#06 NEWRELUPDATE STAY CONNECTED WITH NEWRI - YOUR GLOBAL RESEARCH & TECHNOLOGY PARTNER

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ISSUE





Dear Colleagues & Friends of NEWRI:

My last message to you included an invitation to visit our booth at the 2014 Singapore International Water Week exhibition. We had a successful outing at the exhibition where we met with many existing and new partners. Thank you all for dropping by then and speaking with us.

NEWRI had and continues with efforts to bring value to research beyond satisfying scientific curiosity and so lending substance to the value chain we seek to embed in the organization - ie research-translation-development-application. Our latest partners from industry now include NSL, Grundfos, and Huntsman. We are witnessing increased interactions with industry, in part, due to our maturing projects. The latter has resulted in IPs (knowhow and patents) which can be of interest to the industry. Licensing of these IPs have occurred to or are being discussed with established and NEWRI's own newly formed spinoff companies. An example of the latter is NE4Technology - a NEWRI spinoff company which has licensed a cluster of IPs and so allowing it to operate in a technical advisory capacity in the environmental engineering domain. These industry outreach activities have been supported by NEWRITech (NEWRI's industry outreach arm) – which has seen a very busy 2014. NEWRI's water and wastewater interests, championed by Singapore Membrane Technology Centre (SMTC) and Advance Environmental Biotechnology Centre (AEBC), continue to perform well. These two units have brought in projects which shall keep them busy well into 2015 and 2016, and are already pursuing potential projects which shall bring them into 2017. DHI-NTU maintains its "traditional" interest in water quantity and quality modelling such as the Mekong River system project but it has also increasingly moved into treatment process modelling which has attracted industry interest. DHI-NTU, AEBC, and the Environmental Chemistry and Materials Group (ECMG) have "adopted" the Nanyang Lake clean-up effort at NTU. The intention is to turn the lake into a centrepiece for NTU's interest in environmental betterment much like what NEWRI did with Kandy Lake for Kandy City in Sri Lanka. The growing interest in waste management has meant NEWRI's Residues and Resource Reclamation Centre (R3C) has seen substantially increased activity in 2014. It is now in the process of planning a 30 t/d experimental incineration facility which shall be constructed on Nanyang Technological University campus.

Year 2014 has also been good to the careers of NEWRI colleagues - with two Centre Directors, Wang Rong (SMTC) and Liu Yu (AEBC) promoted to full professor and two senior research fellows, Yan (AEBC) and Ziggy (SMTC), appointed as assistant professors at NTU's School of Civil & Environmental Engineering (CEE) following a global search and competition. Prof Wang Rong was concurrently appointed Chair of CEE in 2014. NEWRI is proud to be closely associated with CEE School, a globally ranked School (ranked 8th in the world for Civil & Structural Engineering in the 2013 QS World University Rankings by Subject) and the College of Engineering at NTU (which was placed in the top 10 in Asia and globally in 2014 by Essential Science, QS, US News, and SJTU). We have also had departing PhD students who have graduated and research fellows who have completed their projects finding employment with the industry and other academic/research organizations. To date our NEWRI alumni have not experienced difficulty finding employment and for this we are very appreciative of the support extended us by colleagues in the industry, research, and academic domains. NEWRIComm (NEWRI community outreach unit) completed and handed the Kandy Lake

and Temple Sewage Treatment Plant (STP) projects over to our Sri Lankan stakeholders in 2014. With projects completed and nearing completion, NEWRIComm is seeking new projects and had invited proposals from around the world. It is presently assessing some 80 proposals. Initial assessment would suggest there may be urgency to address clean water and good sanitation issues at a number of Central Asia locations. We have had a most eventful 2014 and as we begin 2015 I take this opportunity to wish you all that is good in the new year.

1. PROFESSOR TAN SOON KEAT & PROFESSOR LIU YU'S TRIP TO YIXING

In December 2014, Professor Tan Soon Keat, Deputy Executive Director of NEWRI and Professor Liu Yu, Director of AEBC were invited to visit the China Yixing Industrial Park for Environmental

Science & Technology which environmental protection State Council in 1992. and Liu discussed with committee on possible mechanisms and met listed environmental

On the same trip, to visit Zhejiang Bohua Co., Ltd. which is a environmental technology, operation of environmental was approved the national hi-tech industrial zone in China by the During the visit, Professors Tan the Park's management collaboration models and with the lead people of several companies in the park.

Professors Tan and Liu were also invited Environmental Technology & Engineering high-tech enterprise specialized in investment, construction and installations. At the meeting with

operation of environmental protection installations. At the meeting with the CEO of Bohua, both parties expressed strong interest to pilot-test NEWRI's patented technology for sludge reduction at a full-scale wastewater treatment plant in Chongqing.

project

2. UNIVERSITY OF PANNONIA VISIT

University of Pannonia, Hungary, has 5 faculties which include the Faculty of Engineering with Environmental Engineering as one of its major programmes. The latter focuses on wastewater treatment like SBR, MBR and Anaerobic Digestion, with interests also in waste management, air quality monitoring and modelling. University of Pannonia is exploring collaboration with NEWRI on R&D.

3. GUANGZHOU KNOWLEDGE CITY VISIT

Mr Li Hongwei, Vice Chairman of Administrative Committee of Sino-Singapore Guangzhou Knowledge City (SSGKC) and Delegation arrived at NEWRI on the 17th of November 2014 to discuss development of the Joint Research Institute (JRI) at Sino-Singapore Guangzhou Knowledge City. The meeting was chaired by Prof Ng Wun Jern Dean, College of Engineering & Executive Director, NEWRI. This was followed by a tour of the NEWRI laboratories.



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4. SINGAPORE INTERNATIONAL WATER WEEK 2014

NEWRI at Singapore International Water Week 2014



5. CONGRATULATIONS

Professor Liu Yu

Prof Liu Yu for receiving the Public Administration Medal (Bronze) at the National Day Awards 2014

Dr Esra Uckun Kiran

Dr Esra Uckun Kiran, Research Fellow, NEWRI-AEBC, for the Certificate of Merit awarded by American Chemical Society, Division of Environmental Chemistry, for a presentation in August 2014.

Liao Yuan

Liao Yuan, PhD Student, NEWRI-SMTC for best paper awarded by EuroMembrane Society 2014. Her paper "Fabrication of polyvinylidene fluoride (PVDF) nanofiber membranes by electro-spinning for direct contact membrane distillation" was published on 1 January 2013 in Journal of Membrane Science.

Lee Jian Yuan

NEWRI-SMTC PhD Student awarded "Green Talent 2014". The German Federal Minister of Education and Research Prof Johanna Wanka honoured the winners of this year's Green Talents-Competition at a ceremony in the new ministry building in Berlin. A jury of experts selected 25 'green' visionaries out of over 800 applicants from more than 100 countries as "Green Talents 2014". This prestigious title was



awarded for the sixth time under the patronage of the minister to tomorrow's leading scientists in the field of sustainable development. The awardees were invited to participate in the two-week "Green Talents – International Forum for High Potentials in Sustainable Development" event, during which they visited locations in Germany where research on sustainability is conducted. This is to afford them opportunity to gain deeper insight into the country's innovation system, its technologies and stateof-the-art approaches, and to network and exchange ideas with the country's leading experts at individual meetings. NEWRI-SMTC doctoral student, Lee Jian Yuan, was one of the 25 awardees receiving the title "Green Talent 2014". His interdisciplinary research focus is on sustainable chemistry, material science and water technology.

Low Jiun Hui

NEWRI-SMTC PhD Student awarded Best Oral Presentation at IDW2014. Hosted by KDPA, GDRC-GIST, EDS, and DTSG-KSEE, the 2nd International Desalination Workshop (IDW 2014) was held at Lotte City Hotel on Jeju Island on November 5-8, 2014. The workshop's theme was "Low-Energy and New Materials System Desalination". A total of 90 presentations was made



at the workshop which was attended by more than 150 participants from 17 countries. NEWRI-SMTC



PhD student, Low Jiun Hui, had his paper among the five best papers selected for the SeaHERO Award and he won the Best Oral Presentation. Jiun Hui's presentation was titled - The roles of Pseudomonas aeruginosa extracellular polysaccharides in reverse osmosis membrane biofouling and nitric oxide biofouling control.

Xia Li Jun

NEWRI Alumni Xia LiJun won Best Student Poster Award at SIWW 2014. The poster on mathematical modelling of the hydrodynamic condition in a bubble column reactor was submitted by Xia Lijun as part of her PhD work as student of NEWRI-SMTC. Upon graduation she joined DHI-NTU, and she has since joined Mitsubishi.





6. New wastewater sludge treatment increases biogas production by 50%

A two-year research project on enhancing sludge solids reduction while increasing biogas production post-biological wastewater treatment was initiated by PUB and NEWRI-AEBC. The research investigated effectiveness of combining ultrasonication with ozone says Senior Research

Fellow Dr Antoine Prandota Trzcinski. In the investigation, the team discovered combination of ultrasonication a and alkali treatment was significantly more effective - with production of biogas increasing by 50% while residual sludge solids was reduced by 30%. This technology could lead to increased biogas production which could be used to generate more power while reducing the amount of sludge solids going to landfill or incineration says Professor Ng Wun Jern, Director for NEWRI. Sludge management is anticipated to become a major industry requirement in many parts of Asia.



7. GRUNDFOS-NEWRI COLLABORATION WINS FUNDING FOR NOVEL SLUDGE FILTRATION TECHNOLOGY DEVELOPMENT

Grundfos, a global pump and water technologies leader, with NEWRI-AEBC has won funding for development of novel sludge cake filtration technology. The technology utilizes activated sludge to form or reform the filter matrix which operates at low pressure. Because of the biological nature of the sludge cake filter, filtrate quality is expected to be good enough for discharge into natural watercourses. Prof Ng Wun Jern, Exec Dir of NEWRI, was much enthused with the collaboration as such interactions with industry partners not only generate scientific information but also quicken the pace of moving the research outcomes to end-users.



8. NEWRI SUPPORTS DEVELOPMENT OF OPTICAL FIBER SENSORS



Set-up of microfiber sensor

Ground water supplies are increasingly getting polluted by toxic chemicals from the likes of industrial discharges, and chemical spills. Consumption of water contaminated with heavy metal compounds such as lead, and chromium can be detrimental to living organisms. To date, the electro-chemical sensor has been commonly used to detect such heavy metal ions. However, such sensors often suffer from electrical or electromagnetic interference and may not be

sufficiently sensitive. To address this challenge, NEWRI is supporting Prof Tjin SC and Asst Prof Yong Ken Tye in a project (with CRP potential) to develop a fibre optic chemical sensor that is costeffective, compact, immune to electromagnetic interference, and capable of providing in-situ and high resolution measurement. The detection principle is based on change in the property of light propagated into the region surrounding the fibre at the fibre's measurement zone. The surface of the fibre in the measurement zone is surface treated to contain chelating agents that will immobilize

heavy metals that may be present. To date, the team has investigated various chelating agents capable of binding metal ions such as Cd, Pb, Zn, and Cu with detection sensitivity of 10 parts per million (10 ppm). Work is progressing with specialty fibres capable of sensitivity to parts per billion (ppb) level. These fibres have been prepared using the new fibre fabrication facility at sister organization, The Photonics Institute.



9. New JOINT LABORATORY PARTNERSHIP WITH NSL

NSL OilChem is a leading integrated waste management company in Singapore and offers services for hazardous waste problems. NSL OilChem operates hazardous waste reception facilities to collect, transport, process, recycle and dispose toxic industrial wastes. As part of its new business, NSL OilChem plans to move into the treatment and reclamation of industrial waste water with a focus on newly industrializing countries in South East Asia. NEWRI and NSL OilChem are now in a partnership collaborating on R&D activities in the areas of waste water treatment and reclamation under a Joint Research Laboratory. The Joint Laboratory capitalises on NEWRI's capabilities, expertise and facilities to provide technical support to NSL OilChem's businesses, including R&D work for NSL OilChem's current business in the treatment of oils and slops, development work on waste oil reclamation and purification, and industrial waste water treatment.

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10. NEWRI REGULARLY CONDUCTS WORKSHOPS. HERE ARE SOME RECENTLY CONDUCTED SEMINARS



11. WORKSHOPS FOR PROFESSIONAL ENGINEERS

In collaboration with the Public Utilities Board (PUB), an in-house advanced hydraulic course was conducted for PUB engineers during the months of July, September and October 2014. This event was attended by more than 100 PUB engineers and senior managers with Prof Tan Soon Keat and Prof Shuy Eng being the facilitator/instructors. Topics such as Design for Siphons, Vortex Drops, Sizing and design of pumping mains were covered during this workshop. PDUs were also awarded to professional engineers who attended the workshops.

12. **F**RAUNHOFER WORKSHOP

A workshop with Fraunhofer Institute for Ceramic Technologies and Systems (IKTS) was conducted on 9th of September at NEWRI. Prof Wolfgang Mueller Director of Fraunhofer IDM, led the discussion on topics such as "Solar Photocatalytic Regeneration of Spent Activated Carbon", "Vibratory-Stirring Membrane Bioreactors" and "Membrane Materials & Processes" during the course of the day. These topics were covered concurrently throughout the day as professors gave their presentations on their specified fields. Discussions on possible collaborations took place as the day drew to a close with Prof Ng Wun Jern, Dean and Exec Director, NEWRI.

13. VIEWPOINT: PROFESSOR LIM TEIK THYE (CO-ORDINATOR, ECMG-NEWRI)



Nanomaterials and nanotechnology provide new opportunities to solving various increasingly challenging environmental and water issues facing the world. These include drinking water treatment, wastewater treatment and reclamation, desalination, ultrapure water production, industrial waste treatment and reuse, resource recovery, environmental monitoring, remediation and climate change mitigation. The potential rewards of environmental nanotechnology application include more efficient use of materials, energy savings, less residues, and overall reduction in the cost of environmental solutions.

"The research team in ECMG applies chemical engineering principles and novel nanomaterials to break the deadlocks in the energy-water-materials nexus, and so create novel technological solutions to challenging environmental problems including water reuse, contaminant detection and remediation". ~Prof Lim Teik Thye

14. VIEWPOINT: PROF WILLIAM CHEN AT A CNA INTERVIEW

In a documentary aired by Channel News Asia (7 Jan 2015) on new ways to find food sources, Prof William said traditional food waste can be biologically treated. In a microbial engineering process, Prof Chen's laboratory uses bacteria to convert food waste into valuable ingredients. Through this process, food waste can now be converted into a type of fat by bacteria and in the future, there can be a larger food supply due to the diverse new ingredients created by such innovative methods. Prof Chen also spoke about alternative food sources like insects, as their protein value is comparable to eating animal meat. This has led to the UN actively promoting the consumption of insects. Prof Chen added that insects are more resilient, have a high growth rate and there is a more diverse feedstock



15. VIEWPOINT: SHAWN S.MUSLIM, A VISITING GRADUATE STUDENT FROM NORTH AROLINA CENTRAL UNIVERISTY, ENVIRONMENTAL, EARTH, AND GEOSPATIAL SCIENCES

"I had a unique opportunity to work with Dr. Teik-Thye Lim's group at NEURITARI as an international exchange intern with support from the NSF -Partnerships for International Research and Education (NSF-RIRE) program during summer 2014. The Pls of NSF-PIRE in the U.S. and their international partners started academic partnerships and have their students do international lab rotations. My research work at MM with Dr Lim's group (Mr. 2 Hu, Dr. P. Wang, Dr. R Doei) focusing on synthesis of nanohybrid materials was a continuum of my thesis under Dr. John Bang at NCCU, yet the scope and quality of the work involved in Dr. Lim's group was very impressive and impeccable. Introduction to unexplored techniques and concepts brought another great value that made every single second of my visit at NTU meaningful, and I was truly consinced that NTU is one of the best academic institutions in the world. I hope to see Dr. Lim's group continuously serve the academic field as a global leader for conserving and creating sustainable environments in the coming years."

SHAUN S. MUSLIM

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16. NEWRICOMM PHOTO ESSAY

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.





Centre of Excellence for Environmental Management in Kandy, Sri Lanka



The project aimed to protect Kandy Lake and its downstream waterways, including the Mahaweli River, a major water source in Sri Lanka.

The floating wetlands remove excess nutrients in Kandy Lake and trap fine solids entering the lake. Close to 100 m2 of wetlands have been set up at four of the lake inlets. This is a full-scale application of the floating wetlands for tropical urban lake restoration.

Centre of Excellence for Environmental Management in Kandy, Sri Lanka





Centre of Excellence for Environmental Management in Kandy, Sri Lanka





17. **R**ECENT PUBLICATIONS AND CONFERENCE PRESENTATIONS

Over the last 6 months, there are some 39 new publications and 24 conference papers presented. You may view them on our NEWRI's website. Here are some highlights.

1. Chen GZ., Yang X., Lu, YH., Wang R., & Fane A. G. (2014). Heat transfer intensification and scaling mitigation in bubbling-enhanced membrane distillation for brine concentration, Journal Of Membrane Science, 470, pp.60-69, DOI: 10.1016/j.

2. Xu T.Y., & Qin X.S. (2014). A sequential fuzzy model with general-shaped parameters for water supply-demand analysis. Water Resources Management, p.16

3. Sendjaja A. Y., Tan Y., Pathak S., Zhou Y., Bin Abdul Majid M., Liu J. L., & Ng W. J. (2014). Regression based state space adaptive model of two-phase anaerobic reactor. Chemosphere. doi:10.1016/j.chemosphere

4. Liao Y., Wang R., & Fane A. G., Fabrication of Bioinspired Composite Nanofiber Membranes with Robust Superhydrophobicity for Direct Contact Membrane Distillation. North American Membrane Society 24th Annual meeting, Houston, TX, USA.

5. Lim T.-T., Hu Z.T., Liu J.C., & Yan X.L. (2014). Synthesis of Bi2Fe4O9 at Low Temperature for Photocatalytic Degradation of Bisphenol A under Solar Light. The 19th International Conference on Semiconductor Photocatalysis & Solar Energy Conversion (SPASEC-19), 16-20 November 2014, San Diego, California, USA.

6. E. Uçkun Kiran, A.P. Trzcinski, & Y. Liu (2014). Developing novel biorefineries using food waste as substrate, ACS National Meeting & Exposition, San Francisco, (10-14 Aug 2014)



Till the next update - best wishes,

Prof WJ Ng Executive Director, NEWRI