



Preparation of Al₂O₃/PU/PVDF composite membrane and performance comparison with PVDF membrane, PU/PVDF blending membrane, and Al₂O₃/PVDF hybrid membrane

Jiali Dai¹, Kaijun Xiao*, Hao Dong¹, Wei Liao, Xu Tang, Zhihui Zhang, Sheng Cai

College of Light Industry and Food Sciences, South China University of Technology, 381 Wushan Road, Guangzhou 510640, P.R. China, Tel. +86 20 87113843; Fax: +86 20 87113843; email: fejxiao@scut.edu.cn (K. Xiao)

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ABSTRACT

In this study, Al₂O₃/polyurethane/polyvinylidene fluoride (Al₂O₃/PU/PVDF) composite membrane was prepared via the thermally induced phase separation process. Pure PVDF membrane, PU/PVDF blending membrane, and Al₂O₃/PVDF hybrid membrane were also prepared for comparison. These membranes were characterized by means of contact angle test, mechanical properties test, Fourier transform infrared (FT-IR) spectroscopy, atomic force microscopy (AFM), and differential scanning calorimetry (DSC). In addition, the separation performance of membranes was evaluated in terms of water flux and rejection ratio. The results showed that the Al₂O₃/PU/PVDF composite membrane had better hydrophilicity and mechanical properties compared with pure PVDF membrane, PU/PVDF blending membrane, and Al₂O₃/PVDF hybrid membrane. FT-IR test confirmed the introduction of the hydrophilic groups, such as hydroxyl and carbonyl, which are responsible for the enhancement of the hydrophilicity of Al₂O₃/PU/PVDF composite membrane. The AFM results showed that the Al₂O₃/PU/PVDF composite membrane had the lowest roughness, manifesting its improved anti-fouling properties. Furthermore, DSC results revealed that the crystallinity of PVDF polymer matrix decreased with the introduction of the functionalized Al₂O₃ nanoparticles.

Keywords: PVDF; PU; Hydrophilicity; Organic–inorganic composite membrane; AFM

*Corresponding author.

¹Jiali Dai and Hao Dong contributed equally to this work.