

Membrane distillation process with laminating membranes of positive and negative charges for evaporation of concentrated salt solutions

Masao SUDOH and Katsuhiko SUZUKI

*Department of Chemical Engineering
Shizuoka University, Hamamatsu 432 Japan*

Summary

The permeation flux of water in membrane distillation is affected by membrane properties, vapor pressure of the membrane and also operational conditions. Since the vapor pressure is related with the concentration of aqueous salt solution, the vapor flux through the pervaporation membrane is decreased with increasing concentration of the salt solution. The permeation characteristics using charged membranes prepared by plasma-grafted polymerization was compared with those using a hydrophobic PTFE film and ion-exchange membrane such as Nafion film.

The permeation flux using a hydrophobic PTFE membrane was linearly proportional to the difference in the vapor pressure of the opposite sides of the membrane. The transport properties of vapor through an ion-exchange membrane was analysed by a solution-diffusion model. In plasma polymerization, acrylic acid was grafted on the surface of the film. The resultant membrane had the grafting degree up to $5.8 \times 10^{-3} \text{ kg} \cdot \text{m}^{-3}$ and fixed charge density up to $26 \text{ kmol} \cdot \text{m}^{-3}$ -water in membrane. The Donnan exclusion by fixed charges of poly(acrylic acid) resulted in the increase in the vapor-permeation flux rather than the non-charged membrane.