Preparation of PVDF/Al₂O₃ hybrid membrane via alkaline modification and chemical coupling process

Hao Dong, Kaijun Xiao*, Xiangli Li, Zhaomei Wang, Siyuan Guo

College of Light Industry and Food Sciences, Research Institute of Light Industry and Chemical Engineering, South China University of Technology, Guangzhou, 510640, P.R. China
Tel./Fax: +86 20 87113843; email: fekjxiao@scut.edu.cn

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ABSTRACT
Polyvinylidene fluoride PVDF/Al₂O₃ hybrid membrane (PAHM) was prepared via alkaline modification and chemical coupling using PVDF modified by KOH in the solution of methanol as a membrane-forming polymer, using vinyl-trimethoxy-silicane as a coupling agent and aluminum isopropoxide (AIP) as an inorganic precursor, respectively. PAHM, linking PVDF and Al₂O₃ with chemical bond, was obtained by sol–gel method. FT-IR spectroscopy, surface contact angle testing, differential scanning calorimetry, and atomic force microscope were applied to characterize the PAHM. The effects of the coupling agent on the structure and properties of the hybrid membrane were also investigated. The results showed that the hydrophilicity of the modified PVDF were the best with 5 wt% of KOH solution at 60˚C for 30 min. When PAHM is prepared with 1% coupling agent, the average pore size and the pure water flux decreased compared to PAHM without coupling agent, while the rejection rate significantly increased. Along with the increase in AIP concentration, the tensile strength and elongation at break of PAHM gradually improved, but both of them have a reduction when AIP concentration reached to 10% by weight. Compared with the original PVDF membrane, the flux attenuation coefficient of PAHM prepared by alkali-coupling agent modification declined from 45 to 27%, which means the antifouling performance of membrane improved markedly.

Keywords: Modified PVDF; Alkali modification; Coupling agent; Hydrophilicity; Organic–inorganic hybrid membrane

*Corresponding author.

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