

List of EWI awarded projects for EWRP 06/01 Request-for-Proposal (RFP)

Name of PI/Co-PI	Participating Organisations	Abstract of Project
<p>1. Development of low-pressure, high-flux UF and NF membranes based on electrospun nanofibers for water treatment</p>		
<p>Prof Seeram Ramakrishna (PI) Prof Ng Wun Jern (Co-PI) Prof Takeshi Matsuura (Co-PI)</p>	<p>NUS NTU University of Ottawa</p>	<p>This project aims to develop a new class of energy efficient nanofiber membranes capable of removing small organic molecules such as pharmaceuticals and personal care products (PPCPs), endocrine disrupting compounds (EDCs) and ions in water treatment. The nanofibres – which are more than 200 times smaller than a human hair - are produced using a process known as electro-spinning. The electrospinning technique creates thin membranes with a sufficient mechanical strength, making them suitable for water treatment applications. In addition, these electrospun nanofiber membranes (ENMs) are highly porous so less pressure is required to force water through the membrane. This translates into significant energy savings.</p>
<p>2. Development of Piezoelectric Sensors for Chemical Pollutants in Water Supplies (Piezoelectric sensors)</p>		
<p>Prof Sam Li Fong Yau (PI) Asst Prof Toh Chee-Seng Dr Karen Mak</p>	<p>NUS NUS NUS</p>	<p>The main objective of the proposed project is to develop a system to provide real-time monitoring of chemical contaminants in water samples based on the use of piezoelectric oscillating crystals with different types of coatings which will detect specific groups of chemical pollutants, including organics, inorganics, and biochemical toxins. The system will be used for on-line monitoring of contaminants in process, recycle, and waste water, in NEWater quality monitoring, in detection of contaminants in streams, lakes and water supplies, and in monitoring dumping/discharge in rivers, coasts and off-shore locations.</p>
<p>3. Use of Small Aquarium Fish to Develop Biological Monitoring Systems for Water Quality and Security</p>		
<p>Assoc Prof Gong Zhiyuan (PI) Prof Ong Choon Nam</p>	<p>NUS NUS</p>	<p>The team proposes to use two small aquarium fish, the zebrafish (<i>Danio rerio</i>) and medaka (<i>Oryzias latipes</i>), to develop biomonitoring systems for on-line</p>

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(Co-PI) Dr Lam Siew Hong (Co-PI) Dr Zhang Lifeng (Co-PI) Dr Xie Rongjing (Co-PI) Dr S. Mathavan (Co-PI) Prof Ed Liu (Co-PI)	NUS CAWT CAWT GIS GIS	surveillance of water quality and security. The team aims to develop two major technologies in the two projects: transgenic biomonitoring fish and molecular-based biomarker gene assays. In the first project, the team will generate transgenic zebrafish and medaka that will display fluorescent color in the presence of water contaminants. In the second project, the team will use zebrafish DNA microarray approach to identify biomarker genes that are differentially regulated in response to different chemicals.
4. Development of Innovative Cleaning Technique for Reverse Osmosis Fouling Control		
Dr. Qin Jianjun (PI) Kiran A Kekre	CAWT and Membrane Recovery Limited, Israel (MRL)	Membrane fouling is one of the limitations of RO technology, which limits its operating flux, decreases water production, increases power consumption and requires periodical membrane cleaning-in-place procedure. This proposal aims to develop an innovative cleaning technique for RO fouling control. Pilot trials on a new backwash technique via interval direct osmosis without interruption of the operational process will be carried out with the real feed in a NEWater Plant and operating conditions of the on-line cleaning method will be optimized. This project is a collaboration effort between the SUI and the MRL.
5. Development of Integrated Removal of Carbonaceous Matters, Nitrogen and Phosphorus in Municipal Wastewater Treatment		
Dr. CaoYeshi (PI) A/P. Liu Wen-Tso (Co-PI)	CAWT NUS	Nutrients (nitrogen and phosphorus) removal from municipal sewage is legally required in many developed countries since the 1980s to prevent eutrophication for the protection of water quality in rivers, lakes and sea. Many countries in this region have either imposed or will soon require nutrients removal in their regulatory control. This proposal aims to study carbonaceous matters (COD), nitrogen and phosphorus removal through experimentation with a laboratory-scale modified University of Cape Town (UCT) process with focuses on cost effective usage of

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		carbon and energy and population dynamics, which are critical to the process. Actual sewage and sludge collected from municipal sewage treatment plants will be adopted to simulate the tropical conditions. This project is a collaboration project between the SUI and the NUS.
6. Demonstration trial of integrity sensor for membrane processes by relative trans-membrane pressure monitoring technique		
Dr Wong Fook Sin (PI)	IESE, NTU	<p>The invention relates to a novel technique for integrity testing of membrane processes by using a multi-membrane device located downstream of the operating membrane. The device incorporates small-area membranes connected in series as a particle monitor. The relative trans-membrane pressures from these monitoring membranes are used to monitor the integrity of the upstream membrane processes.</p> <p>The objective of this project is to conduct a demonstration trial of a new invention, a sensor for monitoring membrane integrity, in an operating water reclamation, an MBR plant and a submerged membrane water production plant to show that the device can reliably monitor the integrity of membranes in a real plant situation and also to prove that it has the edge in performance and economics over other existing monitors currently in use.</p>
7. Nitrogenated Diamondlike Carbon-Platinum Nanocomposite Thin Film Microelectrodes for Detection of Trace Metals In Water or Biofluid		
Assoc Prof Liu Erjia (PI)	NTU	The main objective of this research is to develop nitrogenated diamondlike carbon-platinum nanocomposite (nc-DLC:N:Pt) thin film microelectrodes for detection of small concentrations of heavy metals in drinking water or biofluids. The nc-DLC:N:Pt thin film microelectrodes to be developed are expected to have potential applications in the areas of water quality technology.

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8. A Handheld Genetic Testing System for Simultaneous Detection of Multiple Water-borne Pathogens: A complete development from DNA markers to a commercial-grade instrument		
Assoc Prof Thomas Gong Hai Qing (PI)	NTU	A primary concern in monitoring the quality of water is to develop an integrated portable platform for rapid, sensitive and parallel detection of multiple water-borne microbial pathogens. This project aims at developing a handheld genetic testing instrument with a disposable real-time nanoliter PCR based microfluidic biochip, pre-loaded with primer pairs for simultaneous analyses of multiple water-borne pathogens. We also aim at developing an integrated capability to the handheld instrument to capture the pathogens from water sample and extract nucleic-acid from the pathogens, which will further facilitate direct and rapid testing of water samples for pathogens.
9. Development of an Online Pathogen Detection System		
Assoc Prof Karina Gin (PI)	NTU	To ensure processed water is safe for drinking, water quality is monitored very closely for any micro-organisms that might cause diseases (pathogens). In this project, a novel system using optical technology to detect pathogens online will be developed to provide increased protection to consumers. The system will allow processed water to be continuously monitored without the need for human contact. This will strengthen the quality control of water produced by processing plants and transported through pipelines.
10. Aerobic Sludge Granulation processes: Linking Processes to the Microbiological Fundamentals		
A/Prof Liu Wen-Tso (PI) Prof Tay Joo-Hwa (Co-PI)	NUS NTU	The main objective of the project is to deepen the microbiological understanding of aerobic granulated sludge reactors for treating wastewater containing organics and nutrients. Sludge granulation will be developed by natural mechanism to conform the ability of simultaneous removal of carbon and nitrogen, and used as the model system to examine the correlation between the process operation and microbiological fundamentals.

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11. Emerging Organic Contaminants in Catchment Surface Waters of the Marina Bay & Use of Chemical Tracers to Identify Wastewater Contaminants (merge of 2 proposals)		
Assoc Prof Karina Gin (PI) Dr Zhang Lifeng (Co-PI)	NTU CAWT	The project proposes to carry out a comprehensive study to detect and characterize emerging organic contaminants and tracers of sewage contamination in tropical waters. The study will involve the development of analytical techniques to detect the target organic compounds. These methods will then be applied to screen the surface waters in urban catchments, primarily in the Marina Bay. The monitoring exercise will provide information on what organics are present and where, what are the possible sources of contamination and what levels are present.
12. Rapid Detection of Bioterrorism Agents and Pathogens in the Drinking Water Distribution System of Singapore		
Dr Ooi Eng Eong (PI) Dr George Yang Dr Kevin Tan	DSO National Laboratories CAWT NUS	The aim of the proposed project is to develop rapid, sensitive and specific methods for the detection of waterborne bioterrorism agents and pathogens in the drinking water distribution system based on the Bio-Plex™ suspension microarray system and the multiplex real-time PCR. The developed detection systems will be used in monitoring waterborne bioterrorism agents and pathogens in the drinking water distribution system.

CAWT: Centre for Advanced Water Technology, Singapore Utilities International
 IESE: Institute of Environment Science & Engineering
 GIS: Genome Institute of Singapore
 NTU: Nanyang Technological University
 NUS: National University of Singapore