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Pervaporative dehydration of ethanol–water solution through asymmetric PC membrane surface modified via residual air plasma-induced graft polymerization of HEMA

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ABSTRACT

This study investigated on the surface modification of an asymmetric polycarbonate (PC) membrane by means of exposure to residual air plasma followed by graft polymerization with 2-hydroxyethyl methacrylate (HEMA) monomer. A tubular type of an evacuated reactor was used in the plasma-induced surface pretreatment. Surface grafting was conducted in a temperaturecontrolled shaking water bath. The degree of grafting was calculated by gravimetric means. Membrane characterizations were done with Fourier transform infrared spectroscopy, water contact angle measuring device, and scanning electron microscopy. The grafted PC membrane was tested for its pervaporation (PV) performance for dehydrating an aqueous ethyl alcohol solution by determining the permeation rate and the separation factor. We considered the monomer concentration, the plasma conditions, and the grafting time as the different parameters affecting the PV performance. In separating a 90 wt% ethanol in water at 25°C by PV, our findings showed that the PC membrane grafted with 30 wt% HEMA solution (PC-g-HEMA) attained the highest permeation flux of 380 g/m^2 h and separation factor of 410 (equivalent to 98 wt% water in the permeate). The conditions applied to produce such surface-modified PC film were 50 W and 90 s for the plasma treatment and 90 min and 80°C for the graft polymerization. The PV performance of the PC-g-HEMA membrane obtained from this study compared well with that of previously investigated flat-sheet membranes.

Keywords: Pervaporation; Asymmetric polycarbonate membrane; Residual air plasma; HEMA graft polymerization

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