Membrane cross-linking to restrict water osmosis in continuous diffusion dialysis

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\textbf{A B S T R A C T}

Acidic HCl/glyphosate (Gly) liquor is produced largely during the production of Gly herbicide. The HCl component can be recovered by continuous diffusion dialysis (DD), while the Gly is precipitated maximumly at the pH ~1.5. Previous DD process showed that the Gly productivity is only 28.0% due to the serious water osmosis (2.0–2.9 × 10^{-4} m/h), which reduced the Gly concentration. Hence in this work, the water osmosis is restricted by membrane cross-linking. Polyvinyl alcohol (PVA) is cross-linked with glutaraldehyde (GA) together with tetra-methoxy silane (TMOS) or 3-aminopropyl-triethoxysilane (APTEOS) to prepare non-charged membranes. Continuous DD process shows that the water osmosis is reduced to 0.71–1.44 × 10^{-4} m/h. The optimized flow rate of acidic liquor is 0.34 L/(m^2 h) and the flow ratio between water and acidic liquor is 2:1. The membrane cross-linked with GA can have the recovered HCl concentration (\(C_{\text{d-H}}\)) of 0.93 mol/L, HCl recovery ratio (\(R_{\text{H}}\)) of 63.9\% and Gly rejection (\(\eta_{\text{Gly}}\)) of 99.5\%. The membrane cross-linked with GA and TMOS can have the \(C_{\text{d-H}}\) of 1.00 mol/L, \(R_{\text{H}}\) of 78.6\% and \(\eta_{\text{Gly}}\) of 96.8\%. Besides, 83.3\% Gly productivity can be obtained from the residual solution after concentration. Hence, the water osmosis is reduced and the Gly productivity is elevated by using the cross-linked membranes.

\textbf{Keywords:} Acid recovery; Diffusion dialysis; Glyphosate; PVA; Water osmosis

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