Surface modification of NF membrane via an environmentally friendly and rapid approach for desalination Process : Performance and stability evaluation

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ABSTRACT

In this study, an environmentally friendly and rapid surface modification method known as surface mineralization was adopted to alter the polyamide (PA) layer of commercial NF270 thin film composite (TFC) membrane, aiming to improve its characteristics for enhanced desalination process. An alternate soaking process was applied on the membrane surface by using barium chloride solution and sodium sulfate solution at varying concentrations (0.01 M, 0.05 M and 0.1 M). The reaction of these two salts can form a layer of barium sulfate ($BaSO_4$) minerals atop the PA layer via an ionic interaction. Our result revealed that the best-performing membrane could be developed using salt solutions at 0.05 M with its water contact angle descended to 33.5° compared to the pristine membrane of 46.4°. Furthermore, the surface roughness of the $BaSO_4$-mineralized membrane was reported to be higher than the pristine membrane. The increase in surface roughness together with improved surface hydrophilicity yielded the $BaSO_4$-mineralized membrane to exhibit 12% higher water flux than the pristine membrane. Nonetheless, the difference in Na_2SO_4 rejection before and after surface mineralization was not found to be statistically significant owing to the high Na_2SO_4 rejection of the control membrane. The $BaSO_4$-mineralized membrane also achieved excellent performance in filtering solutions containing sodium alginate and showed very stable salt rejection for multiple cycle of combined chemical cleaning and water filtration process. These results highlighted the potential of the surface mineralization process in overcoming the trade-off effect between water flux and selectivity of TFC membrane.

KEYWORDS

Fouling resistance; Nanofiltration; Surface mineralization, Barium sulphate; Thin film composite

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