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

PROJECT TITLE	**GREEN SYNTHESIS AND PHYSICO-CHEMICAL CHARACTERISATION OF CNTS-BASED HYBRID AEROGELS FOR WASTEWATER TREATMENT**
PROJECT CODE	**UQIDAR 00182**
PROJECT DESCRIPTION	Growing industrialization and various other human activities have led to the dwindling availability of clean water. The ever-increasing demand for hygienic water has prompted the development of technologies that can be used for treating polluted water with heavy metals, microbes, and pesticides. Many water-borne diseases are a result of blooming microbial populations in water. Conventional methods such as chlorination, ozonation have limitations owing to the formation of disinfection by-products which are carcinogenic in nature. It is therefore vital to develop effective and low-cost technologies that address the problem. Among various elements available in nature, silver has a substantial history of significant disinfection and antimicrobial properties. Further, silver ions can attach effectively to the membranes of water-bourne microbes, thus preventing their multiplication, and ultimately causing death. The current project aims to use nanotechnology to efficiently synthesize bio-based silver nanoparticles that have disinfection properties against microbe-contaminated water. This would involve two parallel protocols to synthesize Ag-nanoparticles: 1) the use of various strains of bacteria, algae, fungi 2) the use of left-over post-production of juices as natural fruit components that act as reducing agents. 1. Synthesis of silver nanoparticles using various cultures of bacteria, fungi or algae and in parallel natural fruit components. 2. Isolation/purification/characterization of Ag-nanoparticles using UV-Vis/SEM/FTIR/EDX. 3. Antibacterial assay of Ag-nanoparticles. 4. Application to water purification: development of suitable methods followed by field trials and scaling of the overall technology: sedimentation/decantation of Biomass of silver nanoparticles reacting with bacteria; The clear water will be tested for the presence of silver; if the silver concentration is detected to be above 100ppb, the collected water will be treated with fruits extracts acting as metal chelators for capturing silver particles and the sedimentation/decantation will be repeated (this time the sedimented biomass will be collected for Ag-nanoparticles re-synthesis) and clear water will be released.
PROJECT OUTCOMES	Prof. Pant at IIT Delhi has rich experience in the development of new technologies for water treatment, and his lab is also well equipped for the synthesis and characterization of various nano-based catalysts. Dr. Ziora at UQ has the agreement with Fruits Producers in Queensland, Australia, who will provide her the left-over components from juice production e.g. (citrus peels and fruit stone seeds). The dried and ground peels, seeds and/or extracts from them can be used as natural reductive reagents for synthesizing silver nanoparticles, to make it green chemistry. Dr Ziora has a urban water contaminated with known bacteria model suitable for testing the antimicrobial potency of silver nanoparticles. She is based at the IMB, which possesses a well-equipped facility for the complete bio-evaluation of the obtained silver nanoparticles, including the analysis of antimicrobial activity of them. Collaborator Dr Blaskovich (IMB) will provide additional support and advice for the antimicrobial characterisation. Collaborator Prof Walsh has expertise in water systems microbiology and will provide advice on biofilm models for testing novel antimicrobial compounds. Outcomes of the project: 4) The project aims to develop novel technology for water disinfection which will be highly instrumental in addressing the problem of scarcity of disinfected water.

	5) Patents, Publications, PhDs 6) Binational Collaboration
ADVISORY TEAM	**Dr Mark Blaskovich** https://researchers.uq.edu.au/researcher/1614 m.blaskovich@imb.uq.edu.au Institute for Molecular Bioscience (IMB) The University of Queensland **Professor Kamal K Pant** http://web.iitd.ac.in/~kkpant/ kkpant@chemical.iitd.ac.in Department of Chemical Engineering Indian Institute of Technology Delhi
TYPE OF STUDENT	Applications are open to i/a students who meet eligibility criteria. note: i-students must have own scholarship to apply (CSIR, UCG-NET, etc)
DISCIPLINE BACKGROUND OF STUDENT	Ideally, this project requires students with a background in inorganic chemistry, chemical engineering, microbiology.
IDEAL CANDIDATE	Essential capabilities: • Inorganic chemistry, chemical engineering, Desirable capabilities: • biology and microbiology Expected qualifications (courses, degrees, etc): • this should be a student eligible to apply for PhD program and who had already courses in inorganic chemistry, chemical engineering and potentially microbiology
APPLICATION PROCESS	Apply online by the due date: https://www.uqidar.org/students/how-to-apply/