Separation of Water/Ethanol Mixtures by Cellulose/PAN Blend Membranes

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Pervaporation is a membrane separation process that can be used for the separation of liquid mixtures. Especially, the pervaporation technique is attractive when the amount of the component that has to be removed is relatively small, e.g.the separation of azeotropic or isomeric liquid mixtures at a concentration near one of the pure components, the removal of small amounts of water from organic solvents etc. Because liquid mixtires can not be separated through porous membranes the pervaporation membranes have to be fully dense or composite membranes. In case of dehydrating process the hydrophilicity of membrane material plays an important role in controlling membrane performance. Because of preferential affinity to water molecule, cellulosic polymers are thought to be very important and potential materials for the membranes dehydrating organic liquids.

In this work we studied dehydration of ethanol by pervaporation through cellulose blend membranes. Blend films of cellulose/polyacrylonitrile were obtained from solutions in N,N-dimethylacetamide/lithium chloride by coagulation in a non-solvent. Visual inspection gave no indication of phase separation in the regions above 60 wt% cellulose content. Pemeation of ethanol/water mixtures was carried out by ordinary pervaporation technique. The feed was stirred by circulation method and the membrane area in contact with liquid was 19.63cm^2. Pervaporation experiment was carried out at constant temperature, 30℃. The permeate compositions were analyzed by GC equipped with a 1.8m-long column packed with Porapak Q.

For blends investigated water permeated preferentially from a feed mixture of ethanol and water. The flux of the blend membranes increses with decreasing ethanol concentration in the feed, whereas the selectivity decreses. Flux decreases by increasing the content of PAN, the highly water selective and low permeating polymer, but selectivity increases. The equilibrium sorption experiments at 30℃ showed that for increasing PAN content the total swelling decreased which is in accordance with pervaporation behavior.