ISSUE #04

NEWRI UPDATE

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DEC 09/13

NEWRI UPDATE

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Dear Colleagues & Friends of NEWRI:

NEWRI newsletter Issue #4 is devoted largely to SMTC – NEWRI's membrane science and technology unit. The preceding period has been a busy and successful one for SMTC with our membrane colleagues winning both national and international recognition from the research and industry communities. Recognition from the two communities is important to NEWRI as we place emphasis on achieving the contiguous value chain of research, translation, development, and application – ie we seek not only to generate scientific knowledge but also to be relevant to community and economy. Evidence of NEWRI pushing beyond just publication of its knowhow may be seen in the development of its spin-off companies. Two of the latter, De.Mem and Water Optics Technology, were at Techventure 2013 seeking interest in their technology offers. Techventure 2013 was an event to showcase Singapore's entrepreneurial and technology innovation ecosystem. De.Mem (the more mature of the two) has shown robust growth and has gone on to build, own and operate water treatment plants with its first plant located at Duc Hao just outside of Ho Chi Minh City.

NEWRI places importance on experiential education and uses its philanthropic programs to provide field training for its students and researchers. This issue features NEWRIComm's activites with its Lien Environmental Fellow at Candirejo, Indonesia. Newsletter Issue #4 also features development of a novel material intended for use when natural disaster events occur. The super adsorbent cryogel "filters" and disinfects water simultaneously without need for electrical power and so shall be relevant to NEWRI's philanthropic activities. The material has been developed by research colleagues from SMTC and NEWRI's environmental chemistry and materials group, ECMG. This issue also includes a viewpoint from Prof Liu Yu director of NEWRI's biotechnology unit, AEBC, as an introduction to the next issue. NEWRI newsletter #5 shall be devoted largely to AEBC.

1. PROF TONY FANE RECEIVES THE IWA MEMBRANE AWARD

At the IWA Membrane Technology Conference in Toronto (Aug 25-28, 2013) Professor Tony Fane, Director-Mentor of SMTC-NEWRI, received the prestigious IWA Membrane Technology award. He also delivered the opening Plenary with a special presentation - 'My Life in Membranes'. The citation on the award reads: 'Membrane Technology Award presented by the Membrane Technology Specialist Group of the International Water Association to Professor Anthony G Fane for unprecedented and pioneering contribution in Research, Education, and Dissemination of Membrane Technology over the World' (August 27th, 2013).

2. NEWRI RESEARCH FELLOW WINS YOUNG SCIENTIST AWARD IN SUSTAINABLE DEVELOPMENT

Sustainable Development – two simple but yet complex words which encompass important issues on the environment, economy, and society. NEWRI works on sustainability, with emphasis on the water and technology domains. On 19 August 2013, SMTC-NEWRI research fellow, Dr Shi Lei, received US$1,000 cash prize at the ProSPER.Net-Scopus Young Scientist Award In Sustainability Development 2013, as well as a prestigious fellowship offered by the Alexander von Humboldt Foundation. Dr Shi was awarded the grand prize (water category) with his presentation titled "Novel hollow fiber membrane for Forward Osmosis and Low Pressure water softening" – benefitting sustainable development through invention of the world's first thin film composite Forward Osmosis (FO) hollow fiber membrane that also has the best performance among competitors. The two key SMTC-NEWRI authors of the winning abstract are Prof Wang Rong and Dr Shi Lei.

3. NEWRI COLLEAGUES WIN MND R&D AWARD 2013

In 2011, MND set up the Minister for National Development R&D Award to recognise the important role R&D plays to realise the shared vision of making Singapore an endearing home and a distinctive global city. This year, the award was extended to MND's partner agencies, in recognition of the cross-agency efforts in achieving MND's vision and mission.

NTU's project was recognised for its innovative and energy efficient approach to water reclamation, and was awarded the Merit Award. The project, titled "Integration of novel forward osmosis membranes and optimized bioprocess for water reclamation" involves NEWRI colleagues who aims to develop novel forward osmosis membranes integrated with biological processes for water reclamation. Their project was lauded by the judging committee for developing and demonstrating a high performing, novel approach for water reclamation, reducing energy consumption and potentially generating additional energy, and bearing potentially robust benefits not only for energy conservation and water security in Singapore but internationally.

NEWRI colleagues in the project are Profs Anthony G Fane (SMTC), Wang Rong (SMTC), Tang Chuyang (SMTC), Liu Yu (AEBC), and Mr Martin Andersen (DHI-NTU). The project also involves international collaborator Prof Li Kang (Imperial College London, UK), and industrial collaborators Dr Qin Jianjun (PUB), and Mr Kiran A Kekre (PUB).

4. MOST CITED ARTICLES

Congratulations to our colleagues at SMTC-NEWRI, who have been identified as being among the most cited authors in journals published by Elsevier.

MOST CITED ARTICLES

AUTHORS	TITLE	JOURNAL	WHEN
Rong Wang, Lei Shi, Chuyang Y. Tang, Shuren Chou, Changquan Qiu, Anthony G. Fane	Characterization of novel forward osmosis hollow fiber membranes	Journal of Membrane Science	2010 & 2011
Chuyang Y. Tang, Qianhong She, Winson C.L. Lay, Rong Wang, Anthony G. Fane	Coupled effects of internal concentration polarization and fouling on flux behavior of forward osmosis membranes during humic acid filtration	Journal of Membrane Science	2010 & 2011
Jing Wei, Changquan Qiu, Chuyang Y. Tang, Rong Wang, Anthony G. Fane	Synthesis and characterization of flat-sheet thin film composite forward osmosis membranes	Journal of Membrane Science	2010 & 2011
Shan Zou, Yangshuo Gu, Dezhong Xiao, Chuyang Y. Tang	The role of physical and chemical parameters on forward osmosis membrane fouling during algae separation	Journal of Membrane Science	2010 & 2011
Yuan Xu, Xiaoyu Peng, Chuyang Y. Tang, Q. Shiang Fu, Shengzhe Nie	Effect of draw solution concentration and operating conditions on forward osmosis and pressure retarded osmosis performance in a spiral wound module	Journal of Membrane Science	2010 & 2011
Shuren Chou, Lei Shi, Rong Wang, Chuyang Y. Tang, Changquan Qiu, Anthony G. Fane	Characteristics and potential applications of a novel forward osmosis hollow fiber membrane	Journal Desalination	2010 & 2011

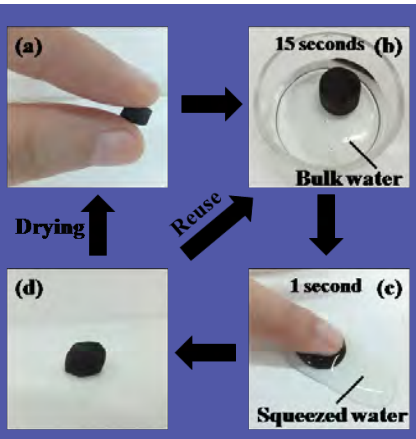
5. NEWRI ANNOUNCES NOVEL MATERIAL FOR DISINFECTION

Contaminated water is a major problem in many parts of the world, especially after the occurrence of natural disasters. Contamination, power outages, and limited resources and abilities pose huge challenges to access to safe drinking water. The after effects of the Indian Ocean tsunami in 2004 had inspired a team at NEWRI to invent a fast, simple, and power-free purification method to help make clean water available to survivors – a superabsorbent cryogel embedded with silver nanoparticles that works like a bacteria-killing sponge.

This novel material is less expensive than most other water treatment processes, can be used where there is no power, and is much faster than water filtration. The porous gel is so light that it can be dropped from helicopters into disaster zones to allow people access to clean water quickly.

The NEWRI researchers plan to make larger batches of the gel and field test the method in Myanmar. An automated method to purify large volumes of water with the gel is also in development.

NEWRI colleagues involved in this invention include Loo Siew Leng (SMTC), Prof Anthony Gordon Fane (SMTC), Assoc Prof Lim Teik Thye (ECMG), Prof William B. Krantz (SMTC), Liu Xin (SMTC), and Prof Hu Xiao (SMTC).



(a) A small piece of absorbent gel decorated with silver nanoparticles

(b) Soaks up water and disinfects it in 15 seconds

(c) A one-second squeeze releases drinkable water

(d) The gel can be used again for about 20 absorb-squeeze cycles without degrading or losing its bacteria-killing powers.

6. NEWRI SPIN-OFF COMPANY EXPANDS ITS SCOPE AND FORMS SUBSIDIARY

Membrane Instruments and Technology Pte Ltd (MINT) is a SMTC-NEWRI spin-off company founded in 2009. Specializing in membrane sensing and optimization technology for water treatment facilities, MINT developed the world's first 3-in-1 water quality monitoring system with its patented invention - Membrane Integrity Sensor (MIS). MINT has since expanded its scope and officially opened De.Mem Pte Ltd, its subsidiary in Vietnam worth S$3 million. The formation boosted MINT's current value to S$7 million, triple its value in 2011.

De.Mem – in short for decentralized membranes, entered a joint venture to build, own, and operate water treatment plants. Its first hi-tech remote-monitored water treatment facility, located at Duc Hoa in Long An province outside Ho Chi Minh city, is capable of producing 1 million litres of drinking water daily at its modest premise of 120 square metres. Riding on its success based on the new model of decentralized water network, 3 more water treatment plants are expected to come online before the end of this year.

Decentralized water treatment systems are increasingly popular due to reduced distribution costs – since less energy is needed to distribute water over short distances, as well as the small footprint and modular nature from applying membrane technology. By integrating MINT's innovative sensors, De.Mem is able to centralise collection of operating parameters from various water treatment plants, and apply algorithms to monitor performance as well as predict any issues that may occur. This allows a large number of plants to be always operating at optimal conditions without having a large engineering team, and thereby benefitting nearby communities and industries in the Southeast Asia region with the supply of affordable, clean and safe water.

7. NEWRI SPIN-OFFS AT TECHVENTURE 2013

Techventure 2013 was launched at the Suntec Singapore International Convention and Exhibition Centre by Deputy Prime Minister and Chairman of the National Research Foundation, Mr Teo Chee Hean. The event is a showcase of Singapore's entrepreneurial and technology innovation ecosystem, and offers opportunities for start-ups to seek investment from venture capitalists and investors.

Two of NEWRI's spin-off companies participated at the exhibition, under the clean energy and water tech sectors.

De.mem Pte Ltd (SMTC)

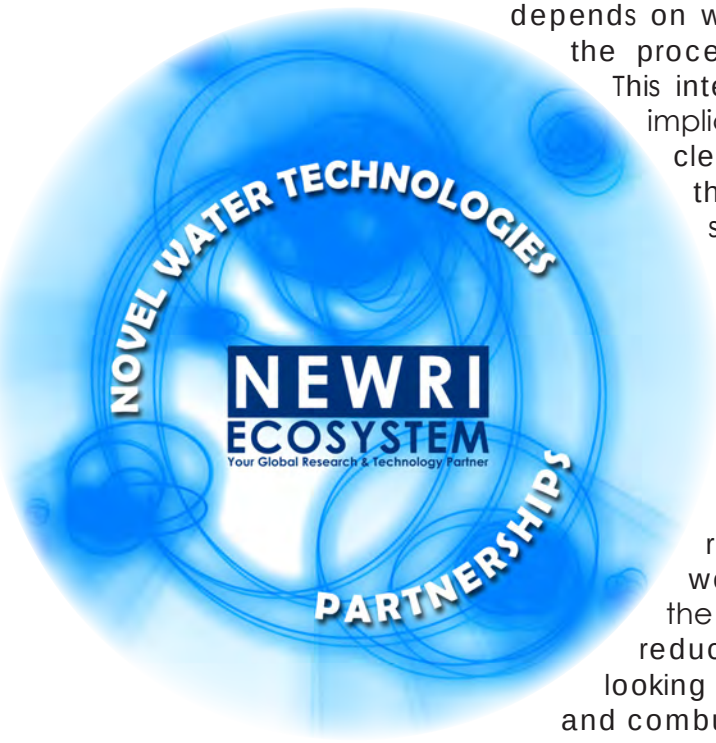
De.Mem Pte Ltd (SMTC) designs, builds, and operates decentralized water treatment plants for the South East Asian markets.

Water Optics Technology Pte Ltd (AEBC)

Water Optics Technology Pte Ltd (AEBC) provides real-time water quality monitoring solutions, which are low cost and have easy maintenance.

8. NEWRI PURSUES NOVEL WATER TECHNOLOGY AND PARTNERSHIPS

With the recent funding grant received from EWI-EDB, the NEWRI family stepped into its next phase of operation aimed at expanding NEWRI's capabilities and capacities to develop novel technology solutions, with a significant focus on the energy-water nexus. Energy production depends on water and, likewise, water depends on energy in the process of treatment, distribution, and consumption. This interdependence between energy and water has implications on the world – while humanity benefit from clean drinking water using treatment technologies, the environment suffers due to the energy-intensive systems which create large carbon footprints.



NEWRI is working on initiatives to reduce energy use such as moving away from high pressure systems and instead, looking at forward osmosis in water treatment. To change the idea of water treatment more fundamentally, NEWRI may shift from using size exclusion towards next-generation concepts such as attraction and repelling to reduce pressure. In wastewater treatment, NEWRI is working on intercepting carbon and removing it from the effluent stream using a biologic process, which reduces energy usage by 60-70 percent. NEWRI is also looking at recovering energy using enhanced anaerobic and combustion systems.

Partnerships help expand NEWRI's capabilities and efforts in sustaining the environment and looks for companies which are looking at filling 'gaps' with technological advancements. NEWRI seeks partnerships not only for technology adoption, but also for its positioning in the industry so that NEWRI, through it, can better learn of the industry's needs.

The above article is written based on a news report featuring NEWRI by OOSKAnews.com on 5 June 2013. If you would like to read the story, you may click *here* to view.

9. VIEWPOINT: "TRANSLATING INDUSTRIAL WASTEWATER INTO USEFUL RESOURCES" - PROF LIU YU (AEBC-NEWRI)

"Industrial wastewater is more challenging than municipal sewage for biological treatment processes given its complex chemical characteristics and potentially inhibitory/toxic properties. However, industrial wastewater can be rich in resources, e.g. it often contains very high level of organics which can be recovered as biogas and value-added materials. AEBC-NEWRI aims to develop emerging bioprocesses to mitigate the inhibition of industrial wastewater in order to improve biological reaction kinetics/efficiency and further enhance recovery potential of energy and resources from industrial wastewaters. The approaches being developed in AEBC-NEWRI include selection and cultivation of more robust microbial consortium, chemical and biological pre-treatments, novel operation strategies, and process design."

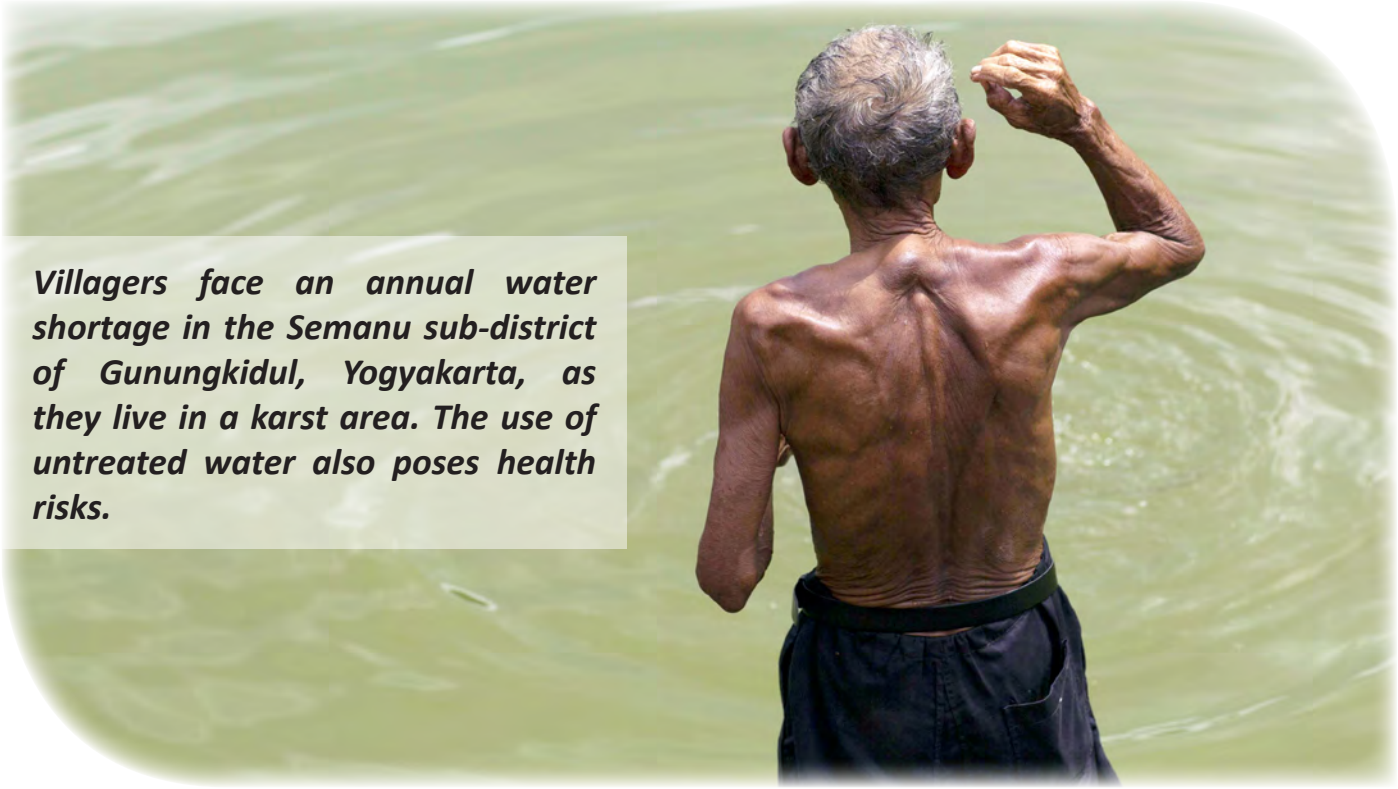
~ Prof Liu Yu (Co-Director, AEBC-NEWRI)

10. NEWRICOMM PHOTO ESSAY:

NEWRIComm Improves Water Access For Communities In Karst Ecosystems In Yogyakarta, Indonesia

About NEWRI Community Development (NEWRIComm)

NEWRIComm partners benefactors for social investments for a better shared future in Asia through innovations and holistic solutions in water technologies. Our network of local stakeholders ensures sustainable solutions through ownership and technical knowledge diffusion.



Villagers face an annual water shortage in the Semanu sub-district of Gunungkidul, Yogyakarta, as they live in a karst area. The use of untreated water also poses health risks.

NEWRIComm advised on the construction of a well at Candirejo Village, complementing government initiatives to provide and promote clean water.

NEWRIComm Improves Water Access For Communities In Karst Ecosystems In Yogyakarta, Indonesia

The gotong royong spirit, or community co-operation, helps the villagers improve their water resources.

NEWRIComm works with villagers for cleaner ponds, to protect their water and food source.

NEWRIComm Improves Water Access For Communities In Karst Ecosystems In Yogyakarta, Indonesia

The NEWRIComm solution assimilates local wisdom and respect for the environment.

The well in Candirejo Village is now managed by the village youth group, while the water access programme is being expanded to Saptosari Village.

Till the next update - best wishes,

Prof WJ Ng
Executive Director, NEWRI

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