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IMPROVEMENT OF PERFORMANCE OF FORWARD OSMOSIS MEMBRANE BY INCORPORATION OF CARBON NANOTUBES TO REDUCE POLLUTION IN MARINE SYSTEMS

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Nowadays, the scarcity of fresh water has significantly constrained the sustainable development of public health, ecosystem and economy. To solve the global water scarcity problem, extensive studies have been undertaken to explore novel technologies for desalination and wastewater reclamation at acceptable cost. Although existing techniques for water treatment have resulted in considerable achievement, high energy consumption of the above processes restricts their further development. Alternatively, forward osmosis (FO) has drawn more and more attention in past decades. In this work, novel carbon nanotubes (CNTs) incorporated thin-film nanocomposite (TFN) membranes were fabricated by interfacial polymerization of m-phenylenediamine (MPD)/CNTs and trimesoylchloride (TMC) on polysulfone (PSf) substrate. Nanocomposite membranes thus prepared were characterized by Fourier transform infrared spectroscopy, scanning electron microscopy, atomic force microscopy and contact angle and evaluated in terms of membrane morphology, structure, surface property and separation performance. The effect of nano material composition and concentration of solutions drawn towards FO performance was studied and subsequently compared with that of traditional thin-film composite (TFC) membrane. It was found that CNTs had significant influence on the properties and the performances of synthesized FO membranes. Osmotic performance tests showed that CNT incorporated membranes achieved higher water flux and reverse salt flux selectivity, as compared to those of TFC membranes. The CNT impregnated membranes with a loading of 800 ppm exhibited a water flux of 28.6 L m^{-2} h^{-1}, which is 90.98% higher than that of the TFC membrane with a specific reverse salt flux of 0.12 g L^{-1} using 2 mol L^{-1} sodium chloride solution drawn against deionized water in the FO mode. This work indicates that the FO membranes prepared from multiwall CNTs on PSf substrates are promising for practical FO applications.

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