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Preparation and characterization of surface-modified zeolite-polyamide thin film nanocomposite membranes for desalination

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ABSTRACT

NaA type zeolites were surface modified with octadecyltrichlorosilane (OTS) and then added in polyamide layer of thin film composite (TFC) membranes to prepare surface-modified zeolite-polyamide thin film nanocomposite (TFN) membranes for desalination. The zeolites were characterized by Fourier transform infrared spectroscopy (FT-IR) and X-ray diffraction (XRD). The properties of membranes were characterized by scanning electron microscopy (SEM), contact angle measurement, and the permeation experiment, respectively. The results showed that zeolites were successfully surface-modified with OTS without changing of its structure. The SEM images depicted that the membrane morphology was more homogeneous and the zeolites aggregation in membranes was ameliorated after the zeolites were surface modified. The results of contact angle measurement indicated that the hydrophilic property of membranes was not changed after the zeolites were modified with the long alkyl chain organosilane. The RO performance results verified that the flux of the modified-zeolite TFN membranes was all higher than that of the original-zeolite TFN membranes under the same conditions whereas the salt rejection was improved slightly. The flux of the TFN membranes with 0.05% (w/v) zeolite loading was increased from 28.5 to 40.9 l/m^{2}h, while the salt rejection was increased from 97.8% to 98.5% after the zeolite modification. The experimental results revealed that the modification of zeolites made the molecular sieve zeolite nanocrystals well dispersed in the polyamide thin film layer, and hence improved the water permeation while maintaining high solute rejection.

Keywords: Polyamide; Zeolite; Octadecyltrichlorosilane; Thin film nanocomposite; Reverse osmosis; Desalination

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