

Abstract

Pervaporation (PV) membranes made of a chitosan (CS) homogeneous membrane, poly (vinyl alcohol)-poly (acrylonitrile) (PVA–PAN) and chitosan-poly (vinyl alcohol)/poly (acrylonitrile) (CS–PVA/PAN) composite membranes for the separation of ethanol–water solutions were manufactured. The swelling behaviors of CS homogeneous membranes and CS–PVA/PAN composite membranes were measured. Effects of membrane thickness, CS–PVA concentrations in the coating solution, PVA concentrations in the CS–PVA blend polymer, ethanol concentrations in the feed solutions and feed solution temperatures on pervaporation performance for the ethanol–water mixtures are discussed. The experimental results showed that the separation factor (α) of CS–PVA/PAN composite membranes increased with an increase of PVA concentration in the CS–PVA blend polymer from 0 to 40 wt%. With an increase in the membrane thickness from 12 to 18 μm , the separation factor (α) of the CS–PVA/PAN composite membrane increased while permeation flux (J) decreased. With an increase of ethanol–water solution temperature, the separation factor (α) of CS membranes decreased and the permeation flux (J) of CS membrane increased while for the PVA–PAN and CS–PVA/PAN composite membranes they increased. The apparent activation energy (ΔE_a) of water for CS membranes was 34.3–59.5 KJ/mol and less than that of ethanol with 39.4–71.4 KJ/mol. The apparent activation energy (ΔE_a) of water for both PVA–PAN and CS–PVA/PAN membranes was twice as high as that of ethanol. The ΔE_a of water and ethanol for PVA/PAN and CS–PVA/PAN membranes was 13.6–61.6 KJ/mol, 3.3–15.1 KJ/mol, 41.0–60.6 KJ/mol, and 20.9–31.3 KJ/mol, respectively.