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Modified Colloidal Sol-gel Process for Fabrication of Titania Nanofiltration Membranes with Organic Additives

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Abstract

A modified colloidal sol-gel process with organic additives was proposed for the fabrication of TiO₂ NF membranes with a MWCO of ~820 Da and a water permeability of ~8 L/(m²·h·bar). The properties of the TiO₂ materials were greatly influenced by the modified route denoted Route B, but little difference was detected in the materials synthesized via the traditional route denoted Route A. For the TiO₂ materials prepared using Route B, the DLS analysis showed that the particle size of the TiO₂ hydrosol decreased as the amount of organics increased; the XRD patterns and TEM images confirmed the role of additives in restraining the TiO₂ grain growth and A→R transformation. This behavior may be explained by the lower packing and ordering of the nanoparticles, which would inhibit rearrangement among the nanoparticles and slow both the grain growth and phase transformation. After comparing the N₂ adsorption-desorption results, the TiO₂ material with 90 dwb% glycerin was optimized for forming NF membranes. Small organics were better for this process than larger ones. Finally, the TiO₂ NF membranes were fabricated using Route B, and the resultant membranes showed better retention properties compared to that of the TiO₂ membranes fabricated via Route A.

Keywords: titania; nanofiltration; membrane; modified; colloidal sol-gel process

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