일반강연 II-9

Pervaporation Separation of Water/Ethanol Mixtures through PBMA/anionic PAA IPN Membrane

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IPN (Interpenetrating Polymer Network) is a mixture of two or more crosslinked polymers with physically interlocked network structures between the component polymers. IPN can be classified as an alloy of thermosets and has the characteristics of thermosets such as the thermal resistance and chemical resistance and also has the characteristics of polymer alloys with enhanced impact resistance and amphoteric properties. The physical interlocking during the synthesis restricts the phase separation of the component polymer with chemical pinning process, thus the control of morphology is possible through variations of the reaction temperature and pressure, catalyst concentration and crosslinking agent concentration. Finely dispersed domain structure can be obtained through IPN synthesis of polymer components with gross immiscibility.

In membrane applications, particularly for the separation of liquid mixtures, crosslinked polymer component with specific affinity to the permeate is needed. With the presence of the permeant-inert polymer component, the mechanical strength and the selectivity of the membranes are enhanced by restricting the swelling of the transporting polymer component networks.

Poly(butyl methacrylate)/anionic PAA (PBMA/anionic PAA) membranes were prepared using the sequential polymerization method. Anionic charge was introduced in the PAA networks by treating with aqueous NaOH solution. The composition of hydrophilic polymer (PAA) was controlled by equilibrium swelling of acrylic acid monomer in hydrophobic component. Average molecular weight between crosslink ($\overline{M}_c$) was 2000 for the PBMA/anionic PAA IPN. The thickness of these membranes was about 80-90 μm. Pervaporation tests were carried out varying ethanol concentration of feed solution at room temperature and 60°C for 3 hours.

At room temperature, PBMA/anionic PAA IPN membrane ($\overline{M}_c$= 2000) had large separation factor ranging from 10 to 510 and relatively small permeation rate ranging from 32 to 95 g/m^{2}hr depending on the concentration of the feed mixture. Permeation rate increased and separation factor decreased with the increase of $\overline{M}_c$ of anionic PAA. At higher temperature, permeation rate increased by one order of magnitude but separation factor decreased significantly. (Fig. 1)

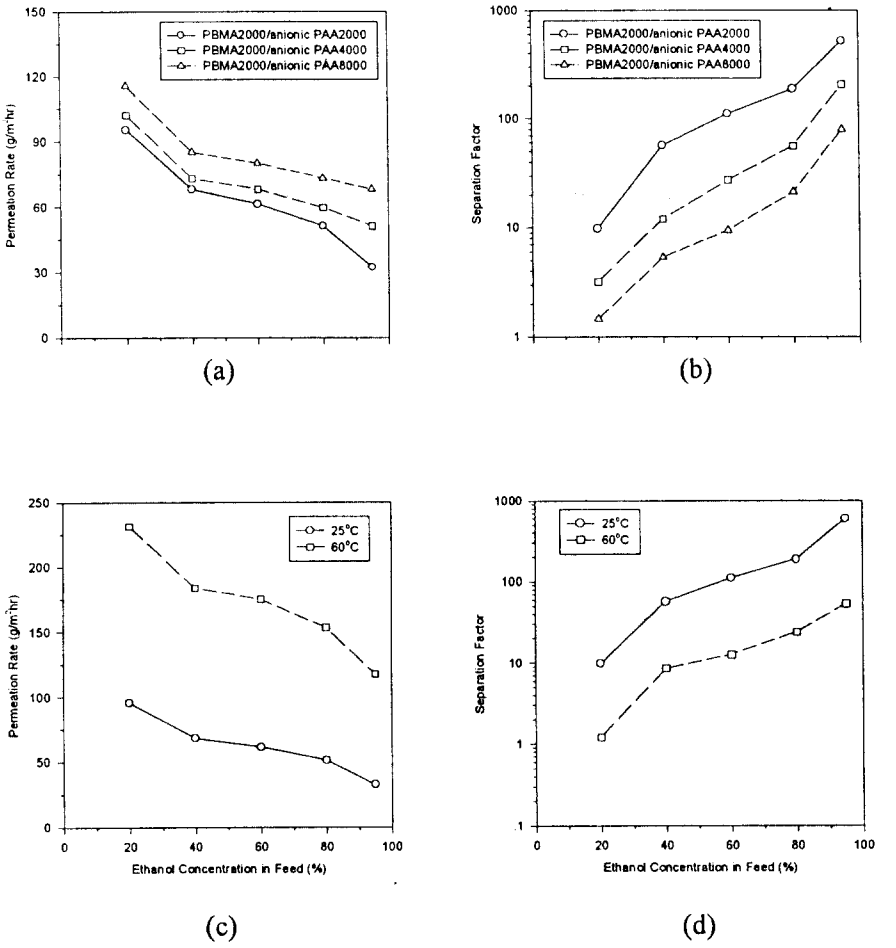

Fig. 1 Pervaporation Characteristics of PBMA/anionic PAA IPN Membranes
(a) Permeation Rate of various IPN Membranes
(b) Separation Factor of various IPN Membranes
(c) Effect of Feed Temperature on Permeation Rate
(d) Effect of Feed Temperature on Separation Factor

Reference

(1) Y. D. Kim, B. K. Lee, E. J. Jeon, Y. C. Shin and S. C. Kim, Macromol. Symp., **98**, 665, 1995
(2) E. J. Jeon, Y. S. Jin and S. C. Kim, Proc. ICOM '96, August, 1996