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Novel pore size tuning method for the fabrication of ceramic multi-channel nanofiltration membrane

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Abstract:

A novel pore size tuning method was proposed for the fabrication of TiO_2 multi-channel nanofiltration membrane from TiO_2 ultrafiltration substrate using in situ chemical deposition. Titanium isopropoxide and isopropanol were employed as the precursor and solvent, respectively. The effects of solvent, precursor, pore size of ultrafiltration substrate, as well as thermal treatment temperature, on the performance of TiO_2 multi-channel nanofiltration membrane were studied. The optimized TiO_2 multi-channel nanofiltration membrane, prepared from ceramic ultrafiltration substrate with an MWCO of approximately 5 kDa, showed a high pure water permeability of approximately 20 $L \cdot m^{-2} \cdot h^{-1} \cdot bar^{-1}$ and a low MWCO of approximately 800 Da. The average membrane pore radius was tuned from 2.4 nm to 0.9 nm. The TiO_2 multi-channel nanofiltration membrane was successfully applied to the decolorization of sodium dehydroacetate. The decolorization rate was ~89.5%, and the sodium dehydroacetate recovery rate reached 98%, which is 2%-3% higher than that obtained using the traditional activated carbon decolorization process. The in situ chemical deposition method has great potential as a novel and facile pore size tuning technique for ceramic ultrafiltration membrane for the fabrication of the ceramic multi-channel nanofiltration membranes, especially for large-scale production.

Keywords:

ceramic membrane, nanofiltration, multi-channel, in situ chemical deposition