UNESCO CENTRE FOR MEMBRANE SCIENCE AND TECHNOLOGY

SPECIALISTS IN THE USE OF MEMBRANE FOR WATER AND WASTEWATER TREATMENT AND REUSE

The UNESCO Centre for Membrane Science & Technology (UCMST) is one of only four UNESCO Science Centres worldwide.

UCMST's research ranges from fundamental material development and characterization of membrane technology, and from more appropriate module and system design, to process operation and control in the field of water and wastewater treatment.

UCMST has been at the forefront of membrane research for water and wastewater treatment activities in Australia for over 25 years, and continues to do so through engaging with many major funding bodies (Australian Research Council, Centres of Excellence) and our numerous Australian and International industrial partners.

THE TOOLS OF OUR TRADE

UCMST offers expertise to industries through membrane autopsy, laboratory and pilot scale trials and experimentation.

In particular, UCMST features a unique range of advanced water characterization techniques, including liquid chromatography – organic carbon and nitrogen detector LC-OCD and fluorescence (FEEM) spectrophotometer.

WHAT WE DO

The Centre continuously focuses on increased fundamental understanding of the complex mechanisms occurring in membrane systems, resulting in greater acceptance and reliability of the process.

Sea and brackish waters still represent great potential for safe water supply. The opportunity to develop less energy-intensive systems and to use the osmotic force of the sea remains a key aspect of our research activities.

Given their improved performances, membrane bioreactors (MBR) and reverse osmosis (RO) become integral parts of wastewater recycling operation. However, their sustainability and reliability is also to be improved.

UCMST actively works on the development of novel membrane materials and processes tailor-made to target current challenges of water treatment. From super-hydrophilic and anti-fouling membranes, to membrane distillation, crystallisation and forward osmosis, novel technologies are continually developed.

Some of the key research activities include:

- Impact of membrane ageing on performances
- Novel operating strategies for forward osmosis operation
- Development of real time integrity monitoring techniques for low and high pressure membrane systems
- Computational fluid dynamic (CFD) modelling of liquid/air flow, fouling, concentration polarization
- Full scale membrane module and reactor design using CFD
- Resilience modelling of water recycling plants
- Finite element analysis of membrane failure modes
- Wealth out of waste – resource recovery from sugar cane spent wash by membranes

More information contact： Professor Greg Leslie (g.leslie@unsw.edu.au)
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OUR PARTNERS

UCMST academics and project engineers collaborate extensively with university researchers both internationally and within Australia. Key industrial partners include Sydney Water, South East Water, Water Corporation, Evoqua Water Technologies, Veolia Water, Origin Water.

KEYSTONE PROJECTS

- Development of national validation guidelines for water recycling processes, including membrane bioreactors and reverse osmosis
- Resilience modelling of advanced water treatment plants
- Optimisation of hybrid coagulation/submerged membrane bioreactor treatment of wastewaters
- Development of novel membrane integrity tests for virus sized particles
- Mass and heat transfer in submerged vacuum membrane distillation and crystallization
- Study of floc strength and stability during direct filtration of surface water
- Reuse of old reverse osmosis membranes used in desalination plants
- On-line monitoring of cyanobacteria to predict coagulant doses and powdered activated carbon application in water treatment
- Computational fluid dynamics modelling of membrane bioreactors
- Mechanical reliability of microporous membranes in water recycling applications

OUR EXPERTS

Professor Greg Leslie is the Director of UCMST. Greg's research team works on water and nutrient recycling. They use experimental and numerical modelling techniques to improve the performance of membrane processes to recycle water and nutrients from municipal and industrial waste. In particular, Greg critically examines the performance of polymeric and ceramic membranes in desalination, water recycling, biofuels and meat abattoir applications.

Professor Vicki Chen's research interests include hybrid biocatalytic membrane processes, bioseparations (protein recovery, algae separation, vibrating membrane systems), membrane bioreactors, desalination, membrane fouling and cleaning.

Associate Professor Pierre Le-Clech has extensive research experience in membrane processes, with emphasis on fouling in membrane bioreactors (MBRs). Pierre has recently led four studies funded by the National Centre of Excellence in Desalination Australia, with topics ranging from reuse of RO modules, to novel operating conditions for Forward Osmosis. He is also involved in the development of validation guidelines for MBR and RO used in water recycling.

Dr Rita Henderson is interested in process engineering that tackles sustainable water and energy supply solutions. Her research focuses on the solid-liquid separation of microalgae systems, including coagulation-flocculation, dissolved air flotation and membrane filtration processes, for application in water treatment and harvesting for bioenergy production. Through advanced characterisation of algae systems, process optimisation studies and the development of process monitoring techniques, she improves our understanding of the underlying biological, physical and chemical mechanisms that govern separation processes, enabling more effective, efficient and sustainable options to be established.

Francisco Trujillo is developing a system that combines membranes with ultrasound for fouling control in membranes, as well as modelling the effect of vibration of hollow membranes on cake formation and concentration polarization. Francisco has also worked on modelling the simultaneous heat and mass transfer during chilling of food products. In the area of photocalysis he has worked developing a CFD model of a bubble column photoreactor.

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