



## Synthesis of new modified MCM-41/PSF nanocomposite membrane for improvement of water permeation flux

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### ABSTRACT

The preparation of MCM-41 nanoparticles was made using tetraethylorthosilicate as silica source and cetyltrimethylammonium bromide as surfactant. The X-ray diffraction, transmission electron microscopy, laser particle size analysis and N<sub>2</sub> adsorption techniques were used for characterization of nanoparticles. The dimethyldichlorosilan (DMDCS) was applied to improve the dispersion of MCM-41 nanoparticles into the polysulfone (PSF) matrix. The investigation on the thermal stability with thermogravimetric analysis showed the enhanced stability of membranes possessing higher loading of MCM-41 nanoparticles. The scanning electron microscopy was used to evaluate the quality of particles dispersion and the result showed that the modification of MCM-41 particles by DMDCS caused good quality dispersion of particles in to the polymer matrix. In order to enhance the hydrophilicity of MCM-41 nanoparticles, modification by ethylene diamine was performed. Permeation performance of the prepared membranes was evaluated in terms of water content (WC) and pure water flux (PWF) and NaCl salt rejection. The WC of modified membranes increased compared to unmodified and neat polymeric membranes. The membranes, PWF permeation test showed that addition of modified MCM-41 nanoparticles led to increase in water permeation. The adequate NaCl, Na<sub>2</sub>SO<sub>4</sub>, and CaCl<sub>2</sub> salt rejection indicated that the nanofiltration process incorporating MCM-41 particles into the matrix of PSF is a promising candidate for desalination applications. The rejection results indicate that the charge (Donnan) exclusion mechanism is the dominant effect resulting in high salt rejection.

*Keywords:* Modified MCM-41; Polysulfone; DMDCS; Ethylene diamine; Water content; Pure water flux

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