

Membranes in Drinking and Industrial Water Production

Leeuwarden, The Netherlands, 6–8 February 2017

Symposium on

Novel theoretical approaches for membrane transport processes in drinking water production

7 February 2017

Leeuwarden, The Netherlands

Chair Dr. M. Tedesco (Wetusus, The Netherlands)

Co-Chair Dr. J. Catalano (Aarhus University, Denmark)
Dr. P.M. Biesheuvel (Wetusus, The Netherlands)

General scope

The focus of this one-day symposium is presenting novel theoretical approaches to model membrane processes for drinking water production and related technologies. In particular, we aim to discuss theoretical approaches that focus on the microscopic level, i.e., modeling the membrane-solution interface, the membrane structure, and the single compartment, thus leaving out of scope larger scale modeling studies.

This symposium is driven by a renewed interest in the physics-based modeling of membrane processes, and the need for understanding the laws that all these membrane processes have in common at the fundamental level. Different scales of microscopic models, empirical models and phenomenological approaches all have their various applications. However, it is imperative to build bridges between these levels of modeling.

The symposium will focus on all the membrane processes that have pressure, electrical and osmotic effects as driving force. These include, but are not limited to: electrodialysis (ED), reverse electrodialysis (RED), reverse osmosis (RO), forward osmosis (FO), and membrane capacitive deionization (MCDI).

Overview of topics

- Ion sorption equilibrium and Donnan potential
- Modeling the membrane-solution interface
- Overlimiting current phenomena
- Water transport in ion exchange membranes
- Transport of multivalent ions
- Electrokinetics
- Non-Ohmic energy losses
- Polarization phenomena
- Modeling fouling phenomena
- Modeling pH effects
- Transport of organics
- Modeling membrane structure

List of speakers and titles

KEYNOTE: Kyle C. Smith

University of Illinois at Urbana-Champaign, USA

Desalination and energy-harvesting dynamics of (reverse) electro dialysis stacks utilizing intercalation electrodes

A. Ghoufi¹, E. Drazevic², A. Szymczyk¹

¹ Université de Rennes 1, France | ² Aarhus University, Denmark

Interactions of organics within hydrated selective layer of reverse osmosis desalination membrane: a combined experimental and computational study

C. Galinha, J. Crespo

Universidade Nova de Lisboa, Portugal

Hybrid modelling of membrane bioreactors integrating 2D fluorescence data

P.M. Biesheuvel

Wetsus, The Netherlands

Combined ion and water flow in ion exchange membranes and carbon nanotubes: From Space Charge theory to Stefan Maxwell, for single pores and full ED cells

J.E. Dykstra

Wageningen University | Wetsus, The Netherlands

Energy consumption modeling in membrane capacitive deionization

J. Catalano

Aarhus University, Denmark

Electrokinetic energy conversion with membranes: phenomenological vs. microscopic modelling and the effect of hydrodynamic slip

B. Balannec¹, H. Zhu², A. Ghoufi¹, A. Szymczyk¹

¹ Université de Rennes 1, France | ² Tongji University, Shanghai, China

Improving pressure-driven ion separations by nanoporous membranes with optimized pore geometry and surface charge density

T.M. Mubita^{1,2}, J.E. Dykstra^{1,2}, S. Porada², A. van der Wal¹

¹ Wageningen University | ² Wetsus, The Netherlands

Water desalination with wires: transport modeling for ideal and leaky membranes

S. Galier¹, A. Fuoco², G. De Luca², H. Roux-de Balmann¹

¹ Université Paul Sabatier, France | ² Istituto per la Tecnologia delle Membrane ITM-CNR, Italy

Molecular modelling of membrane-solute interactions in desalination systems using ion exchange membranes

M. Tedesco

Wetsus, The Netherlands

Theory and perspective of water desalination by shock electro dialysis

I. Hitsov^{1,2}, K. De Sitter², C. Dotremont², I. Nopens¹

¹ Ghent University | ² VITO, Belgium

Full-scale air gap membrane distillation (AGMD) model, opportunities for module design improvement

V. Freger, N. Fridman-Bishop, V. Kolev

Technion - Israel Institute of Technology, Israel

Ion Transport in Desalination Membranes: Recent Insights and Emerging Challenges

M. Manghi, B. Loubet, J. Palmeri

Université Paul Sabatier - Toulouse 3, France

Modeling dielectric exclusion effects in ionic transport through hydrophobic nanopores

S. Pawlowski, J. Crespo, S. Velizarov

Universidade Nova de Lisboa, Portugal

Modelling of reverse electrodialysis for improving its design and performance

D.A.M. de Winter¹, S. Porada¹, H.V.M. Hamelers¹, A. van der Wal², P.M. Biesheuvel¹

¹Wetsus | ²Wageningen University, The Netherlands

Carbon nanotube membranes: from paper to practice

J. Palmeri, A. Deratani

Université Montpellier, France

Signature of non-electrostatic interactions in nanofiltration

H. Wyss

TU Eindhoven, The Netherlands

Exploiting the physics of exclusion zone formation for water purification

S. Ahualli, M.M. Fernández, G.R. Iglesias, M.L. Jiménez, A.V. Delgado

Universidad de Granada, Spain

Effect of multi-valent ions on capacitive water desalination by soft electrodes

A. de Lichtervelde¹, A. ter Heijne¹, P.M. Biesheuvel²

¹Wageningen University | ²Wetsus, The Netherlands

Dynamic membrane theory for bioelectrochemical systems

G.C. Franken¹, J.E. Dykstra^{1,2}

¹Wetsus | ²Wageningen University, The Netherlands

Modelling ion transport and adsorption in porous carbon electrodes including the effect of chemical charge

C. Ersoy, M. Tedesco

Wetsus, The Netherlands

Identifying optimal membrane thickness for (reverse) electrodialysis

Y.S. Oren¹, R.G.H. Lammertink², P.M. Biesheuvel¹

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Ion transfer in reverse osmosis membranes