The University of Queensland - IIT Delhi Academy of Research Joint PhD Project

PROJECT TITLE	NEW APPROACHED TO DETECTION OF POLLUTANTS THROUGH HIERARCHICALLY-STRUCTURED MOLECULARLY IMPRINTED POLYMERS
PROJECT CODE	UQIDAR 00108
PROJECT DESCRIPTION	This project aims to develop novel highly-sensitive sensors of pesticides, thus addressing a major environmental/health challenge in many countries including India and Australia. The technology will be based on electrochemical sensors constructed from molecularly imprinted polymers (MIPs). MIPs are polymers which are formed around a target "templating" molecule, for example a pollutant chemical, the analyte. The templating molecule is removed after formation of the host conducting polymer, leaving a cavity; the analyte perfectly conforms to the cavity and on absorption a change in electrical properties of the conducting polymer is observed. The field of molecularly imprinted polymers is very active however major barriers to real-world application remain, such as imperfect specificity and low sensitivity. The work of both Profs Whittaker and Pattanayek is concerned with understanding and controlling to a precise level local order and interactions in materials, and it is anticipated that their complementary expertise will lead to new approaches to MIPs for electrochemical sensors. The project will develop new approaches to sensor design. The key to more specific sensors is control of the structure of the conducting "sensing" molecules over a range of dimensions, to permit more precise binding events, and controlled diffusion of analytes to the sensing polymer. To achieve this we will prepare new block copolymers consisting of a guiding framework and active, conducting polymer elements.
PROJECT OUTCOMES	The project focuses on developing technologies for detection of organic pollutants in the environment. The presence of persistent organic pollutants (POPs) in the environment has serious and tragic health effects in India, as highlighted for example by Sharma (2014). These POPs include chlorinated organic molecules arising from pesticides and the electrical/electronic industries. Accordingly we identified a range of important POPs as target analytes for our electrochemical MIP sensor. The outcomes will be: - A new concept in sensor design based on an hierarchical architecture of polymeric components. - A detailed understanding of the relationship between chemical and structural properties of MIPs and sensitivity to analyte detection. - Proof of principle of the sensors for detection of a small number of the most important POPs. - Training of an outstanding PhD candidate in advanced technology for environmental sciences. Outside of the framework of the PhD project, the investigators Whittaker and Pattanayek have identified potential commercial partners for the sensor technology. These are Dow Dupont, and ITC Limited in India. They will work with their respective legal offices to protect intellectual property arising from the project.

ADVISORY TEAM	**Professor Andrew Whittaker** https://polymer-chemistry.group.uq.edu.au/ a.whittaker@uq.edu.au Australian Institute for Bioengineering and Nanotechnology (AIBN) The University of Queensland **Professor Sudip Kumar Pattanayek** http://web.iitd.ac.in/~sudip/ sudip@chemical.iitd.ac.in Department of Chemical Engineering Indian Institute of Technology Delhi **Other advisors** Professor Bhesh Bhandari, School of Agriculture & Food Sciences, UQ Professor Satya Narayan Naik, IITD
TYPE OF STUDENT	Applications are open to i/a students who meet eligibility criteria.
DISCIPLINE BACKGROUND OF STUDENT	Ideally, this project requires students with a background in chemistry, materials synthesis, polymer chemistry, environmental chemistry.
IDEAL CANDIDATE	Essential Capabilities: • Degree in an appropriate field such as chemistry, chemical engineering, biomedical engineering. • Demonstrated capacity to conduct research projects under supervision. Desirable Capabilities: • First Class in all previous degrees (CGPA of 6.75 or 60% marks) • Experience in polymer synthesis.Experience in polymer engineering. Expected qualifications (Courses/Degrees etc.): • For a-student, BSc (Honours) in Chemistry of Biomedical Engineering, or BEng with a research component in materials science. • For i-student: B.Tech/ M.Tech. in Chemical Engineering or Biotechnology.
APPLICATION PROCESS	Apply online by the due date: https://www.uqidar.org/students/how-to-apply/