GIAN course on

Chemical/Phytochemical mediated disruption of bacterial Acyl Homoserine lactone mediated, quorum sensing Communication systems

25th to 29th July 2018

Overview

This course adverse effects, the use and disposal of microbicidal agents and pharmaceuticals might potentially have, on human and ecological health. Microbicidal agents used in wastewater treatment and pharmaceuticals are released directly into the environment. If the drugs are not degraded or eliminated during sewage treatment, in soil or in other environmental compartments, they will reach surface water and ground water and potentially drinking water. The selection and development of antibiotic-resistant bacteria is one of the greatest concerns about the use of antimicrobials. Antibiotic resistance represents a serious and growing human and wildlife health threat in terrestrial or aquatic environments. Quorum sensing inhibition (QSI) by means of natural molecules or phytochemicals has been reported to be an excellent alternative and effective means for controlling the undesirable physiological functions of certain bacteria without the use of growth-inhibitory agents that unavoidably select for resistant organisms. Furanones isolated from the marine red alga *Delisa pulchera*, are one of the most extensively studied classes of natural compounds with respect to their role QSI. 'Quorum Sensing' (QS) is the phenomenon whereby the accumulation of signaling molecules enable a single cell to sense the number of bacteria (cell density). Efforts to disrupt undesirable microbial physiological functions like environmental biofilms and pathogen-virulence have enabled the identification of bioactive molecules produced by prokaryotes and eukaryotes that could act as QSI molecule. These molecules act primarily by quenching the QS system. The phenomenon is also termed as quorum quenching (QQ). Compounds like salicylic acid, urosolic acid, cinnamaldehyde, extract from garlic and cranberries have all shown various degrees of QSI properties. Vanillin effectively reduces biofouling of RO membranes in water industry. In addition, synthetic compounds have also been found to be effective in QQ. Therefore, QQ could be a potential environmentally friendly technology for the future.

Students, professors, and researchers in Environmental engineering explore issues of physical and chemical sciences such as biochemistry, biophysics, water, and toxicology from both a life science and an engineering perspective. Throughout the curriculum, our educational programs link with quenching the QS system, bioactive molecules and microbial physiological functions like environmental biofilms, signaling molecules and controlling the undesirable physiological functions. The course will be planned and offered as per the norms set by NIT-Trichy for wastewater treatment and new separation process subject.

Objectives

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The primary objectives of the course are:

- Exposing participants to the threats involved in the use and fate of various microbicidal agents that are used in different industries including medical and water treatment
- Understanding Quorum sensing and Quorum Quenching
- Methods in developing natural QSI molecules including phytochemicals
- Developing effective carriers including nanostructures as delivery agents of these
- To brainstorm modules of fusion aspects of Nano-technology, Biotechnology and Chemical technology in developing these innovative technologies for various industries
- Laboratory based hands on training in this technological area
- Brainstorm certain aspects of Quorum sensing and its applications for computing and robotics.

Course Details

Day	Date	Time	Topic
1	25-07-2018 (Wednesday) **Overview of Microbicidal agents used in wastewater treatment. Quorum Sensing & Quorum Quenching**	**08:30-09:30**	**Registration & Inauguration**
		9:30-13:00	**Lecture1**: Overview of sewage treatment, in soil in environmental compartments. **Lecture2**: Selection and development of antibiotic-resistant bacteria **Lecture3**: Scientific & technological challenges
		14:00-17:00	***Hands-on exercise 1:*** Antibiotic resistance in human and wildlife health threat in terrestrial or aquatic environments and solutions ***Hands-on exercise 2:*** *S*ystems analysis problems
2	26-07-2018 (Thursday) **Quorum sensing inhibition (QSI)**	**9:00-13:00**	***Lecture 1:*** Introduction to Quorum sensing inhibition (QSI) ***Lecture 2:*** Fundamentals of on physiological functions and growth-inhibitory agents .***Lecture 3:*** Effect of various natural compounds and their role in QSI.
		14:00-16:00	**Laboratory** Laboratory based hands on training in this technological area
		16:30-17:00	Quiz 1
3	27-07-2018 (Friday) **Primarily on natural and synthetic**	**9:00-13:00**	***Lecture 1:*** Phenomenon on accumulation of signaling molecules and sening by bacteria ***Lecture 2***: Efforts to disrupt undesirable microbial physiological functions ***Lecture 3:*** Different signaling systems for Quorum Sensing

	quorum sensing inhibitors (QSIs)	**14:00-16:00**	***Laboratory:*** Embedded in a self-produced matrix of extracellular polymeric substances and exhibit an altered phenotype
		16:30-17:00	Quiz 2
4	28-07-2018 (Saturday) **Macromolecular Inhibition of and Biofouling control by quorum sensing inhibition on membrane surface.**	**9:00-13:00**	***Lecture 1:*** Fundamentals of microbiology and Biochemistry ***Lecture 2:*** Interactions among Quorum Sensing Inhibitors ***Lecture 3:*** Control of membrane biofouling
		14:00-16:00	***Lab Session*** Microbiology and Biochemistry Quantification of Bacterial biofilms on the membrane coupons
		16:30-17:00	Quiz 3
5	29-07-2018 (Sunday) **Modules of fusion aspects of Nano-technology, Biotechnology**	**9:00-13:00**	Fundamentals of Biotechnology Materials for QSI and membranes Nanotechnology for biofouling control QSI membranes
		14:00-16:00	***Laboratory Session*** Fabrication and biofouling control QSI membranes Biofouling testing
		16:30-15:00	Quiz 5

Registration Fees

Modules	• **Introduction of concepts, methods and tools** • **Documented Laboratory Sessions**
You Should Attend If…	• **Practicing Engineers, Researchers from Industries, government organizations including R&D laboratories** • **Students at all levels (UG/ PG/ PhD) or Faculty from reputed academic institutions and technical institutions**
Fees	**Participants from abroad:** US $300 **Industry/ Research Organizations:** Module cost: Rs. 20000/- **Academic Institutions:** Module Cost: Rs. 4000/- (Faculty) Module Cost: Rs. 2000/- (Research Scholars/UG/PG) The above fee include all instructional materials, computer use for tutorials, 24 hr free internet facility. The participants will be provided with single bedded accommodation (sharing basis

	double room) on payment basis in Hostel/ Institute Guest House.
How to Register	**Stage1: Web (Portal) Registration:** Visit GIAN Website at the link: **http:**//www.gian.iitkgp.ac.in and create login user ID and Password. Fill up blank registration form and do web registration by paying Rs. 500/- on line through Net Banking/ Debit/ Credit Card. This provides the user with life time registration to enroll in any no. of GIAN courses offered. **Stage2: Course Registration (Through GIAN Portal):** Log in to the GIAN portal with the user ID and Password created. Click on "Course Registration" option given at the top of the registration form. Select the Course titled "**Chemical/Phytochemical mediated disruption of bacterial Acylomoserine lactonec mediated, quorum sensing communication systems"** from the list and click on "Save" option. Confirm your registration by Clickinng on "Confirm Course". **Only Selected Candidates will be intimated through E-**mail by Course Co-ordinator. They have to remit the necessary course fee in the form of DD drawn in favor of "The Director, NIT, Tiruchirappalli – 620015" payable at NIT-Tiruchirappalli.
Accommodation	The participants may be provided with hostel accommodation, depending on the availability and on payment basis. Request for hostel accommodation may be submitted through e-mail to the Course Co-ordinator.

Teaching Faculty

Dr. Diby Paul

Diby Paul is an Associate Professor in Environmental Engineering with Konkuk University (KU), Seoul, South Korea. He has been teaching and conducting research at KU since 2007. He has his doctoral degree in Environmental Microbiology and has 3 years of post doctoral training. He has received several awards for academic and research excellence including Endeavor Executive Award of the Australian Government. He has more than 60 research publications to his credit. He has been working on developing environmentally friendly strategies of biofouling control of RO membranes. His team of researchers established the potential of certain natural compounds as Quorum Sensing Inhibitors that could be used for biofouling control.

Dr. G.Arthanareeswaran

G. Arthanareeswaran research interest involves development of polymer membranes for waste water treatment. He has been the Principal Investigator for project on Removal of Toxic Metal Ions using Polymeric Membranes supported by the Department of Science and Technology and has also been Principal Investigator for India-Brazil Joint collaboration Research Project on Development and application of inorganic membranes in the treatment of wastewater from processing industries. He joined National Institute of Technology, Tiruchirappalli in 2007 and became Lecturer at the chemical engineering department. In 2008, he established membrane research laboratory at the Department of chemical Engineering at the National Institute of Technology, Tiruchirappalli. He was appointed as Assistant Professor in the same department in 2008.

Course Co-Ordinators

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