Membrane Society of Australasia

www.membrane-australasia.org

October – December 2011 Newsletter

Message from the President

It is with great pleasure to present to you our October - December 2011 newsletter. It's been nearly a year since our last newsletter, but this doesn't mean it's been quiet at the MSA! After wrapping up a successful AMS6/IMSTEC conference last November, we had our next AGM and election of directors on the 30th May 2011. I would like to thank all those who participated in our AGM and in particular our guest speaker, Prof Geoff Stevens. Our activities for 2010 have been presented in our Annual Report, which is readily available via the MSA contact in this newsletter or on our website.

At the moment, we are undertaking the necessary changes to our constitution in response to the new reporting requirements of ASIC for companies like the MSA.

The next key event organised by the MSA is the Early Career Researchers Membrane Symposium, to be held in Glenelg, South Australia from November 23 to 25. Dr Mike Dixon is the chair of the symposium and his team have brought together a great event with a line-up of key membrane specialist speakers, together with membrane industry sponsors and of course the presentations from students and early career researchers. I encourage you to consider registering to join us!

I would also like to thank A/Prof Sandra Kentish and Prof Stephen Gray for their progress in organising the next IMSTEC meeting to be held in Melbourne in 2013, which is now an MSA event. You can also read more about it in this newsletter.

Finally, I want to thank all our members and industry supporters that keep the MSA alive, which in turn presents to the community the importance of membrane science and technology to sustainable energy, water and foods. It's no surprise our activities gain support across the research, political, and industrial sectors considering that the global membrane market is expected to grow from $1.5 billion in 2009 to $2.8 billion in 2020 (Lux Research report). The MSA sees that one if its roles is promoting this growth and ensuring our membrane community has its part in it.

Please read more in this newsletter about our past, present and future activities in the membrane science and technology space!

Associate Professor Mikel Duke – President, MSA

Editor:
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In this issue:

In the News

Eureka Prize for Water Research and Innovation

Associate Professor Greg Leslie from the UNESCO Centre for Membrane Science and Technology shared the 2010 National Water Commission Professor Peter Cullen Eureka Prize for Water Research and Innovation with Professor Bruce Sutton from the faculty of Agriculture, Food and Natural Resources, University of Sydney. Their work "Salt-Free Farming: The Reverse Osmosis Capable Drip Irrigation System" was described as the most significant irrigation innovation based on theoretical science in at least a decade.

Their reverse osmosis capable drip irrigation system lets plants draw water through salt filters in irrigation pipes at their roots, using tiny amounts of energy naturally created by evaporation at their leaves. Described as the most significant irrigation innovation based on theoretical science in at least a decade, this work may soon be providing a lifeline for farms across Australia. It means that in future droughts it may be possible for farmers to efficiently tap into groundwater that would otherwise have remained out of bounds.

Australian Museum Eureka Prizes

International Congress on Membranes and Membrane Processes (ICOM) July 23-29 2011, Amsterdan

The Membrane Society of Australasia provided 2 oral and 2 poster prizes of A$500 for young researchers in the field of membrane science and technology, along with the European Membrane Society sponsoring 4 orals and 4 poster prizes. The winners are:

Poster Prizes

- David Grzenia,
  - Colorado State University USA
- Marlon Tijink,
  - University of Twente, The Netherlands
- Blaine Carter,
  - University of Colorado, USA
- Sebastian Schwark,
  - Universitat Duisburg-Essen, Germany
- Bahar Basak Peksen Ozer,
  - Izmir Institute of Technology, Turkey
- Kotaku Yuasa,
  - Kobe University, Japan

Oral Presentation Prizes

- Olga Maria Kattan,
  - University of Twente, The Netherlands
- Joanna Stawikowska,
  - Imperial College, United Kingdom
- Wei-Song Hung,
  - Chun Yuang University, Taiwan
- Geoffrey Geise,
  - University of Texas at Austin, USA
- Jing Lei,
  - Universitat Duisburg-Essen, Germany
- David Vermaas,
  - University of Twente, The Netherlands

MSA New Board Members

The new board as of the AGM on 30, May, 2011 is:

- *President* - Mikel Duke, (Victoria University)
- *Vice President* - Long Nghiem (University of Wollongong)
- *Secretary* - Simon Smart (University of Queensland)
- *Treasurer* - Aaron Thornton (CSIRO)
- *General Board* -
  - Ken Morison - New Zealand Representative (University of Canterbury)
  - Andrew Groth (Siemens),
  - Vicki Chen (University of New South Wales),
  - Pierre Le-Clech (University of New South Wales),
  - Colin Scholes (University of Melbourne) and
  - Shaomin Liu (Curtin University)

Research in Focus

Tuning membrane chemistry for deslaination and water reuse applications

Water reuse, recycling and desalination programs are becoming an important component of city water strategies. Membrane technology is an increasing focus within this rapidly evolving water treatment industry. In particular, nanofiltration (NF) and reverse osmosis (RO) membranes are used in groundwater remediation, sewage recycling and seawater desalination.

A large number of groups worldwide are focusing on the development of novel membrane materials for these applications that can offer improved membrane flux, increased chlorine resistance and increased fouling resistance relative to the state of the art polyamide technology. However, there remains an incomplete understanding of how both ionic salts and neutral species permeate these materials.

The aim of the project is to provide a more fundamental understanding of these crucial aspects of membrane science by characterising the polymers used for both reverse osmosis and nanofiltration in water industry. Independent measurement of diffusivity, solubility and free fractional volume of the polymer for a number of ionic and neutral species will be carried out and used to develop an improved model of solute permeation through RO and NF membrane materials.

Results will allow membrane chemistry to be tuned to provide maximum rejection of key solutes such as endocrine disruptors. In turn, this will improve operability in a range of Australian desalination and water reuse facilities.

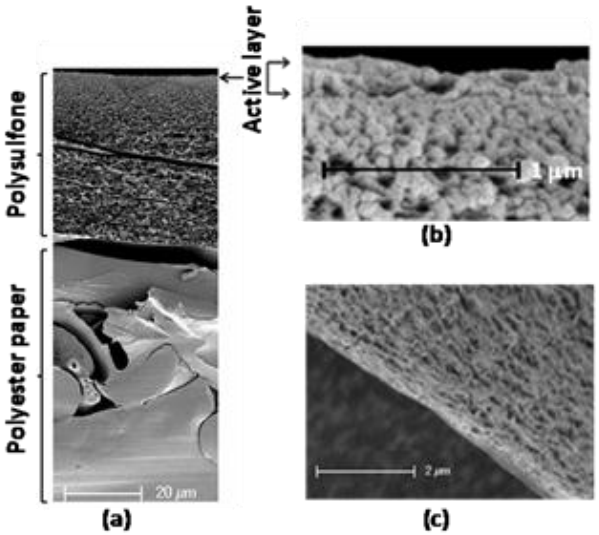

FIG. 1: SEM IMAGE OF SW30 RO MEMBRANE (A) CROSS-SECTION OF THE MEMBRANE (B) TOP SECTION OF THE MEMBRANE SHOWING A LAYER OF AROMATIC POLYAMIDE ON TOP OF THE POROUS POLYSULFONE SUPPORT AND (C) A SHEET OF THE POLYAMIDE THAT HAVE BEEN ISOLATED FROM THE SUPPORT LAYERS.

Judy Lee[1] (jytlee@unimelb.edu.au)
Anita Hill[2] and Sandra Kentish[1]
[1]University of Melbourne, [2]CSIRO

Feature: Desalination in the Pacific

The recent droughts in the island nations of Tuvalu and Tokelau have sharply focused the issue of water desalination in the Pacific. Prolonged drought caused by the 2010 La Nina weather event has meant in some small islands water reserves where down to two days. It is hard to imagine Pacific islands suffering droughts given their idyllic locations. However, for the coral atoll's their fresh water is dependent on rain and ground water extracted from the atoll's freshwater lens. In times of severe droughts, the freshwater lens rapidly shrinks, resulting in sea water seepage into their drinking wells.

FIG. 1: DESALINATION IN NAURU (SOURCE PACIFIC ISLANDS APPLIED GEO-SCIENCE COMMISSION)

Naturally, when Tuvalu declared a state of emergency recently the international community rushed to help, with New Zealand flying in two portable RO desalination plants to the Pacific island, and the International Red Cross also shipping two portable desalination plants. However, this isn't the first time desalination has been implemented in the Pacific or even Tuvalu, and it is vital to understand what has happened in the past to solve this problem.

Almost anyone who has ever holidayed in the Pacific would have been exposed to desalination water. Many of the resorts utilise RO desalination to provide the high quality water expected of resort patrons and to ensure water supply given that many of the resorts are some distance from the local water supply. Compared to Australia, these units are tiny, on the order of 27000 L per day, which is 0.007% of the Victorian Wonthaggi desalination plant currently under construction. This small scale means they are 2-3x more expensive to operate than Australian plants, mainly from the importing of diesel to drive the process.

The first time RO desalination plants were installed in Tuvalu was 1990, in response to a severe drought by the Australian Government International Development Assistance Bureau (later AusAID). Other desalination plants where installed in the 1990s and 2000s, funded by the Government of Japan. To date, all but one of these RO plants is no longer working and was useless in assisting the current drought crises in Tuvalu. Only on the capital island of Funafuti does there exist a working desalination plant, which was installed in the early 1980s and is the island's primary source of freshwater.

The Marshall Islands are in a similar situation, with all existing RO desalination plants used to supply water to hotels. For community consumption, during the late 1980s the Japanese government donated three RO units (total 22,000 L per day), USA government donated five RO units, and in the 1990s an extra 5 RO plants where imported. All but one, on the island of Ebeye, has broken down due to lack of maintenance.

There are desalination successes in the Pacific, with Nauru and Tonga getting it right. Currently Nauru operates three seawater RO plants to provide 80% of household demand. They are container units leased from Veolia Water, and produce ~120 m^3 per day, with extra capacity to spare. The Kingdom of Tonga on the other hand has no fixed RO desalination units; instead it holds a large number of portable RO units which are deployed by the navy in times of emergency. This ensures the units can be delivered to locations when needed and concentrates the servicing and maintenance of the units in one location. This partly solves the other problem with freshwater in the Pacific, distribution. Extra water generation capacity must go hand in hand with extra delivery mechanisms. For many island nations, away from the main town, water is delivered by tankers. So any extra water generating capacity must go hand in hand with upgrading distribution networks.

The situation on Kiribati is a prime example of how desalination is going wrong in the Pacific. 7 RO plants where installed in the late 1990s in response to drought conditions across the nation's three island chains. None are currently in operation, with two units only logging 72 and 128 working hours before malfunctioning. This is the most significant problem with desalination in the Pacific, once the crises have past, it is too expensive to continually operate desalination plants and so they are mothballed. However, RO plants cannot be left idle for long-periods of time without maintenance, and inevitably those in the Pacific fall into disrepair.

This isn't a Pacific problem, the Gold Coast desalination plant in Tugun is currently mothballed, yet it's upkeep in this state costs the Queensland government ~$5m per year. Of course the problems in the Pacific are further compounded by the fact contacting the manufacturer is difficult, costly and time consuming, while obtaining the necessary replacement parts and service support can be almost impossible given that many islands only access is by supply boats every few months.

FIG. 2: PORTABLE DESALINATION IN THE MARSHALL ISLANDS (SOURCE PACIFIC ISLANDS APPLIED GEO-SCIENCE COMMISSION)

So for the island nations in the Pacific, desalination solutions they are in need of is about efficient plant design and robust machinery, and a process that can handle regular start-up and shut-downs, as well as extend periods of being idle. These are issues that RO desalination can only partly answer.

Colin Scholes, University of Melbourne

Industry Update

Australia's newest desalination plant, the Western Australia's Southern Seawater plant in Binningup, was officially opened on the 2nd September. The $955 million plant and associated infrastructure will be fully commissioned before the end of the year producing 50 gigalitres of portable water for southern Western Australia, or around 20% of Perth's requirements. The plant is to be operated for 25 years by the Southern SeaWater Alliance (SSWA), comprising of Tecnicas Reunidas, Valoriza Agua, AJ Lucas, WorleyParsons and the Water Corporation (the state government's water utility). The plant is planned to be reliant entirely on energy from the $50 milliion Greenough River Solar Farm and Mumbida wind farm by late 2012.

The Western Australian Government has already announced plans to double the capacity of the plant to provide 100 gigalitres of portable water, at a cost of $450 million. Work has already began and the expansion is expected to be delivering water by December 2012.

SOUTHERN SEAWATER DESALINATION PLANT AT BINNINGUP WA AND DESALINATION MEMBRANES ON SITE - WATER CORPORATION

- Water Corporation

Upcoming Events

IMSTEC

MSA is hosting the 8th International Membrane Science and Technology Conference (IMSTEC), 25 - 29th November 2013, in Melbourne.

Sponsorship of the conference and program events is being sourced for this important event. Contact David Halliwell at:David.Halliwell@WQRA.com.au

Upcoming Events Continued

Early Career Researcher's Membrane Symposium 2011

The MSA has the pleasure of welcoming delegates to the Early Career Researcher's Membrane Symposium 2011. The event will be hosted in Adelaide in the seaside suburb of Glenelg at The Beachouse from November 23-25.

ECRMemSym2011, is Australia's premier symposium for membrane scientists in the early stages of their career. During our three days at the conference we will discuss fundamental and applied membrane science, engineering and technology in the areas of water treatment, gas separation and membrane fabrication. It offers a platform for extensive exchange of ideas, thoughts and discussions as well as career development and peer support for early career researchers. The program will offer 25 platform presentations, 12 posters and 8 guest speakers including Professors Tony Fane and Stephen Gray.

Many thanks must go to the tireless efforts of the Organising Committee:

- George Chen, Vice Chair;
- Hirra Azher, Secretary;
- Angela Hausmann, Treasurer;
- Ming Xie, Abstracts and Papers,
- Takahiro Fujioka, Sponsorship;
- Zenah Bradford-Hartke, Program;
- Clare Johnston, Venue and
- Ben Weereratne, Web and Graphic Design.
- A special thanks to Long Nghiem for his mentorship of the committee.

Thanks must also go to our sponsors, without whom the conference would not be possible. Thanks to our:

- Platinum Sponsor,
  - CSIRO
- Gold Sponsors
  - the National Centre of Excellence in Desalination
  - Hatch
  - Siemens
- Silver Sponsors
  - Dairy Innovation Australia
  - Acciona Agua
  - International Desalination Association- Young Leader Program.

We are looking forward to a fruitful and inspiring event!

Mike Dixon – Event Chair (SA Water)
http://www.ecrmemsym2011.com.au/home

Other Events

- 12th International Conference on Inorganic Membranes (ICIM) - Enschede,
  - The Netherlands,
  - July 9 - 13, 2012
  - www.icimconference.com
- North American Membrane Society (NAMS) Conference –
  - New Orleans, Louisiana,
  - June 9-13, 2012
  - www.membranes.org
- Euromembrane
  - London, UK,
  - September 23-27, 2012
  - www.euromembrane2012.com
