Proposal of a new evaluation method of RO performance using dialysis

Kensaku Mizoguchi and Shigetoshi Matsui
Dept. of Materials Sci. & Chem. Eng.,Shizuoka Univ.

Summary

In order to evaluate RO separation performance of newly developed polymeric materials easily, a two stage dialysis method is proposed, in which high pressure is not necessary to be applied.

Through the method, three parameters of membrane permeation : L_p (water permeability), σ (reflection coefficient of salt) and ω (salt permeability) can be estimated.

In the first stage dialysis, by changing salt concentration of one side cell of the membrane, a combined value of $L_p\sigma$ can be obtained. To determine the values of L_p and σ, independently, the second dialysis should be carried out where the third substance with larger size molecule is added which can generate osmotic pressure without its permeation (σ =1). From the result, it is possible to get L_p and then σ. For a cellulose acetate membrane, the three parameters obtained agreed fairly well to the reported ones for RO experiment.

In this fiscal year, first of all, effects of rotating speed of stirrer in dialysis cells on permeation fluxes were examined to analyze degree of concentration polarization. In the dialysis system applied, it was found that the rotating speed should be beyond 600rpm to avoid concentration polarization.

Then, the three parameters were measured with a prepared CA membrane and a commercial RO membrane using the two stage dialysis method. Moreover, the parameters were determined from RO experiment (NaCl: 0.1mol/l, 30atm), too. By comparing these data, the following results were obtained:

1. For both of the membranes, the reflection coefficient σ of RO experiment is larger than that of dialysis.
2. For both of the membranes, the values of water permeability and salt permeability of RO experiment are larger than those of dialysis.

From those results, a model concerning structure change of membrane was proposed that fine channels would be formed due to discharge of free water in the membrane by high pressure applied at an RO experiment. Accumulation of these results is useful to build up a new method to evaluate the RO performance for newly developed polymers.