Thin film composite reverse osmosis membranes via co-solvent assisted interfacial polymerization

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Abstract:

This work focused on improving the performance of polyamide thin film composite membranes via co-solvent-assisted interfacial polymerization (CAIP) technique. In this study, we examined, compared, and optimized the effects of adding co-solvent (acetone) in hexane, heptane, and isopar G organic solvents on structural and physicochemical properties of the membrane. The membrane performance characteristics were also evaluated by analyzing the long-term stability and measuring the water flux and NaCl/$MgCl_2$ rejection. The synthesized membrane formed a narrow miscibility zone between the two solutions by reducing the solubility difference and interfacial tension, which ultimately formed a thicker reaction zone and a multi-layered polyamide structure. The water flux performance of the membrane at 2 wt.% of acetone showed a fold by increasing from 27.5 $Lm^{-2}h^{-1}$ (LMH) to 52 LMH, 26.54 LMH to 50.54 LMH, and 24.5 LMH to 44 LMH, for hexane, heptane, and isopar G-based membranes, respectively, with the negligible sacrifice of salt rejection. With co-solvent assisted interfacial polymerization, the membrane performance can be increased without compromising rejection and membrane strength. The CAIP membranes were found to be promising candidates for brackish water desalination and water treatment.

Keywords: Co-solvent assisted interfacial polymerization (CAIP), Polyamide, Thin-film composite, Reverse osmosis, Membrane fabrication