

BIOFUEL CELL TECHNOLOGY: FUNDAMENTALS AND APPLICATIONS

Overview

Biofuels will play a key role in the 21st century as the world faces two critical problems: volatile fuel prices and global climatic changes. Both of these are linked to the overdependence on the fossil fuels: petroleum, natural gas, and coal. Despite a significant amount of research into biofuels, the field has not been able to replace fossil fuels. Recent advances will change this scenario. The combination of fuel cell and biomass fermentation technologies has emerged as a primary candidate for the renewable generation of heat and power on decentralized basis. Biofuel cells are devices capable of directly transforming chemicals to electrical energy via electrochemical reactions involving biochemical pathways. Biocatalysts, including proteins, enzymes or whole cell organisms, can also offer cost advantages over metallic catalysts. Widespread usage of a biocatalyst would however tend to lower the cost of biofuel production, which is not true of transition metal catalysts.

This course will provide deeper insight into recent advancements in biofuel cells and thereby contribute to the understanding of this important topic. The course content includes a brief introduction on the first, second, third and fourth biofuel generations. The course is intended, however, to largely concentrate on advances made in recent years in the area of biofuel cell together with a discussion surrounding the practical application of biofuel cells. Furthermore, the course will be extremely useful for researchers, scientists, engineers and graduate students, who are working in the areas of biofuels more specifically on biofuels cell.

Objectives

The primary objectives of the course are as follows:

- To largely concentrate on and give an overview of the advances made in recent years in the area of biofuel cells together with a discussion surrounding its practical applications.
- To introduce participants to the state-of-the-art biofuel cells research including current knowledge gaps.
- To discuss some of the full-scale applications of biofuel cells technology and identify potential opportunities for the combination of biofuels and fuel cells.
- To provide details on the advanced materials for biofuel cell application including biotechnological process development and optimization of process conditions

<p>Tentative Schedule</p>	<p>23rd – 27th April, 2018</p> <p>Day 1: Introduction to biofuels (1 hr, PL), Biofuel cells and its classification (1 hr, PL) and Biomass for biofuel and its pretreatment (1 hr, KP)</p> <p>Day 2: Enzymatic fuel cells (1 hr, PL), Microbial and hybrid fuel cells (1 hr, PL) and Biofuels as feedstock for biofuel cells (1 hr, PL)</p> <p>Day 3: Bioethanol production from up-stream to down-stream and continuous recovery (1 hr, KP), Biobutanol (1 hr, DD) and Biofuels and environmental issues (1 hr, PL)</p> <p>Day 4: Biofuel production and wastewater treatment (1 hr, KP), Fuel cells utilizing biogas and landfill gases (1 hr, PL) and nano materials, polymer based materials and metal oxides for fuel cell applications (1 hr, PL)</p> <p>Day 5: Syngas fermentation (1 hr, PL), Biohydrogen in fuel cells (1 hr, PL) and Case studies on practical application of fuel cells for electricity generation (1 hr, PL)</p> <p>Prof. Piet Lens <PL>: 11 hrs lectures Prof. Kannan Pakshirajan <KP>: 3 hrs lectures Dr. Debasish Das <DD>: 1 hr lectures</p>
<p>You Should Attend If...</p>	<ul style="list-style-type: none"> • Executives, engineers and researchers from process industries and government organizations, including R&D laboratories. • Students at all levels (BTech/MSc/MTech/PhD) or Faculty from reputed academic institutions and technical institutions.
<p>Course Co-ordinator</p>	<p>Professor Kannan Pakshirajan Department of Biosciences and Bioengineering Indian Institute of Technology Guwahati Guwahati 781039 Assam, India.</p> <p>E-mail: pakshi@iitg.ernet.in Tel: +91-361-2582210; Fax: +91-361- 2690762.</p> <p>..... Registration portal http://www.gian.iitkgp.ac.in/GREGN</p>

<h2 style="color: white; background-color: #1a3d4d; padding: 10px;">Fees</h2>	<p>Students : INR 1000 /- (Refundable) Participants from abroad : USD 500 /- Industry/ Research Organizations: INR 15,000 /- Academic Institutions: INR 7,500 /-</p> <p>The fee is to be paid using Demand Draft. The Demand Draft for the students (only) will be returned back to them if and when they physically attend the course.</p> <p>Hostel accommodation and lodging necessities will be provided for students, at a per day per person cost of approximately INR 250 /- Faculties and industry persons would be provided IITG Guest House rooms (twin sharing / single rooms depending on availability) at a per day per person cost of approximately INR 500 /- (Charges may vary). Participants may avail food/meals inside or outside the IITG campus, wherever they prefer, on their own expenses.</p>
<h2 style="color: white; background-color: #1a3d4d; padding: 10px;">Registration procedure</h2>	<p>Please follow the following steps for registration :</p> <ol style="list-style-type: none"> 1. Go to GIAN website (http://www.gian.iitkgp.ac.in/GREGN/index) First time users need to register and pay a one - time fee of INR 500/- 2. Select course: “Biofuel cell technology: fundamentals and applications”. Once you enroll for the course, an Enrolment/Application number will be generated, and the course coordinators will be notified. The course coordinators will shortlist the candidates out of the applicants. The shortlisted candidates will be notified by email 3. The selected candidates must pay the applicable fees using Demand Draft (DD) drawn in favour of “Registrar, INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI”, payable at IIT Guwahati. Please write your Name and Enrolment/Application number at the back of the DD, and post/courier it, to reach by 28 February 2018 4. Fill the course registration form in GIAN portal. Email the course registration form to the Course Co-ordinator along with DD by 28 February 2018

The Faculty



Prof. Piet Lens is Professor of Environmental Biotechnology at the Pollution Prevention and Resource Recovery Chair Group of the Department of Environmental Engineering and Water Technology of UNESCO-IHE. Previously, he was on the faculty of the Sub-Department of Environmental Technology at Wageningen University (1999-2006), where he still has a zero nomination. He has also held visiting faculty appointments at the Universities of Louvain La Neuve (UCL) and Leuven (KUL). Prof. Lens obtained his Ph.D. in Environmental Engineering at the University Gent (Belgium). He has (co-)authored over 240 scientific publications and edited nine book volumes. Besides innovative research, he is also a leader in education and capacity-building, organising numerous study-days, conferences, summer schools and short courses. His awards include the IWA Publishing Award (2002), a Marie Curie Excellence Grant (2004) and a nomination as IWA fellow (2010).



Prof. Kannan Pakshirajan is Professor and Head of the Department of Biosciences and Bioengineering at Indian Institute of Technology Guwahati, Assam. He specializes on biological removal of pollutants (organic/inorganic) and resource recovery from wastes. His areas of research interest are Environmental Biotechnology, Biological removal and recovery of inorganic compounds from wastewaters, Biofuels and other Biotechnological Products: production, process design, kinetics and environmental applications. He is a recipient of many awards and honours. These include, besides others, Indian National Science Academy (INSA) Award for Young Scientist, National Academy of Sciences India (NASI) Young Scientist Award, Hiyoshi Young Leaf Award, Japan.



Dr. Debasish Das is Associate Professor in the Department of Biosciences and Bioengineering at the Indian Institute of Technology Guwahati, Assam, India. He specializes on bioprocess development for biofuel production. His research areas includes novel microalgal isolates as cell factory for biodiesel production, development of *Clostridium sp.* as a cell factory for butanol production, lignocellulosic ethanol fermentation involving recombinant hydrolytic enzymes expressed and isolated from *Escherichia coli*, metabolic modeling of biological systems, engineering simultaneous transport of hexose and pentose sugars in *Zymomonas mobilis* for biofuel production from lignocellulosic waste etc.