Pervaporation of ethanol/water mixtures by zeolite filled sodium alginate membrane

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ABSTRACT

For a few decades, pervaporation (PV) has been considered as an energy saving, environmentally friendly and cost effective separation technique which separates close boiling point, azeotropic and thermally sensitive components. It is clearly well known that the PV has significant advantages in azeotropic mixtures separation where distillation needs an entrain solvent which must be removed in the following steps. The most important part of PV is the selection of the appropriate membrane. The inadequate selectivity and low flux values limited the expansion of this process. It is always assumed that efficient pervaporation means a membrane with good permeability and selectivity. In this work, sodium alginate (NaAlg) was used as the membrane material. Pristine NaAlg and zeolite 4A filled NaAlg mixed matrix membranes (MMMs) have been prepared by solution casting evaporation and cross-linking method. Phosphoric acid (PA) was used as the cross-linking agent. The morphologies of the membranes were studied using scanning electron microscopy (SEM), Thermogravimetric analysis (TGA) and Fourier transform infrared spectrophotometer (FTIR). Pervaporation performance of all membranes have been tested for dehydration of aqueous ethanol feed mixtures at 25°C. The effects of zeolite loading and feed composition have been investigated. With the adding of zeolite to the polymer, flux values increased. However, selectivity values decrease unexpectedly because of the interfacial voids which were formed between zeolite and the polymer. With increasing water content in the feed mixture, flux increased but selectivity decreased as expected.

Keywords: Pervaporation; Sodium alginate; Zeolite 4A

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