Ben-Gurion University of the Negev
Blaustein Institutes for Desert Research
The Swiss Institute for Dryland Environmental and Energy Research
Alexandre Yersin Department of Solar Energy and Environmental Physics

Title:

# Energy—Water Nexus: Viability of Pressure Retarded Osmosis

Speaker:

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Abstract:

One of the main challenges for the 21st century is the nexus of water and energy. Currently, different technologies are been developed to bridge over these challenges in a sustainable fashion. Pressure retarded osmosis (PRO) is an emerging membrane technology that utilizes salinity gradients to generate sustainable energy. Next-generation PRO approaches aim to harness the energetic potential of streams with high salinity differences such as wastewater and seawater desalination brine. In this study, we evaluated biofouling propensity in PRO and estimated the effect on system efficiency. Dynamic bench-scale experiments were carried out for 24 hours using a model wastewater feed solution inoculated with Pseudomonas aeruginosa bacterium and artificial seawater brine containing the model bacterium, Pseudoalteromonas atlantica. Permeate flux and pressure losses were measured during the experiment, while a full membrane autopsy was conducted at the end including confocal, scanning and transmission electron microscopy as well as other biochemical assays. Our results indicate that at the wastewater stream, irreversible biofilm developed throughout the spacer and the membrane support layer, resulting in ~50% permeate water flux decline. We also observed an increase in the pumping pressure required to force water through the spacer-filled feed channel, with pressure drop increasing from 6.4 ± 0.8 bar m−1 to 15.1 ± 2.6 bar m−1 due to spacer blockage from the developing biofilm. In contrast, no biofilm was found attached to the spacer or membrane at the seawater brine stream. We estimate the energetic losses due to biofouling may be greater than 40%, posing serious doubts regarding the feasibility of wastewater-brine pairing in PRO. We conclude that generating energy by PRO using wastewater and seawater brine may become possible mainly by using a new membrane design.

Tuesday, November 29, 2016, 11:00
Lecture room, Physics Building (ground floor)