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Effect of Temperature on Pervaporation Performance of Ag-Poly Vinyl Alcohol Nanocomposite Membranes

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Abstract : Bio-ethanol is considered of higher potential as a green renewable energy source owing to its environmental benefits and its high efficiency. In the present study, silver nanoparticles were in-situ generated in a poly (vinyl alcohol) in order to improve its potentials for pervaporation of ethanol-water mixture using solution-casting. Effect of silver content on the pervaporation separation index and the enrichment factor of the membrane at 15 percentage mass water at 40°C was reported. Pervaporation data for nanocomposite membranes showed around 100% increase in the water permeance values while the intrinsic selectivity decreased. The water permeances of origin crosslinked PVA membrane, and the 2.5% silver loaded PVA membrane are 26.65 and 70.45 (g/m².kPa.h) respectively. The values of total flux and water flux are closed to each other, indicating that membranes could be effectively used to break the azeotropic point of ethanol-water. Effect of temperature on the pervaporation performance, permeation parameter and diffusion coefficient of both water and ethanol was discussed. The negative heat of sorption ΔHs values calculated on the basis of the estimated Arrhenius activation energy values indicating that the sorption process was controlled by Langmuir's mode. The overall results showed that the membrane containing 0.5 mass percentage of Ag salt exhibited excellent PV performance.

Keywords : bio-ethanol, diffusion coefficient, nanocomposite, pervaporation, poly (vinyl alcohol), silver nanoparticles
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