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Evaluation of a mixture of amines for the preparation of the polyamide layer of the thin-film nanocomposite membranes for forward osmosis

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ABSTRACT

Thin-film nanocomposite (TFN) forward osmosis membranes were prepared by incorporating halloysite nanotubes (HNTs) into the polyamide layer which formed by the interfacial polymerization (IP) reaction between the mixture of amines polyethylenimine (PEI): *m*-phenylenediamine (1:1) and trimesoyl chloride on the surface of polysulfone substrate. The surface hydrophilicity of the membranes was evaluated using contact angle goniometer. The surface morphological features of membranes were determined using atomic force microscope and field emission scanning electron microscope. The combined effect of using 1:1 mixture of amines with increased loading of HNTs into polyamide layer altered the membrane morphology first from nodular structures to ridge valley structures. Due to the presence of PEI during the IP process the resultant membranes experienced increased smoothness for the loading of HNTs. The loading of 0.05 wt% of HNT termed as an optimized composition and this membrane witnessed maximum flux of 44.6 L/m^{2}h at the active layer facing draw solution mode with relatively less reverse solute flux of 4.2 gMH. The TFN membranes exhibited stable flux during the fouling tests and easy cleaning efficiency due to their smooth and hydrophilic surfaces.

Keywords: Thin-film nanocomposite membrane; Polyethyleneimine; *m*-phenylenediamine; Antifouling

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