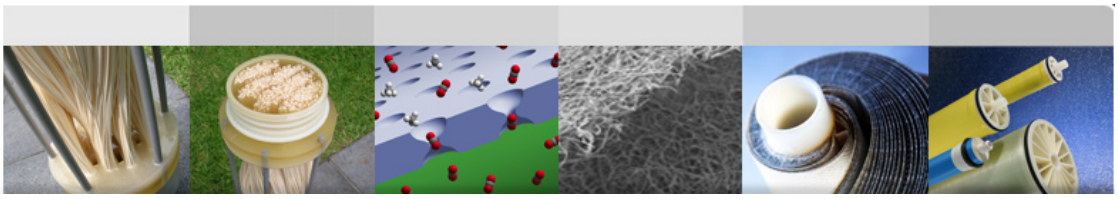
Membrane Society of Australasia



http://www.membrane-australasia.org

**MSA Newsletter**

**March 2014**

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Members who wish to contribute to future editions of the MSA Newsletter should contact the editor directly.

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**Upcoming events:**

- 12th International Conference on Inorganic Membranes, ICIM Brisbane—Australia, 6–9 July 2014
- International Conference on Membranes, ICOM Suzhou—China, 20—25 July 2014
- European Conferences on Fluid-Particle Separation, Lyon—France, 15-17 October 2014
- 4th IWA Regional Conference on Membrane Technology, Ho Chi Minh City—Vietnam, 3-6 December 2014
- AMS9 Taipei—Taiwan, September 2015

# *Message from the President*

Thank you for reading the first MSA newsletter of 2014. This year starts on a positive note with the success of IMSTEC last year in November, which was the first time run by the MSA and held outside of Sydney. This year the MSA will support the International Conference on Inorganic Membranes (ICIM) to be held in Brisbane from the 6-9 July. Shortly after, the 10th International Congress on Membranes and Membrane Processes (ICOM) will be held on the 20-25 July in Suzhou, China. The MSA supports ICOM via the Aseanian Membrane Society. Also this year, the MSA will initiate organising the next student and early career researcher symposium. If you are a student or early career researcher, please contact myself or any MSA board member to find out how to be involved. The invitation to participate also extends to early career industry professionals working in the membrane field who would like to present their work, and meet up with others working in their field. I also encourage established researchers and professionals to participate in the event to offer their experiences in the field.

One key function being organised now is the annual general meeting and election of directors, which will be held on 29th May at the University of New South Wales. We have good outcomes to report on from last year and a list of great events coming up which I hope to see you at. I am also pleased to announce that the next IMSTEC will be held in Adelaide in 2016. Please contact the conference chairs Prof Amanda Ellis and Prof Linda Zou for more details.

*Professor Mikel Duke — President of MSA*

# *Update on the ICIM14 Conference*

MSA is proud to host the 13th International Conference on Inorganic Membranes (ICIM) in Brisbane Australia from 6th-9th July 2014.

The proposed programme of the ICIM2014 is built upon the undeniable success of previous ICIM conferences, covering the broad range of fields that have come to be represented. ICIM2014 will emphasize the most urgent and pressing needs facing society in the early 21st century, namely "**Water, Food, Health, Energy and the Environment**" and the background membrane research pointing to the way forward. Practitioners in the field are obviously aware of the tremendous opportunities to address these challenges using inorganic membrane science and technology – indeed the future sustainability and prosperity of the entire world relies on sustainable, affordable and environmentally benign membrane technologies being developed and commercialised. Membrane technology is a truly enabling technology. For this reason the proposed ICIM2014 programme will include many topics as set out below under the theme "Water, Food, Health, Energy and the Environment".

The organiser also endeavours to include novel topics which may be in the interest of the research community, government and industry.

ICIM2014 will be organised by Elsevier.

For more information, please visit

**ICIM 2014**

6th-9th July, 2014

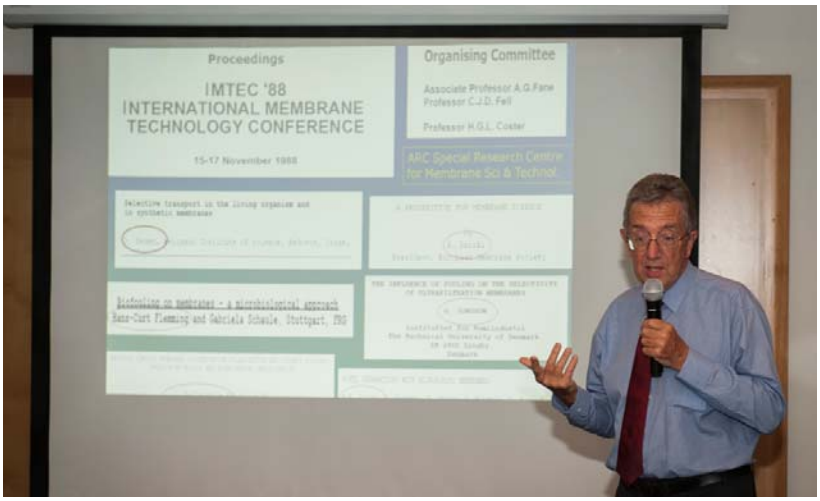
Brisbane, Australia

Web: http://www.icimconference.com/

# *Report on IMSTEC 2013 in Melbourne*

This IMSTEC conference was a first for two reasons; it was the first time the Membrane Society of Australasia (MSA) was the organizer, and the first time IMSTEC had been held outside of Sydney. Over the course of 5 days in late November 2013, IMSTEC was held at the University of Melbourne, chaired by Prof. Stephen Gray (Victoria University) and Prof. Sandra Kentish (University of Melbourne). The conference was one of the most successful IMSTEC to have been held, with over 145 oral presentations and 115 poster presentations. We were extremely privileged to have Prof. Young Moo Lee, Prof. Jean-Louis Maubois and Prof. Lloyd Robeson as plenary speakers who provided much detailed and invigorating discussion in the areas of gas separation and dairy research. One of the key highlights of this year's IMSTEC was the broad range of membrane topics – traditional membrane fields such as micro/ultra filtration and desalination were presented, as well as newer fields such as blue energy. One of the great successes of IMSTEC2013 was the international scope of research presented, with researchers from Japan, Korea, China, Malaysia, France, UK and USA attending. As Prof. Tony Fane pointed out during the conference dinner presentation, IMSTEC has continually grown over the years and the Australian membrane community has continually extended its international reach.

Highlights were the conference dinner at Victoria University Convention Centre overlooking Flinders Street Station and the Yarra River. In particular, the native animals available for handling, with the koala and crocodile getting the most attention, while a lot of people avoided the python. There were also some humorous moments, such as Prof. Tony Fane excellent presentation on superabsorbent cryogels in the Early Career Research Session.




**Prof Tony Fane reviewed the proud history and tradition of IMSTEC at the conference diner.**

**Prof Mikel Duke and Prof Felicity Roddick presented the Chairs of IMSTEC2013, Prof Sandra Kentish and Prof Stephen Gray, with a gift on behalf of MSA at the closing ceremony.**

The organizing committee would like to thank and acknowledge IMSTEC2013 sponsors and exhibitors, including Anton Paar, Crea Laboratory Technologies, Australian Water Recycling Centre of Excellence, International Desalination Association, National Centre of Excellence in Desalination Australia, Porometer n.v., Memcor and Water Research Australia Limited. After a successful IMSTEC in Melbourne, the MSA and membrane researchers worldwide look forward to the next IMSTEC to be held in Adelaide in 2016.

*By Colin Scholes, Melbourne Uni*

# *MSA Workshop - Challenges for potable water reuse: Removal of small contaminants by membranes*

The Membrane Society of Australasia supported the workshop titled "Challenges for potable water reuse: Removal of small contaminants by membranes" which was held at the University of Wollongong (UOW) on 31st January 2014. The

event was attended by 31 delegates from a range of industry and universities. The workshop mainly focused on trace organic chemicals present in wastewater which permeate through even RO membranes.

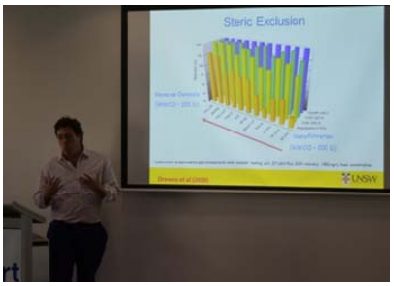
The half day event started with a welcome speech from Prof. Roger Lewis who is Associate Dean of Research at UOW. A/Prof. Stuart Khan (University of New South Wales) gave a presentation about the rejection mechanisms of small molecules by RO membranes and the rejection data obtained from their pilot-scale RO study. Dr. Wolfgang Gernjak (University of Queensland) presented factors influencing the occurrence and formation of N-nitrosamine and a range of the other disinfection by-products (DBPs). Mr. Takahiro Fujioka (University of Wollongong) presented a summary of his PhD work focusing on N-nitrosamine rejection by RO membranes in the laboratory-, pilot- and full-scale levels. The morning session was ended with a presentation from A/Prof. Long Nghiem (University of Wollongong) on a topic of on-line monitoring of boron as a surrogate of NDMA. During the lunch break, A/Prof. Long Nghiem showed several participants around his group's laboratories.

The afternoon session began with Mr Yvan Poussade (Veolia Water Australia & New Zealand) who talked about the application of membranes for potable water reuse in SEQ, showing the actual water quality data taken from full-scale RO systems. The second presentation from Dr. Wolfgang Gernjak (University of Queensland) focused on factors affecting a range of DBP's rejections by NF and RO membranes. Prof. William Price (University of Wollongong) gave a presentation on the chemical cleaning on membrane permeability and TrOC rejection. The workshop ended with a presentation given by Mr Kha Tu (University of Wollongong) who talked about the impact of membrane preservation on boron removal.

The successful half-day event provided all delegates a comprehensive knowledge and practical experiences with regards to the occurrence of micropollutants and their removal by NF/RO membranes. The event also provided networking opportunities among students, researchers and engineers who are involved in water reuse and membrane separations and fabrications. Many presentations agreed that there still remain challenges on the removal of micropollutants by RO membranes, in particular for direct potable water reuse. All speakers and attendees are greatly appreciated for making the event a great success.

*By Takahiro Fujioka, Uni of Wollongong*

**MSA Workshop on "Challenges for potable water reuse: Removal of small contaminants by membranes" on 31st Jan 2014 at Uni of Wollongong.**




**A/Prof Stuart Khan delivering his keynote speech at the Workshop**

# *The role of membrane separation in the food industry: a New Zealand perspective*

Within New Zealand, membrane separation is strongly associated with the dairy industry but other applications are becoming more common for purification of primary products or water. In this article I review commercial applications, and recent research, of membrane processes in NZ.

## Commercial Applications

***Dairy***. The dairy industry led the way with experimentation in ultrafiltration (UF) of whey proteins from whey in 1969, followed by the first commercial whey protein concentrate (WPC) plant about 10 years later. The development continued and now practically all of the


**A typical milk UF system (Courtesy Environment Products International Limited, Auckland)**

whey produced from cheese or casein production is ultrafiltered using spiral-wound polyethersulfone membranes. For well over 20 years whey has been viewed as a co-product and not a by-product of the industry, with an export value in 2012 of about $750 million. These plants are installed by ompanies such as GEA Process Engineering Ltd, Tetra Pak, and Environment Products International Ltd, and have filtration areas up to 14,000 $m^2$.

UF is also used to produce milk protein concentrate (MPC) from skim milk. This high protein product is used in cheese making overseas. Another application of UF is the "standardisation" of milk. New Zealand milk has a much higher fat and protein concentration than most overseas milk, so milk is standardised by centrifugation (for fat) and UF (for protein). The cream, milk retentate and milk permeate are recombined to produce a range of consistent products of different compositions. The use of high protein milk in cheese making increases the throughput of cheese factories, while milk with lower protein content can be used to meet the normal milk powder specifications. This standardisation process was made famous in Australia when the milk permeate was described as "green snot-like", but despite a media stir up in NZ, it failed to gain any traction here.

The permeate from dairy UF contains lactose, minerals and salts. The lactose is recovered by reverse osmosis (RO), then evaporation and crystallisation, and in some cases is used for milk powder production. RO is used on three sites for the concentration of raw milk near farms. Milk is collected from nearby farms, concentrated, and then transported, using fewer truck loads, to dairy factories that are hours away. RO is also used to concentrate wash water from casein production, thus recovering product while reducing the BOD loading of the water. Similarly it is used to polish so called "cow water", the water

**RO plant for water recovery (Courtesy Environment Products International Limited, Auckland)**

**A truck mounted cross flow filtration unit for wine processing (Courtesy Vintech Pacific Ltd).**

that has been evaporated off milk, thus producing high quality water to reuse in the factory. All the RO plants use polyamide based thin-film composite, spiral-wound membranes.

Membranes are used to recover sodium hydroxide from used cleaning solutions, remove protein and fat from salt brine used for salting gouda and parmesan cheese. Microfiltration (MF) is used to reduce the fat content of whey protein concentrate so it can be sold as whey protein isolate (WPI) containing more than 90% protein, and also for purification of lactoferrin streams after its isolation from milk.

*Wine.* The wine industry use a variety of membranes in their processing. While some of the larger wineries have their own equipment many are serviced by Vintech Pacific Ltd who have about 40 trucks or trailers with mobile separation systems.

They use MF for clarifying wine, RO for small adjustments to juice concentration, UF for colour control and electrodialysis for removal of tartrates and metal cations. RO is also used in conjunction with ion exchange or adsorption columns to remove specific components from the permeate before recombining it with the wine.

***Other products.*** EnzaFoods NZ Ltd use RO to concentrate apple juice prior to evaporation, and UF and MF for clarification of juices. Within NZ, the company Environment Products International Ltd has installed UF plants for juice clarification and nanofiltration (NF) for ash reduction of juice. There are some specialists small plants, e.g., for extraction of anti-oxidants from pine bark (ENZO Nutraceuticals Ltd), production of grape seed extract (NZ Extracts Ltd), and protein separation and ash reduction of animal blood.

***Water.*** RO is not used for city water supplies in NZ, a recent exception being the emergency deployment of RO water supplies by the NZ military after the Christchurch earthquake of 2011. But as mentioned above it is used within the dairy industry to recover water and reduce effluent. A number of MF systems have been installed by Pall NZ for surface water treatment to ensure low turbidity and low levels of protozoa. Membrane bioreactors have been applied in some specific locations for effluent treatment.

**Research**

Research in New Zealand's universities and Crown Research Institutes has focussed on food industry applications. Over the years students at the University of Canterbury have worked on multi-stage membrane plant design, simulation and control; degradation of polyethersulfone UF membranes by sodium hypochlorite; and fouling and cleaning mechanisms during RO of milk. For this work a fully

automated small scale AKTA crossflow membrane unit, and a Osmonics SEPA unit for small flat sheet trials simulating spiral membranes, have been used.

At Massey University Steve Flint and his students have investigated the cleaning of biofilms in membranes used in the dairy industry. They have compared different cleaning agents such as hypochlorite, enzymes, electrolysed brine and ozonated water for the removal of biofilms. Marie Wong and a student used pervaporation to concentrate flavour components in dairy products. Paul Middlewood from AgResearch with James Carson of Waikato University investigated the use of MF to extract amaranth starch from aqueous media. They found that the cleaning of regenerated cellulose required a combination of cold rinsing, caustic, and enzymes.

Filicia Wicaksana (the University of Auckland) has research interests in membrane applications for water and wastewater treatment, techniques for observation of particle deposition, and membrane processes for desalination and food.

**Conclusion**

While the dairy industry dominates membrane processing in New Zealand in terms of membrane area, there are very many smaller applications, most of which are for processing of food, nutraceutical or pharmaceutical products.

*By Ken Morison, Uni of Canterbury*

# *MSA Networking Event*

The 1st membrane networking event was held on Thursday the 30th of January at the University of Technology in Sydney and brought together 18 researchers and 4 guests from industry. The membrane networking sessions were initiated to provide early career researchers an opportunity to meet each other and to facilitate collaboration and communication among early career researchers and working professionals. The evening started with seminars from guest speakers Yvan Poussade, research and innovation manager at Veolia Water; and Mal Keen, area sales manager at Bürkert fluid control systems. Both speakers highlighted companies' interest in research that is readily applicable within the business for performance improvements, risk mitigation or to develop competitive new technology. Researchers were encouraged to consider the business case for innovation and present a solution rather than a problem. The next networking event is scheduled in June together with the next MSA workshop.

**The 1st MSA Networking Event at UTS on 30th Jan 2014**

*By Zenah Bradford-Hartke, Uni of New South Wales*

# *MSA Mentoring Program*

The MSA has decided to pilot a mentoring program this year. The Mentoring program is aimed at assisting students, young researchers and young professional members of the MSA in various aspects of their personal, professional and academic growth. To express interest in the program as a mentor or mentee, or to learn more about the program, please contact Takahiro Fujioka (takahiro@uow.edu.au), MSA Secretary.

# *Annual General Meeting and Election of Directors*

Annual general meeting and election of directors will take place at 4 pm on 29th May 2014. **Location:** 320A Chemical Engineering Building (F10), University of New South Wales, Kensington Campus. Please contact Takahiro Fujioka (takahiro@uow.edu.au) for director nomination form.