



Editorial note on special issue



This special issue includes papers mostly based on presentations made in the *2nd International Conference on Desalination Using Membrane Technology (MEMDES-2015)*, Singapore, 26–29 July 2015. The program of this significant Conference was very rich, covering essentially all aspects of membrane-based technology for water treatment as well as research efforts devoted to advancements of this field. The relatively limited number of papers comprising this special issue was selected, through the usual peer-review process, out of a significant number of submissions. Therefore, one cannot claim that the topics in these papers are totally representative of the breadth of coverage (of the membrane desalination field) by the oral and poster presentations made in MEMDES-2015. Nevertheless, the contents of this Issue highlight the broad spectrum of R&D activities in the membrane desalination field, internationally. Indeed, as shown in the following, areas attractive to a large part of the R&D community include: novel membrane types and improved membrane performance, methods to characterize and mitigate membrane fouling, development of novel as well as hybrid methods to purify water (by removing a great variety of undesirable species), efforts to improve methods for pre-treatment of RO-plant feed-water, Membrane Distillation, and novel RO membrane implementations.

Papers are included herein that are typical of the significant R&D activity on improving the properties of membrane active layer as well as on development of novel membrane types for various water treatment tasks. *Reis et al.* investigate the use of helium and water plasma to endow the membrane surface with desirable properties (e.g. hydrophilicity). *Ingole et al.* report on the successful development of a thin-film-composite, hollow fiber, membrane to separate water vapor from a gas mixture. *Zambare et al.* present work on novel graphene-oxide-based polysulfone (mixed matrix) membranes which are functionalized by polyamines; improved hydrophilicity and permeability are reported. *Lee et al.* propose a new method to characterize Forward Osmosis membranes and obtain more reliable performance parameter values than those resulting from the conventional technique employing pressurized RO testing. *Dzinun et al.* report on the performance assessment of a co-extruded dual-layer hollow fiber (DLHF) membrane; the outer layer of DLHF membrane is comprising TiO₂ catalyst nanoparticles and the membrane performance is tested in hybrid membrane photoreactor. *Ahmad et al.* present results of an evaluation of novel PES/ZnO mixed matrix hollow fiber membranes in respect of their fouling mitigation characteristics.

Membrane fouling characterization and mitigation are at the forefront of research. *Chilcott et al.* present results of advanced modeling employed to interpret electrical impedance spectra; significant insights are gained through such data regarding the mechanism of membrane

surface fouling by calcium agents. *Wu et al.* report new results on the effect of mechanical scouring by Granular Activated Carbon on micro-filtration membrane fouling; the effects of permeate flux and mode of filtration are investigated. *Nagaraja et al.* report on the successful use of free radical-generating organic compounds which can degrade (in situ) polysaccharide (bio-)films.

Significant R&D activity is evident on the removal of inorganic species (in some cases for exploitation of brines), of undesirable organic compounds and micro-organisms, by novel processes. *Du et al.* present interesting results on the application of a hybrid PAC-MBR method to effectively remove iron, manganese and ammonia from groundwater. *Abdulkarem et al.* employ electro-kinetic cells, for pre-treatment of feedwater to SWRO plants, focusing on the reduction of undesirable ionic species (Ca, Mg, SO₄) and bacteria. *Aftab et al.* report significant new data on the performance of an Osmotic Membrane Bioreactor (OMBR) to remove heavy metals (Cr, Pb). *Nie et al.* investigate the use of electrodialysis (ED), with selective ion-exchange membranes, to separate lithium from magnesium ions from synthetic mixtures; application of such successful technology to Li-rich brines is of practical significance. *Camacho et al.* present an optimization study of a novel electrodialysis metathesis (EDM) desalination method that appears to be promising. *Chun et al.* report on the fouling performance of Forward Osmosis for pre-treatment of polluted water associated with coal seam gas production.

Improvement of methods for pretreatment of RO-plant feed-water is of great practical value. *Gwenaelle et al.* present interesting results on the use of micro-bubbles in membrane micro-filtration to improve the pretreatment of sea-water fed to RO plants. *Darwish et al.* investigate the micro-filtration (by PVDF membrane) of micro-sized suspensions of boron-selective resin; the effect of various system parameters on the efficiency of separation is investigated.

The vigorous research toward development of processes based on Membrane Distillation (MD) is also reflected in this Issue. *Kim et al.* report on a hybrid process, integrating Membrane Distillation (MD) with Crystallization (MDC) to treat the difficult shale-gas produced water (SGPW), aiming to increase the clean water recovery. *Alkhudhiri and Hilal* present the results of a detailed experimental study of high salinity fluids, treated by Air Gap Membrane Distillation. Various process parameters (e.g. energy consumption, permeate flux) are assessed. A novel electrospun dual-layer nonwoven membrane is assessed, by *Woo et al.*, for desalination by air gap membrane distillation. *Xing et al.* present results of an interesting pilot scale study, on the performance of multi-effect vacuum membrane distillation.

Finally, new RO designs and applications are manifestations of the versatility of the membrane-based desalination processes.

Haidari et al. report on an interesting RO design (PURO concept), to desalinate brackish groundwater, whereby the RO pressure vessels are placed vertically and accommodated in an especially drilled well.

This Guest Editor believes that major Conferences, such as MEMDES-2015, giving the opportunity to researchers and practitioners to interact, among other benefits, can facilitate prioritization of R&D issues and motivate young researchers, which are essential for progress in the rapidly expanding field of membrane water treatment. In this vein, it is

hoped that the special issue, emanating from MEMDES-2015, will make a positive contribution.

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