Porous P84 co-polyimide anion exchange membranes for diffusion dialysis application to recover acids

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Abstract

Porous anion exchange membranes based on P84 co-polyimide are prepared by phase inversion process and applied to recover acids through diffusion dialysis (DD) for the first time. Recovery efficiency of sulfuric acid (H\textsubscript{2}SO\textsubscript{4}) from simulated titanium white waste liquor (H\textsubscript{2}SO\textsubscript{4}/FeSO\textsubscript{4} mixture), as well as the volume of water osmosis from diffusate (low concentration solution) to dialysate (high concentration solution), is determined by membrane morphologies and operation temperature. In addition, the optimized membrane is also tried to operate DD process of pure acetic acid (HAc). The optimized membrane, which is prepared by phase inversion in isopropanol, amination and then quaternization at 46°C, shows both high permeability and selectivity for H\textsubscript{2}SO\textsubscript{4}/FeSO\textsubscript{4} mixture. The dialysis coefficient of H\textsubscript{2}SO\textsubscript{4} ($U_{\text{H}}$) is 0.0069 m/h and the separation factor ($S$) is as high as 53.8, while the volume of water osmosis is 27 mL. The dialysis coefficient of HAc ($U_{\text{HAc}}$) is in the range 0.00239–0.0133 m/h under operation temperature of 15°C-45°C, and the volume of water osmosis is maintained ~3 mL. The membranes are promising for acids recovery due to their high permeability and selectivity.

Keywords: P84 co-polyimide; Porous; Anion exchange membrane; Diffusion dialysis; Acid recovery; Water osmosis

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