



Sulfonated chitosan/polyvinyl alcohol/SiO₂ hybrid membrane for alkali recovery with diffusion dialysis

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ABSTRACT

Herein, chitosan (CS) is modified into sulfonated CS by reaction with 1, 3 propanesultone (PS) for obtaining ion exchange group. Then, to enhance their mechanical properties, polyvinyl alcohol (PVA) is blended, and tetraethyl orthosilicate (TEOS) is introduced into matrix to cross-link with sulfonated CS by sol-gel method. Eventually, a series of novel sulfonated CS/PVA/SiO₂ hybrid membrane with varied sulfonated CS content are prepared. On this basis, the effect of sulfonated CS content on physical and chemical properties is extensively investigated by ATR-FTIR, SEM, TGA and DMA studies. Those membranes have good homogeneity, thermal stability and flexibility. In addition, ion exchange capacity, water uptake and linear expansion in water also are tested. The results demonstrate that IEC augments from 0.10 mmol/g to 0.65 mmol/g with the increasing content of sulfonated CS content and the range of water uptake and linear expansion in water is 10–25%, 15–20%, respectively. Diffusion dialysis (DD) for alkali recovery is evaluated with NaOH/Na₂WO₄ mixture. Compared to the previously reported hybrid membranes, the developed membranes reveal excellent OH⁻ ion transport performance (U_{OH^-} : 0.0135–0.0160 m/h) and acceptable selectivity (S: 15.6–26.9). Therefore, the developed membranes have potential application in alkali recovery with DD.

Keywords: Sulfonated chitosan (CS); Polyvinyl alcohol (PVA); Hybrid membrane; Diffusion dialysis; Alkali recovery

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