



Power generation with salinity gradient by pressure retarded osmosis using concentrated brine from SWRO system and treated sewage as pure water

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ABSTRACT

Salinity power generation using hollow fiber modules was examined using the pressure-retarded osmosis (PRO) system between pure water and concentrated brine. Pure water and concentrated brine were supplied from a regional sewage treatment facility and sea water desalination (sea water reverse osmosis [SWRO]) plant. To minimize the effect of the concentration polarization near the membrane surface on the pure water side, the number of open ports in the module was increased from 3 to 4 and that modification was found to be effective because non-permeating pure water, which left the module through fourth port, flushed leaked salt from the brine side through the membrane. Our prototype PRO plant got the maximum output power density, 7.7 W/m^2 at a 2.5 MPa hydraulic pressure difference and a 38% permeation of pure water into the brine. To remove the organic foulant in the pure water, a low pressure Reverse Osmosis (RO) membrane and coagulation–sedimentation method with ozonation showed good results. However, the pressure drop across the RO membrane itself and cost concerns have not yet been solved. Based on the pure water's flow simulation, the hollow fiber element was found not to effectively work if the module and element for the SWRO were used without modification because the flow pattern of pure water and brine inside the module and element during the PRO operation was different from that during the RO operation.

Keywords: Pressure retarded osmosis; Concentrated brine; Hollow fiber module; Treated sewage; Fouling; Concentration polarization

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