International Water Association

USANC Notes

United States of America National Committee of the International Water Association

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In This Issue

Website

http://www.iwahq.org/bw/membership/our-members/list-of-governing-members/usa.html

Contact USANC

Secretary/Treasurer
craig.adams@usu.edu

Craig D. Adams, Ph.D.
craig.adams@usu.edu

Chair's Message

The Future….. Shape or Be Shaped?

Having been a member of IWA for more years than I care to count, I am comfortable in making the observation that the Association, like none other in the collage of water associations, is adept at seeing the horizon and turning vision into programs/actions. One need only point to IWA's Cities of the Future, and Basins of the Future initiatives as illustrative. IWA indeed is striving to shape the future imperatives for water management versus being shaped by it.

IWA's draft Strategic Plan for the period 2014-2018 is currently being finalized and it is expected that the Association's Governing Assembly will adopt it this September in Lisbon. As IWA members in the United States, it will be our mission to support its implementation. In the coming months/years your USANC will translate the Plan into appropriate actions here stateside. Whatever the agenda may be, it must involve more than just the seven members of USANC. Will you help if requested? Will IWA's members in the U.S. step forward?

In the coming weeks, an election will be held relative to terms for USANC members that expired at the turn of this year (apologies for the delay). Thereafter, I will stand down as Chairman due to heightened business commitments. It has been a privilege to have had a turn at the helm and I believe USANC, which has recently established a supporting subcommittee structure and a biannual newsletter, is gaining traction to be of greater service to you. But, as a volunteer entity, its utility and degree of effectiveness will be predicated on **your** active engagement. Please step up, we need you! Be one to shape the future…….

Alan Vicory, Jr.
Chairperson

Nanotechnology and the Future of Desalination

By Stefan Urioc & Paul O'Callaghan

Desalination technology has undergone quantum improvements in the last 15 years. So much so that desalination energy costs have been halved, largely due to the use of pressure recovery devices. As we get closer now to the theoretical minimum energy required (circa 1kwhr at 50% recovery) it will be increasingly difficult to make additional gains on the reverse osmosis membrane and many are now focusing on better pre-treatment and the use of Pressure Retarded Osmosis to claw back some of the energy from thermodynamic energy stored in the brine concentrate.

Current seawater reverse osmosis (RO) desalination membranes require extensive pretreatment in order to protect the thin film composite (TFC) membranes, which are prone to the effects of membrane fouling and require chemical cleaning which adds to operational costs and shortens membrane life-span. Some potential step-change improvements could be provided through the use of nano-materials on the TFC membranes to utilize the phenomenon of quorum quenching which interrupts communications between bacteria that trigger the formation of biofilms. Other potential advancements include the use of carbon nano-tubes. Nanotubes are perfect pipes, as they lack roughness on the inner pipe wall. They are constituted of atomically flat planes of graphite that support fast fluid flow without backscattering (i.e. molecules bouncing back because of wall roughness). A major advancement from polyamide to carbon nanotubes membranes could significantly reshape the overall process, reducing capital and operational costs.

CNT membranes are characterized by fast flows, with a velocity of 30-40 cm/s. In comparison, aquaporin proteins that form pores in the membranes of biological cells have a velocity of 100 cm/s. Thus CNT cores have flow rates 4-5 orders of magnitude faster than simple Newtonian fluids.

Other potential advancements for CNT's include the addition of chemical particles at feed-side of nanotubes as selective chemical gatekeepers. They mimic the protein selectivity that natural membranes present in order to achieve ion selectivity. Electricity can be applied to achieve electro-osmosis, as graphite is a conductive material. CNT membrane fouling is resolved with the generation of hydrogen bubbles at the tip of the nanotube, removing any debris. Alternatively, pumping ions through CNTs clean the pipes.

A recent BlueTech Research webinar, *The Potential for Nanotechnology in Desalination,* featured Eric Hoek, CEO of Water Planet Engineering; Bruce Hinds, Materials Engineering Professor at the University of Kentucky; and Rob McGinnis, CEO of Nagare, as panellists. The webinar was moderated by Graeme Pierce, one of the world's leading experts in membrane technologies.

Panellists discussed performance prospects, the practicality of implementation, and the potential economic benefits of CNT. Discussion included the promising future of CNT.

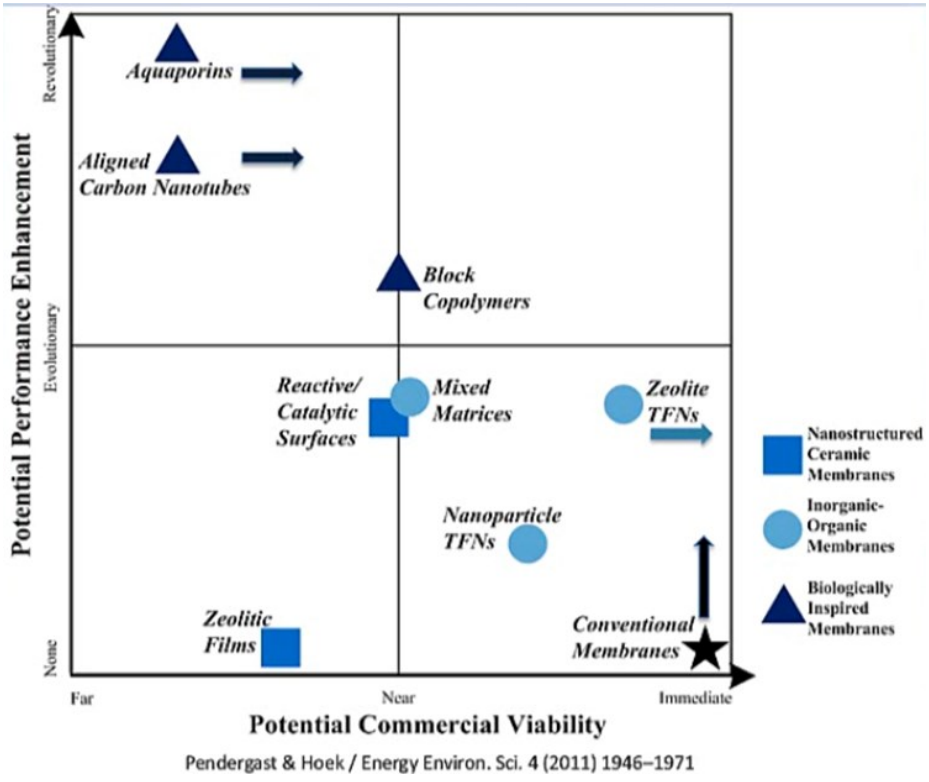
Continued on page 8

Nanotechnology and the Future of Desalination

(Continued from Page 7)

CNTs can be cleaned chemically or under high temperatures (e.g. steam cleaning). Panellist research highlighted that using carbon membranes in a new plant would offer cost reduction of capital costs up to 22% and chemical cost savings up to 76%. Using CNT membranes in retrofitting a plant would offer cost reductions up to 15% in energy cost, and chemical cost savings up to 76%.

Aligned CNT technology, along with aquaporin membranes, present high potential performance enhancement, but are still a number of years away from commercial viability. Other membrane technologies for desalination do not hold as much promise. Zeolite films are moving towards the commercial viability stage, although it has a lower potential performance enhancement. Block copolymers are also moving in the same direction, but possess medium potential performance enhancement. The most promising technology besides CNT is graphene, which has emerged in recent years, but is too early stage to confirm its potential.



Potential commercial viability and potential performance enhancement of different types of membrane technologies (Credit: Eric Hoek, CEO, Water Planet Engineering)

Stefan Urioc is a Water Technology Market Research Analyst for BlueTech Research. Stefan can be reached at stefan.urioc@bluetechresearch.com.

We want you to Contribute to USANC Notes

Are you doing innovative research you would like to share with others? Do you know of an upcoming conference or meeting of interest? Is there a suggested reading or new publication of interest? Would you like to make a call for contributors to a project? Do you know of a new funding opportunity? Is there a colleague that deserves special recognition?

Please share these notices with your USANC colleagues by contributing to the bi-annual Newsletter; USANC Notes. The deadline for contributions for the next issue is December 1, 2014.

Contributions and suggestions may be sent to the USANC Secretary/ Treasurer Craig D. Adams at craig.adams@usu.edu.