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Toward Energy Efficient Reverse Osmosis Polyamide Thin Film Composite Membrane based on Diaminotoulene

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Thin film composite (TFC) membranes with polyamide (PA) as an active layer synthesized via interfacial polymerization (IP) are dominant in reverse osmosis (RO). This work report the development of TFC-PA-RO membrane that minimizes the energy consumption while maintains superior membrane separation properties. The TFC-PA-RO membranes were prepared by IPof 2,6 diaminotoluene (DAT) and trimesoyl chloride (TMC) on polysulfone (PS) support. The conventional monomer, m-phenelynediamine (MPD), is replaced by DAT monomer, DAT.These membranes were characterized by infrared spectroscopy, scanning electron microscope (SEM), and contact angle measurements.It was found that the optimum preparation conditions to obtain the highest performance of the synthesized membranes indicated soaking DAT (1 wt %) for 2 min, TMC (0.15 wt %) for 0.5 min and curing the resultant membrane at 75 ^{0}C for 5 min. The synthesized membranes by these conditions exhibited a salt rejection of 99.54 % and a permeate water flux of 11.4 L/m^2.h at bar operating pressure of 18 for 10 g L^{-1}NaCl solution. Also these membranes produced a salt rejection of 98.25 % and a permeate water flux of 9.3 L/m^2. h at 35 bar operating pressure for 35 g L^{-1}NaCl solution. This low pressure compared with the commercial membranes that operate at 55 bar for sea water desalination saves the energy consumed by the RO system to 1.29 kWh/m^3.

Keywords: Reverse Osmosis; Polyamide; Thin film composite; Membrane; Desalination