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Prediction of pervaporation performance of aqueous ethanol solutions based on single gas permeation

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ABSTRACT

In this study, pervaporation (PV) performance of porous silica membranes during dehydration of ethanol aqueous solutions was correlated with single gas permeation data in an attempt to predict PV performance. Porous silica membranes were prepared using a sol–gel technique with silica or cobalt-doped silica sols fired at different temperatures (from 350°C to 550°C) in air. Single gas permeation experiments were performed using pure gases (He, N_2, CO_2 and SF_6) at 200°C just after membrane preparation. PV experiments were carried out at 70°C at an ethanol feed concentration of 94 wt%. The time-course of PV performance and temperature-dependence for a single gas were investigated. The reproducibility of PV separation and gas permeation was investigated and confirmed. An attempt was made to find correlations between single gas permeation experimental data and PV separation performance. The permeance of He was reasonably well correlated with PV water flux. The permeance ratio of He/SF_6 was correlated with the PV separation factor.

Keywords: Pervaporation; Cobalt-doped silica membrane; Ethanol dehydration; Gas permeation

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