Study on the pervaporation separation and the preparation of polyion complex composite membranes for MTBE(methyl tert-butyl ether)/methanol mixtures

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1. Introduction

In this study, ionic polymers such as sodium alginate and chitosan, a typical hydrophilic material, were used as a membrane material for the separation of MTBE/methanol mixtures. Sodium alginate and chitosan which are ionic polymers of polysaccharides. and they are not only very hydrophilic, but also rigid bulky from a point of structural view. However, because those materials is reletively low long-time stability, they are unable to use as membrane materials. For this reason, the polyion complex membranes have been prepared by using their ionic groups, and the membrane performance was examined for the separation of MTBE/methanol mixtures. A comparison is carried out with the best of the currently proposed membranes.

2. Experimental

2.1. Membrane Preparation

SA solutions were prepared by dissolving SA in water. In order to prepare the polyion complex membranes of composite type, the pure SA composite membranes were prepared by dipping the skin layer side of polysulfone membranes into each SA solution and dried at room temperature. After the polyion complexation, the membrane was taken out of the chitosan solution, washed out several times with pure water to eliminate any possible residual chitosan solution, and dried at room temperature.

2.2. Pervaporation experiments

Pervapoation was performed in the feed mixture of 75/25 wt.% MTBE/methanol, and the fluxes J (kg/m^2hr), concentrations in feed and permeate(wt.%), and separation factors α were determined, respectively.

3. Results and Discussion

The overall polyion complex membranes showed very high permselectivity and permeability because of the excellent polarity and the relatively high free volume. With increasing polyion complexation, the permeation rate was decreased but the separation factor was increased highly. Especially, the permeation rate and the separation factor were increased simultaneously with increasing temperature. It was considered that the positive motion of polymer chains in membranes play a dominant role in increasing the

separation factor and excluding the diffusion of MTBE. The polyion complexation decreased the permeation activation energy of methanol. From these results, it was considered that the permeation behavior of MTBE/methanol mixture was determined by the change of the effective free volume in membranes.

4. References

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