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물/피리딘 혼합물 분리용 PAN계 공중합막

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PAN based-based copolymer membranes for dehydration of water/pyridine mixture

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1. Introduction

We have researched to separate water effectively from aqueous pyridine solution. In our previous papers, we have proposed new separation mechanism, *in-situ* complex, which is different from solution-diffusion and accelerated transport by hydrogen bonding [1,2]. We have adopted *in-situ* complex mechanism to membranes containing phosphoric acids as well as acrylic acid and sulfonic acid in copolymer for dehydration of pyridine.

2. Experimental

Synthetic copolymers are designated as PANAA, PANSS, PANPH, PANVP and PJAMP depending on the comonomers as shown in Table 1. 250ml distilled water was placed in a four-necked-round flask under nitrogen atmosphere. After sufficient nitrogen purge, surfactant, sodium lauryl sulfate (SLS), was added into the flask. Then, predetermined amounts (total 30g) of acrylonitrile and comonomers were poured. KPS (0.5g) was added after heating the mixture up to 70℃. The copolymerization was carried out at 70℃ with continuous stirring and nitrogen atmosphere for 3 hours. After copolymerization, the mixture was filtered with filter paper and washed with toluene. Copolymers were dried in vacuum oven at 50℃ for 2 days.

Synthetic copolymers were dissolved in 3wt% DMF solution with mechanical stirring and heating. The solution was poured into glass plate after filtration with glass filter. Then, the solvent was allowed to evaporate at 50℃ in a vacuum oven. The evaporated solution was dipped into water bath to separate the membrane from the glass plate.

Table 1 Synthetic conditions and designation of copolymers

Sample	Acrylonitrile		Comonomers		KPS	SLS
	Wt%	Mole%	Wt%	Mole%	(g)	(g)
PANAA	76.35	81.43	23.65	18.57	0.82	0.18
PANSS	96.65	97.51	3.35	2.49	0.54	0.18
PANPH	90	97.08	10	2.92	0.15	-
PANVP	85	92.02	15	7.98	0.15	-
PJAMP	90	69.44	10	30.56	0.30	-

3. Result and Discussion

Pervaporation performances of water-pyridine mixture through PAN based-copolymer membranes depended on properties of comonomer in copolymer membranes and operating temperature. The flux through all the PAN based-copolymer membranes increased with operating temperature. Flux through PANAA and PANSS membranes especially showed higher values than that of the phosphorus containing membranes. It can also be proved that PAN based-copolymer membranes show still high water concentration in permeate although operating temperature increases. The reason is obviously due to *in-situ* complex formation between pyridine from feed and acid moieties in copolymer membranes. Because *in-situ* complex is formed between acid component in the membrane and pyridine from the feed, these membranes interact with water molecules in the feed and induced ion-dipole interaction, which promotes water transport from aqueous pyridine solution.

4. References

1. B. K. Oh and Y. M. Lee, Effects of functional group and operating temperature on the seperation of pyridine-water mixture by pervaporation, J. Membrane. Sci., 113 (1996) 183.
2. Y. M. Lee and B. K. Oh, *In-situ* complex membrane : Dehydration of pyridine aqueous solution by pervaporation, Macromol. Symp. 118 (1997) 425.