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Nanofiltration process for seawater desalination–salt production integrated system

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ABSTRACT

A performance of three commercial nanofiltration membranes (NF200, NF270 and TFC-SR2 KOCH) was investigated in order to check their ability in the integrated UF-NF-RO-MED–crystallization seawater desalination system. The experiment was carried out using synthetic seawater solution. The TFC-SR2 KOCH membrane showed good separation properties and could be utilized in the integrated seawater desalination system with simultaneous production of evaporated salt. The rejection coefficients were found as follows (%): Ca^{2+} — 65.7, Mg^{2+} — 81, SO_4^{2-} — 95 and Cl^- — 23.7. Based on aforementioned experimental results and industrial plant operation data, the cost of seawater desalination in UF-NF-RO-MED–crystallization system was then estimated. The total water recovery (the sum of RO permeate, MED distillate and condensate from evaporation-crystallization process) was found as high as 78.2%. If 80% NaCl recovery is assumed (as related to MED brine) 17.1 kg of NaCl per 1 m^3 of UF permeate is obtained. Assuming \$30/t evaporated salt selling price, the cost of desalinated water has been estimated at \$0.5/m^3. The applying of "high boron rejection" RO membranes (boron rejection 93%), and then blending RO permeate with MED distillate (that is practically boron free) may decrease boron content below the value recommended by WHO. To the best of our knowledge, for the unit cost of desalinated water obtained from the system with capacity ca. 50,000 m^3/d, no better results are available in the accessible literature.

Keywords: Desalination; Integrated system; Nanofiltration; Salt production

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