일반강연 II-6

Pervaporation Process for Water/Ethanol Mixture through IPN Membranes

Jeon Eun Jin, Kim Sung Chul*

DooSan Tech. Inst., KAIST Dept. of Chem. Eng*

The pervaporation behavior of EtOH/Water mixture through IPN membranes was predicted in this study. The pervaporation characteristics of single polymer membrane were modeled according to the "six-coefficients model" proposed by Brun. In the case of the IPN membrane, two models were proposed according to the phase structure of the IPN. For a uniphase membrane with no phase separation, the compositional average of the single polymer membrane was used. In the case of the phase separated IPN's two cases existed. The first was the island and sea model: in which one phase was continuous and the other was dispersed. The second was the co-continuous model where two continuous phases existed. For these cases, the permeation rate and the separation factor of the IPN membrane were calculated using the experimental sorption data and the component polymer properties. Comparison with the experimental data indicated that these models could be used to predict the performances of IPN membranes depending on the morphology of the IPN.

Poly(styrene-co-acrylonitrile)/anionic poly(acrylic acid) (SAN/ (anionic PAA)) IPN and (porous SAN)/(anionic PAA) membranes were prepared using the sequential polymerization method, and the pervaporation characteristics of ethanol/water mixtures and morphology were studied. Anionic charge was introduced in the PAA network by treating with aqueous NaOH solution. Preferential pervaporation of water and high permeation rate were observed in these IPN membranes. The permeation rate showed a maximum at pure water and decreased continuously with increasing ethanol concentration in the feed. In the case of the

SAN/(anionic PAA) IPN membranes, the separation factor showed a maximum at around 30wt% ethanol in the feed. The permeation characteristics of the IPN membrane were dominated by the anionic poly(acrylic acid) phase which was more hydrophilic than SAN, formed the continuous phase and acted as the transporting phase in the IPN membrane. In the case of (porous SAN)/(anionic PAA) IPN membranes, the porous SAN phase formed the continuous phase and the anionic PAA filled the pores in SAN. In this case, permeants pass through the pores filled with anionic PAA in the SAN network, and the SAN network suppressed the swelling of the anionic PAA domain effectively when the water concentration was high.

The pervaporation process was modeled using the continuous stirred tank type module and the continuous channel type module. The performance of the continuous channel type module was better than that of the continuous stirred tank type module, the continuous polarization was a very serious problem to decrease the efficiency of the process. The increase in permeation rate increased the concentration polarization, but the separation factor had small influence on the concentration polarization. The objective function was defined as the multiplication of output flow rate of ethanol and the square of ethanol fraction in the feed. It was observed that the optimum permeation rate to give a maximum objective function increased with increased separation factor continuously at constant permeation rate. The shift of the optimum permeation rate. The shift of the optimum permeation rate to lower values was ovserved with increasing the ethaol concentration in the feed.

objective function <flux & sepa. factor>

[illegible]