ADVANCES IN BIOLOGICAL AND BIOELECTROCHEMICAL TREATMENT OF INDUSTRIAL WASTEWATER

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Overview

Waste management is a serious environmental problem word wide. There is no effective treatment options available for the treatment of the new emerging pollutants such as microplastics, antibiotics, nanoparticles, and pharmaceutical and personal care products (PPCP). More basic and applied research are needed to find treatment solutions for the emerging contaminants. Bioremediation is the use of biological treatment systems to destroy or reduce the concentration of hazardous wastes from a contaminated site. It is the intentional use of biodegradation process to eliminate environmental contaminants, where microbial physiological potentials are exploited for site cleanup purpose. There are many thousands of priority pollutant sites in the world that needs to be cleaned up. The cleanup could potentially cost more than 100 billion dollars according to some estimates. There are several groundbreaking discoveries in the bioremediation of hazardous-contaminated soil and water by many researchers. The research includes basic to applied to solve the real world problem of cleaning up the contaminated soil and water.

Bioelectrochemical Systems (BES) is integrated systems combining wastewater treatment with energy generation and resource recovery. BES represents an emerging technology that could eventually become an important renewable energy source. BESs also offer unique possibilities for clean and efficient production of fuels and high-value chemicals using microorganisms, BOD biosensors, as power sources for remote devices, and for bioremediation applications. Power in a BES is generated when bacteria donate electrons to an insoluble anode, these electrons travel through an external circuit, and then go onto reduce oxygen at a cathode, producing water. The circuit is completed by the migration of protons from the anode to the cathode through a proton exchange membrane. Recently, advances in nanocomposites provides a unique opportunity to develop an efficient electrode material due to the remarkable structural, electrical and chemical properties of nano-materials, such as Iron, Gold, and activated carbon. As the BES functions in a completely multi-disciplinary approach, a large quantum of research have been conducted

worldwide in the fields of microbiology, electrochemistry, bio electrochemistry, biotechnology, environmental science, and materials sciences.

In this course, Advanced technology for wastewater treatment, Bioremediation of hazardous chemicals, Bioelectrochemical systems, and various synthetic techniques for nanocomposites for environmental biotechnology applications will be discussed in detail.

Objectives

The main objective of the course is to provide participants with an understanding of the area of wastewater treatment technology and the role of biotechnology in environmental restoration.

After completing the course, students will have the ability to

- Demonstrate the role of biotechnology in environmental quality and restoration.
- Know biological treatment of industrial and agricultural wastewaters. Demonstrate various bioremediation technologies and their strengths and weaknesses.
- Understand the basics and working principles, selection of suitable materials such as electrode and catalyst, Design and stack making process of BES for real time applications.
- Understand the various synthesis techniques of nanoparticles including lithography and photochemical reduction ultrasonic methods for the application of wastewater treatment and environmental technology.
- Review and write scientific articles in the field of environmental biotechnology.

Modules	➢ **Module A:** Fundamentals of Microbial Ecology and Microbial Metabolism in relation to wastes and hazardous chemicals. Fundamentals of biological wastewater treatment process. Reactor design and concept, Wastewater characterization. Fundamentals of Bioremediation Process and bioremediation technologies, ➢ **Module B:** Basic principles of Bioelectrochemical system, Mechanisms of electron transfer, exoelectrogens, BES components: Anode, Cathode materials, catalysts, membrane, architecture, BES stack, types of BES for wastewater treatment and beneficial reuse. ➢ **Number of participants for the course will be limited to 50.**
Date of the course	**7th to 12th, November 2022**

Who Should Attend	➢ Students at all levels (B.Tech/MS/M.Tech/PhD) or Faculty from reputed academic institutions and technical institutions. ➢ Executives, Bioprocess Engineers and researchers from government organizations including R&D laboratories, Pollution control board etc.
Fees	The participation fees for the course is as follows: **Course Fee (including GST 18%)** Faculty and Scientist — Rs. 2500 /- Students / Research Scholars — Rs. 1500 /- Industrial participants — Rs. 5000 /- Students from Abroad — US $ 400 /- Faculty and scientist from Abroad — US $ 600/- Industrial Participants from Abroad — US $ 1000/- The above fee includes all course materials, computer use for tutorials and assignments, laboratory equipment usage charges, internet facility. The participants will be provided with accommodation on payment basis.

Faculty

Dr. RAJ BOOPATHY

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, He received the Nicholls State University's Presidential Award for Teaching Excellence. 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 185 research papers in peer- reviewed journals and 20 book chapters. He serves as a senior editor of the Journal, Renewable Bioresources and is on the Editorial Boards of various International journals including Bioresource Technology, International journal of Biodeterioration and Biodegradation (IBB), and the International Journal of Soil and Sediment Contamination. He 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. 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.

Dr. N. Samsudeen

Dr. N. Samsudeen is working as an Assistant Professor, Department of Chemical Engineering, National Institute of Technology, Tiruchirappalli, India. His main research areas are for wastewater treatment and simultaneous biofuel production from Bioelectrochemical system, biodiesel production, and Biosorption. He has received Prestigious Bioenergy Award for Cutting Edge Research (B-ACER) Fellowship in 2018. He has published more than 30 research articles, 15 International conferences 3 chapters in springer and Elsevier etc.

Dr. Manickam Matheswaran

Dr. Manickam Matheswaran is an Associate Professor in the Department of Chemical Engineering at National Institute of Technology, Tiruchirappalli, India. He obtained his Ph.D in Sunchon National University, Suncheon, South Korea. He received a Hiyoshi Young Leaf Award from Hiyoshi Corporation, Japan and Hiyoshi India Ecological Services Pvt. Ltd., Chennai. He has more than 15 years' research experience in Nanomaterial synthesis and its application, Electrochemical Engineering, Wastewater treatment, Electrochemical Oxidation etc. He has published more than 70 research articles in leading peer review journals, conference proceedings and books.

Course Co-ordinator
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