. Atya Kapley) (Venue: Auditorium)		
02:00-02:30 PM	**Keynote:** Prof. Papamichael M. Emmanuel	Sustainable production of a new generation biofuel: A lipase-catalyzed esterification of fatty acids from liquid industrial wastes
02:30-02:50 PM	**Invited:** Dr. Athanasios Koutinas	Novel and Matured Biotechnologies in Food Bio-processing Based on Micro and Nano Tubular Cellulose
02:50-03:10 PM	**Invited:** Dr. Chrysa Voidarou	Quantitative assessment of certain nitrogen compounds in environmental water samples by a colorimetric method
03:10-03:20 PM	Lavanya Addagada, Ramesh S.T.	SEEC 85: Recovery of Phosphate and Potassium from Synthetic Urine by K-Struvite using Different Magnesium Sources
03:20-03:30 PM	Kaustabh khaire, Kedar Sharma, Vijaynand Mohalkar, Arun Goyal	SEEC 56: Extraction and characterization of xylan from sugarcane tops for xylooligosaccharides production
Session C-2: Waste to Wealth-1 (Session Chair: Dr. Atul Narayan Vaidya) (Venue: Auditorium)		
04:30-05:00 PM	**Keynote:** Dr. Fabrizio Adani	Bioconversion of giant cane for integrated production of biohydrogen, carboxylic acid and PHAs in a multi-stage biorefinery approach
05:00-05:20 PM	**Invited:** Prof. Parmjit Singh Panesar	Biotechnological strategies for the valorization of agro-industrial waste
05:20-05:40 PM	**Invited:** Dr. Anil Kumar Patel	Mixotrophic Microalgae Cultivation: An emerging sustainable bioremediation and biofuel production process from organic wastes
05:40-05:50 PM	Pushpita Das, Aradhana Priyadarsini, Lepakshi Barbora, Vijayanand S. Moholkar	SEEC 153: Biodesulphurization Of Dibenzothiophene And Its Alkylated Compound By Rhodococcus Rhodochrous
05:50-06:00 PM	Priyanka Shinde, Dr. Sandip Mali	SEEC 69: Investigation of best phase distribution method for anaerobic digestion process for organic waste
28th November 2019		
Session C-3: Microbiology (Session Chair: Dr. K Khairnar) (Venue: Auditorium)		
09:00-09:30 AM	**Keynote:** Prof. Ulrika Rova	Microbial assisted production of nutraceuticals from organosolv pretreated forest biomass
09:30-09:50 AM	**Invited:** Dr. R. Praveen Kumar	Comparative Analysis of Different Heterogenous Nanocatalyst in the Production of Biodiesel
09:50-10:10 AM	**Invited:** Dr. Rajeshawar Tyagi	Production of Extracellular polysaccharides by an isolated bacterial strain and application to treat compost and landfill leachates
10:10-10:20 AM	Shushil Kumar Rai, Harpreet Kaur, Sudesh Kumar Yadav	SEEC 79: Cascade biocatalysis: a recyclable dual enzyme nanoflower mediated biotransformation of whey into D-Tagatose
10:20-10:30 AM	M S Priyanka Yadav, Abinaya S, Nayanathara O	SEEC 82: Adsorption of Antibiotics Using Ac- Generated from Spent Tea Leaves

	S, GeorgeK Varghese, Maria Teresa Kurian, Muneeba V, Nimisha Sunil, Rakesh K	
Session C-4: Biotechnological and Other Environmental Applications (Session Chair: Dr. Tapan Chakrabarti) (Venue: Auditorium)		
11:30-12:00 Noon	**Keynote:** Dr. José Sandoval-Cortés	Pectin/CNT based electrochemical sensor for determination of ascorbic acid, uric acid and dopamine
12:00-12:20 PM	**Keynote:** Prof. Vijay S. Moholkar	Mechanistic Features of Oxidative Desulfurization Using Sono-Fenton–Peracetic Acid System
12:20-12:40 PM	**Invited:** Dr. Rajiv Weginwar	The unique multitracer technique: its application to environment, chemistry, biochemistry and biology
12:40-12:50 PM	Binaya Kumar Pattnaik, Sk. Md Equeenuddin	SEEC 37: Metal Contamination of Soil and its impact on Soil Enzymatic Activities around Chromite Mines at The Sukinda Ultramafic Complex, India
12:50-01:00 PM	Rajesh Kumar V, Gandhimathi Rajan	SEEC 77: An Extented analysis on catalyst reusability and degradation pathway determination for Glyphosate removal by heterogeneous Fenton process
Session C-5: Waste & Wastewater Management (Session Chair: Dr. M Suresh Kumar) (Venue: Auditorium)		
02:00-02:30 PM	**Keynote:** Dr. Robin Carl Anderson	Amended poultry litter composting technology that yields a well preserved, high value ruminant crude protein supplement free of pathogenic microbes
02:30-02:50 PM	**Invited:** Dr. Patrick Drogui	MBR treatment of leachates originating from waste management facilities: a study of the design parameters for efficient treatment
02:50-03:10 PM	**Invited:** Dr. Paul Christakopoulos	Valorization of forest biomass cellulosic fraction towards the production of prebiotic oligosaccharides through biocatalysis
03:10-03:20 PM	Bharti Saini, Manish Sinha, Harsh Patel	SEEC 39: Effective Treatment of Oily Wastewater using Polymeric Ultrafiltration Membrane Modified with Cross-Linked Copolymer
03:20-03:30 PM	Anirban Dey	SEEC 72: Elucidating the Effect of Addition Of 1-(2-Aminoethyl) Piperazine As an Activator on the CO_2 Solubility of Aqueous N-Methyldiethanoalmine
29th November 2019		
Session C-6: Biological Processes and Environmental Applications (Session Chair: Dr. Hemant J Purohit) (Venue: Auditorium)		
09:00:09:20 AM	**Invited:** Dr. Mukesh Kumar Awasthi	Effect of black soldier fly amendment on succession of pathogenic bacteria removal during animal manure and sewage sludge composting
09:20-09:40 AM	**Invited:** Prof. Jose Luis Martinez Hernandez	Potential use of agoindustrial products as support for fungal Jasmonic acid production under solid-state fermentation, alternatives substrates
09:40-10:00 AM	**Invited:** Dr. Zengqiang Zhang	Realization of the Cleaner composting employing mineral additives
10:00-10:20 AM	**Invited:** Dr. M. Kanellaki	Whey exploitation
10:20-10:30 AM	Hemant Thakur, satvasheel Powar, Atul Dhar	SEEC 33: Design and development of domestic wastewater treatment plant integrated with anaerobic digestion
10:30-10:40 AM	Anamika Kushwaha, Radha Rani	SEEC 93: Improved Phytostabilization Of Lead in The Rhizosphere of Vetiveria Zizanioides Cv. Ks-1 In Presence of Lead Resistant Bacterium Acinetobacter Junii Pb1
10:40-10:50 AM	Gisha Singla, Rajender S. Sangwan, Parmjit S. Panesar, Meena Krishania	SEEC 52: Comparative Analysis of Environmental Friendly Treatment Methods for the Extraction of Dietary Fiber in Kinnow Pulp Residue
10:50-11:00 AM	Neha Pal, Madhu Agarwal	SEEC 141: Applications Of Guar Gum And Its Derivatives To Remove Heavy Metals From Wastewater: A Review
Session C-7: Cleaner Technology & Environment (Session Chair: Dr. R B Biniwale) (Venue: Auditorium)		
02:00-02:30 PM	**Keynote:** Prof. C. S Gopinath	Possibly Scalable Solar Hydrogen Generation by Thin Film approach
02:30-02:50 PM	**Invited:** Prof. Lens Piet	Solventogenesis from H2/CO2 and syngas by anaerobic granular sludge at different temperatures
02:50-03:00 PM	Ashutosh Kumar Pandey, Ashok Pandey	SEEC172: From Scrap to liquid gold: Microbial lipid derived from wastewater & sludge, further trans-esterified into biodiesel
03:00-03:10 PM	Sandeep Yadav, Piyush Awasthi, Viswanath Balakrishnan, Atul Dhar	SEEC 35: Development of Stainless-Steel Mesh Substrate for NOx Emission Control of Diesel Engines using Selective Catalytic Reduction
03:10-03:20 PM	Bikramjit Mukherjee, Kuntal Jana	SEEC 101: Energy-Environment-Infrastructure Nexus: A Case of Indian Steel Production
03:20-03:30 PM	Karishma Maheshwari, Madhu Agarwal, A. B. Gupta	SEEC 136: Capacitive Deionization Approach For Reverse Osmosis Reject Treatment
27th November 2019		
Session D-1: Sustainable Materials & Processes (Session Chair: Dr. A. K. Bansiwal) (Venue: CCDS)		
02:00-02:30 PM	**Keynote:** Dr. S Venkata Mohan	Self-Sustained Closed Loop Systems Based on Photosynthetic Machinery for Sustainable Development
02:30-02:50 PM	**Invited:** Dr. Bhuvnesh Srinivasan	A Brief Overview of Thermoelectric Materials & Strategies
02:50-03:10 PM	**Invited:** Dr. Suman L. Jain	Photocatalytic carboxylation of organic substrates with CO_2 under mild reaction

		conditions
03:10-03:20 PM	Harshal Kawale	SEEC 155: Synergistic Study of Delonix Regia (Gulmohar) With Tube Waste For Production Of Valuable Products
03:20-03:30 PM	Sandeep Anwani, Ravi Methekar	SEEC 45: Life Cycle Assessment of Recycling of Waste Mobile Phone Batteries
Session D-2: Energy, Environment and Sustainability (Session Chair: Dr. K V George) (Venue: CCDS)		
04:30-05:00 PM	**Keynote:** Prof. Ganti S. Murthy	Biofuels, bioproducts or biofertilizers…What can we sustainably produce from algae?
05:00-05:20 PM	**Invited:** TBD	TBD
05:20-05:40 PM	**Invited:** Dr. Raj Boopathy	Use of Agricultural Residues in Microbial Lipids production as a Potential Biofuel
05:40-05:50 PM	Sandeep Yadav, Srinivas V Veeravalli, Sidh Nath Singh	SEEC 148: CFD Simulation of Two Counter Rotating VAWTs in Proximity
05:50-06:00 PM	Rashmi Soni	SEEC 36: Assessment of Energy potential of Mustard crop residues in Chittorgarh district Rajasthan State, India
28th November 2019		
Session D-3: Technologies & Approaches for Clean Environment (Session Chair: Dr. J S Pandey) (Venue: CCDS)		
09:00-09:30 AM	**Keynote:** T Sundararajan	Sustainable Solar Thermal Solutions for Energy, Water and Clean Environment
09:30-09:50 AM	**Invited:** Dr. Vidyanand M. Motghare	The Star Rating Programme
09:50-10:10 AM	**Invited:** Prof. Arun Kansal	Metabolism approach for sustainable cities
10:10-10:30 AM	**Invited:** Dr. Swati Bhogle	Cooking on traditional wood burning stoves and implications on indoor air quality
Session D-4: Sensors and Materials for Environmental Applications (Session Chair: Prof. Shantanu Bhattacharya) (Venue: CCDS)		
11:30-12:00 Noon	**Keynote:** Prof. KK Pant	Clean Conversion Approach for Recovery of Metals from Waste Electrical and Electronic Equipment (WEEE)
12:00-12:20 PM	**Invited:** Prof. Shantanu Bhattacharya	Fabrication of metal oxide semiconducting nano-materials and composites for gas sensing and water remediation applications
12:20-12:40 PM	**Invited:** Dr. Darina Smržová	Adsorbents for Radionuclides Based on 2d Materials
12:40-12:50 PM	Hemalatha V, Jayachandra bingi	SEEC 61: Electroadsorption Based Fluoride Ion Removal Using Anodised Alumina
12:50-01:00 PM	Nayanathara O S, Aswathy E V	SEEC 23: Removal of Acetaminophen by Adsorption onto Green Synthesized Zinc Oxide Nanoparticle
Session D-5: Biological Processes (Session Chair: Dr. K. Krishnamurthy) (Venue: CCDS)		
02:00-02:30 PM	**Keynote:** Prof. Cristobal Noe Aguilar Gonzalez	Enhanced production of Biological control agents by solid-state fermentation of agroindustrial residues
02:30-02:50 PM	**Invited:** Dr. Deepak Pant	Environmentally safe recycling of gold from E-waste
02:50-03:10 PM	**Invited:** Dr. Sang-Hyoun Kim	Perspective and challenges in anaerobic digestion of Korea
03:10-03:20 PM	Kuldeep Roy, Vijayanand Moholkar	SEEC 81: Degradation of Sulfadiazine in Hydrodynamic Cavitation Assisted Fenton/Persulfate System: A Kinetic Modelling Approach
03:20-03:30 PM	Abinaya Sekar, George K Varghese, M K Ravi Verma	SEEC 24: Multiple Path Particle Dosimetry Model as A Tool for Occupational Dosage Assessment of Particulate Matter
29th November 2019		
Session D-6: Environmental Sustainability (Session Chair: TBD) (Venue: CCDS)		
09:00:09:30 AM	Invited: Dr. Abhay B. Fulke	Emerging public health risks in tropical marine beaches due to rising levels of pathogenic Fecal Indicator Bacteria
09:30-09:50 AM	Invited: Guangming Zhang	Evaluation of protein production by photosynthetic bacteria from various wastewaters
09:50-10:10 AM	Invited: Dr. Vivek Polshettiwar	Black (nano)Gold to Combat Climate Change
10:10-10:20 AM	Ashwini Sk, George K Varghese	SEEC 32: Influence of Environmental and Anthropogenic Factors on Microplastic Pollution in Calicut Beach
10:20-10:30 AM	Poonam Sundriyal, Shantanu Bhattacharya	SEEC 100: Printed and Flexible Super capacitors as Smart Devices for Renewable Energy Management
10:30-10:40 AM	Pooja Manwani, Harish Phuleria, Chandra Venkataraman	SEEC 151: Assessment Of Seasonal Variability In Black Carbon And PM2.5 And Role Of Meteorology At A Regional Background Location In Northern India
10:40-10:50 AM	Hemant Bherwani, Suman Kumar, Amol F. Niwalkar, Anju Singh, Rakesh Kumar	SEEC 91: Assessment of Increase in Urban Heat Island Intensity of Mumbai City Using Geospatial Methods
10:50-11:00 AM	Janki Govani, Abhishek Bhimani, Pankaj Pathak, karan chabhadiya, Yash Pujara	SEEC 58: Assessment on Circular Economy to minimize the Construction and Demolition Waste

Poster Sessions

Poster Session-1 November 27th, 2019 (03:30 to 04:30 PM)			
Track A1: Engineering			
Paper ID.	**Poster Number**	**Authors**	**Poster Title**
SEEC143	**A101**	Sagar Srivastava, Avinash Kumar Agarwal	Methanol (M85) Fuelled Two-Wheeler EFI Prototype Development
SEEC 161	**A102**	Pallavi Singhal, Vandana Pulhani, Bal Govind Vats	Mechanism of Uranium Extraction from Environmental Samples Using Phosphoramide Functionalized Fe3O4 Nanoparticles
SEEC 112	**A103**	Arun Sathyan, Anuj kumar, Sumona koley, Ajay Kalamdhad	Biogas Enhancement of Anaerobic Bi-phase Baffled Reactor
SEEC 167	**A104**	Tk Vanitha, K Gayathri Mahalakshmi, K.N.S Susmitha, Omprakash Sarkar, S Venkata Mohan	Development of Sustainable Treatment Strategy for 2G Ethanol Process Streams
SEEC 144	**A105**	Tushar Kakkar, Vishnu Singh Solanki, Avinash Kumar Agarwal	Prospects of the Gasoline Compression Ignition (GCI) Engine-Fuel System
SEEC 48	**A106**	Jeetu Kumar, Sandeep Anwani, Ravi Methekar	Active Cathode Material Recovery from Spent Li-Ion Batteries Using Sodium Hydroxide.
SEEC 42	**A107**	Ravindra Kshatri, Pravesh Chandra Shukla, Sumit Sarkar	Combustion Investigation of compression ignition engine fueled with Jatropha Biodiesel
SEEC 139	**A108**	Anshul Soni, Avinash Kumar Agarwal	Reactivity Controlled Compression Ignition Engine
SEEC 43	**A109**	Atul Kumar, Pravesh C Shukla	Design and Fabrication of a Partial Flow Dilution Tunnel for Diesel Particulate Collection
Poster Session-1 November 27th, 2019 (03:30 to 04:30 PM)			
Track B1: Environment			
Paper ID.	**Poster Number**	**Authors**	**Poster Title**
SEEC 95	**B101**	Mohd Mubashshir Naved, Ankit Gupta, Ankeet Bobhate, Nitin Labhsetwar	Indoor Mirco-Environment Pm2.5 And Co Concentrations From Traditional Cookstoves In Amravati District, Maharashtra.
SEEC 168	**B102**	Harishankar Kopperi, Amulya Kotamraju, Venkata Mohan S	Polyhydroxyalkanoates (PHA) and Extracellular polymeric substances (EPS) production from Pseudomonas koreensis towards preparation of sustainable composites
SEEC 170	**B103**	Prashik Manwatkar, Ashish Patil, Padma Rao, Anil Bhanarkarand, Anirban Middey	Efficient and sustainable control system for dust emission from thermal power plant fine: A pilot-scale experiment
SEEC 111	**B104**	Yamini Jha, Jai Gopal Gupta	Plastic- Polluter Pays
SEEC 150	**B105**	Akshay Bharti, Janki Govani, Pankaj Pathak	Environmental Externalities Associated With Road Construction Using Plastic Waste
SEEC 73	**B106**	Sanket Joag, Raghav Sai Thiagarajan, Harshika Ninawe	Black Soldier Fly Treatment : A comparative study
SEEC 62	**B107**	Sajeesh Joy, A.G Bindu, George K Varghese	A Study on Noise Levels During Thrissur Pooram, Kerala
SEEC 152	**B108**	Kaushal Powar, Devika Londhe, Harishchandra Dhumal, Shripal Gaikwad, Pravinkumar Patil	Biodegradable Plastic Film From Starch
SEEC 165	**B109**	Omprakash Sarkar, S Venkata Mohan	Scaling up of Biohydrogen Production Process from Waste Integrated with Biorefinery and Environmental Sustainability Analysis
SEEC 68	**B110**	Prashant Awsarmal, Rushikesh Aher, Kushal Khivansara, Mahesh Swami, Prashant Awsarmal	Route Optimization of Muncipal Solid Waste Collection (Ward 109, Aurangabad)
Poster Session-1 November 27th, 2019 (03:30 to 04:30 PM)			
Track C1: Biotechnology			
Paper ID.	**Poster Number**	**Authors**	**Poster Title**
SEEC 57	**C101**	Dolly Kumari, Radhika singh	Biogas Production by Autoclave Assisted Petha Wastewater and Dairy Wastewater Pretreated Rice Straw Using Mixed Microbial Source
SEEC 15	**C102**	Athanasia Panitsa, Theano Petsi, Eleana Kordouli, Argyro Bekatorou, Magdalini Soupioni, Maria Kanellaki,	Isolation of Carbohydrate Nano Tubes (CNTs) after Enzymatic Hydrolysis of Delignified Lignocellulosic biomass: A contribution to sustainability

		Athanasios Koutinas	
SEEC 21	**C103**	**Vassilios Panagopoulos**, Agapi Dima, Argyro Bekatorou, Magdalini Soupioni, Maria Kanellaki, Athanasios Koutinas, Loulouda Bosnea	Bioethanol production using whey by a S. cerevisiae cell factory in one batch prepared without genetic modification
SEEC 50	**C104**	KavibharathyK, Harinipriya S	Prototype of Aqueous Lithium Ion Battery: MnO2 Nanorod Cathode and Graphene Anode (Full Cell)
SEEC 128	**C105**	Prakash Singh, Anuj Kumar, Ajay Kalamdhad	Biogas Generation Through Anaerobic Digestion of Food Waste And Its Purification
SEEC 104	**C106**	Iqbal Singh, Mohit Singla	Performance Evaluation of An Improved Cook Stove
SEEC 171	**C107**	S Venkata Mohan, Manupati Hemalatha	Influence of Process Parameters on Selective Production of Carbohydrates and Proteins in Microalgae
SEEC 159	**C108**	Pavithra Pari	Bioremediation of Oil Sludge using Pseudomonas aeruginosa, Bacillus subtilis and Brassica juncea
SEEC 124	**C109**	Bandita Dalasingh, Shinjini Paul Choudhury, Ajay Kalamdhad	Effect of Hot Air Oven Pretreatment on Refinery Sludge to Reduce the Hydrolysis Period
SEEC 174	**C110**	Poonam Prasad, Abhijeet Dhawale	Internet of Things (IoT) based e-nose system for obnoxious gas monitoring
Poster Session-1 November 27th, 2019 (03:30 to 04:30 PM)			
Track D1: Miscellaneous			
Paper ID.	**Poster Number**	**Authors**	**Poster Title**
SEEC 162	**D101**	Shivakumar Nomula, Munna Varma	Analysis of operational performance in solar power plants vs Rooftop systems in different locations India
SEEC 80	**D102**	Puneet Kedar, Shubham Deshmukh, Gajanan Raut, Ruchir Pohekar, Dr. Sandeep Joshi	Experimental and CFD analysis of Evacuated tube solar cooker
SEEC 92	**D103**	Amit Kanaujiya, Dr. Onkar Singh	Thermodynamic investigations on solar powered supercritical carbon dioxide cycle combined with steam rankine and organic rankine cycle
SEEC 17	**D104**	Iris Plioni, Theano Petsi, **Agapi Dima**, Dimitra Dimitrellou, Argyro Bekatorou, Maria Kanellaki, Athanasios Koutinas, Panagiotis Kandylis	Improving cell factory of S. cerevisiae to ferment cellobiose and cellulose in one batch
SEEC 18	**D105**	**Eugenia Bezirtzoglou**, Stavros Plessas, Athanasios Alexopoulos	Molecular identification of a novel L. paracasei AGR 4 from kefir grains with potential probiotic properties
SEEC 19	**D106**	Athanasios Drosos, **Konstantina Boura**, Panagiota Venetsanou, Agapi Dima, Dimitra Dimitrellou, Athanasia Panitsa, Vassilios Panagopoulos, Christos D. Bontzolis, Magdalini Soupioni, Argyro Bekatorou, Maria Kanellaki, Athanasios Koutinas	Improvement of Cell Factory of S. cerevisiae for Bioethanol Production in One Batch using Polycarbohydrate Feedstocks
SEEC 105	**D107**	Atul Kumar, Dipteek Parmar, Lalit Kumar Singh	Bacterial Infection And Its Evaluation Through Paper Currency In Kanpur City India
SEEC 146	**D108**	Roshni Meghnani, Vasanth D	Development of Tubular Membrane Using Low Cost Clay Based Materials And Its Characterization
Poster Session-2 November 28th, 2019 (10:30 to 11:30 AM)			
Track A2: Engineering			
Paper ID.	**Poster Number**	**Authors**	**Poster Title**
SEEC 47	**A201**	Ashish Yewale, Ravi Methekar, Shailesh Agrawal	Temperature Control to Enhance the Performance of Microbial Fuel Cell
SEEC 156	**A202**	Alex Y, Chacko Preno Koshy	Operating With Blends of Nano-Fueled Plastic Oil Obtained By Pyrolysis Method Mixed With Diesel
SEEC 142	**A203**	Safa Jabeen	Environmental Impacts Of Quarrying- Modelling Of Blast Induced Ground Vibrations
SEEC 55	**A204**	Prem Mohan, Dr. George K Varghese	Exposure of Particulate Matter on Commuters at Different Time of The Day
SEEC 126	**A205**	Rumana Shaikh, Piyush Kokate, Danish Mohammad, Harikumar Naidu	A Novel Wireless Sensor Network Technique for Monitoring Environment
SEEC 34	**A206**	Prashant Saini, Satvasheel Powar, Atul Dhar	Performance Evaluation of Parabolic Trough Collector under Different Environmental Conditions
SEEC 90	**A207**	Sunit Kumar Singh, Ahmed Al-Fatesh, Nitin Labhasetwar	Ni based catalysts for Syngas production via Dry reforming of Methane

SEEC 125	**A208**	Alisha Meshram, Poonam Gera, Amit Saran	Review on Nanoparticles for Photocatalytic Degradation of Dyes
SEEC 132	**A209**	Vignesh S, Yogesh Krishan Bhateshvar, Mohammad Rafiq B Agrewale, Kamal Kishore Vora	Performance of Switched Reluctance Motor for Small Electric Vehicle in Urban Mobility

Poster Session-2
November 28th, 2019 (10:30 to 11:30 AM)

Track B2: Environment

Paper ID.	Poster Number	Authors	Poster Title
SEEC 103	**B201**	Shravan Kumar, R Prasanna Venkatesh, Selvaraju Narayanasamy	Study of Activated Carbon Derived From Water Caltrop Shell As A Potentially Low Cost Biosorbent For Sequestration of Cr(VI) From Waste Water
SEEC 110	**B202**	Abdul Gani	Development of Groundwater Quality Index for various Union Territories of India
SEEC 127	**B203**	Payal Mazumder, Ajay Kalamdhad	Fate of Heavy Metals in Water Hacinath Compost and its Phytotoxicity
SEEC 135	**B204**	Ranjit Chakma, Pottipati Suryateja, Ajay Kalamdhad	Rotary Drum Composting of Water Hyacinth Followed By Vermicomposting
SEEC 31	**B205**	Rao Faraz Waris, Ashish Sengar, Aryan Upadhyay, Izharul haq Farooqi	Advanced Oxidation Processes Tool for Removal of Pharmaceuticals from Wastewater
SEEC 149	**B206**	Rakhul Bharathithasan, Shimar Ahamed	In-House Grey Water Treatment Plant
SEEC 137	**B207**	Prajakta Ramteke, T. Rajesh, Govindachetty Saravanan, Nitin Kumar Labhsetwar	Efforts to rationalize non-putrefying property of River Ganga
SEEC 164	**B208**	Sambhawika Srivastava, Shalini Dhyani	Long-term observation of black carbon aerosols over the central Indo-Gangetic Plain, South Asia
SEEC 175	**B209**	Shikha Dahiya, Ranjith I, Venkata Mohan S	Acidogenic fatty acid production from food waste: Role of bioreactor configuration
SEEC 177	**B210**	Ritesh Vijay, Niharika Labhsetwar, Swapna Chakraborty	Impact of Anthropogenic Activities on Water-Bodies of Nagpur: A Geospatial Analysis

Poster Session-2
November 28th, 2019 (10:30 to 11:30 AM)

Track C2: Biotechnology

Paper ID.	Poster Number	Authors	Poster Title
SEEC 166	**C201**	Amulya Kotamraju, Harishankar Kopperi, Venkata Mohan S	Pressurized CO_2 fermentation for sustainable production of succinic acid with Citrobacter amalonaticus
SEEC 169	**C202**	Yaswanth Lingam, Vanitha Krishne Shikha Dahiya, Venkata Mohan	Acidogenic Process Optimization for volatile fatty acid production from spent wash
SEEC 27	**C203**	Moh Sajid Ansari	Study of fly ash with nitrogen fertilizer on performance of radish (Raphanus sativus L.)
SEEC 75	**C204**	Apeksha Jagadale, Sandip Mali	Correlational Data Analysis of Chemical Parameters of Anaerobic Digestion of Bioreactor for Municipal Solid Waste
SEEC 163	**C205**	Adhikari Srikanth, Ashish Patil, Sweta Kumari, Prashik Manwatkar, Prashant Sakharkar, Ajay Wanode, Anil Bhanarkar, Anirban Middey	Bird's eye view on sustainable management and mitigation measures for the air environment in an Industrial site: Observation & Modelling
SEEC 119	**C206**	Venkatesh Chejarla, D Shekhar Rao, Ajay Kalamdhad	Impact of Precipitation on Behavior of Waste Degradation Process and Active Landfill Management Based on Anaerobic Simulated Reactor
SEEC 121	**C207**	Siddhartha Paul, Heena Kauser, Meena Khwairakpam, Ajay S. Kalamdhad	In-vessel composting: A cost-effective technique for converting biomass-to-bioproduct
SEEC 147	**C208**	Pratibha Gautam, Sunil Kumar	Application of Electrocoagulation For Treatment of Leachate Produced From Hazardous Waste Landfill
SEEC 158	**C209**	Leena Pradeep Pathak, V B Gaikwad, Sucheta Patil	Development of microbial consortium for the treatment of dairy effluent and generation of electricity using microbial fuel cell (MFC)
SEEC 130	**C210**	Mamta Tembhare, Rumana Shaikh, Harikumar Naidu, Piyush Kokate	Application of Optical Fiber For Energy Efficient Lighting Devices At Heritage Sites
SEEC 173	**C211**	Tharaka Ramulu Athmakuri, J Annie Modestra, Venkata Mohan	Microbial electro-catalyzed Conversion of CO_2 to Platform Chemicals in a Single Chamber System

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