Permselectivity between anions through anion exchange membranes whose graft chains can control their hydrophobicity

Mitsuru Higa[1], Koji Matsusaki[2], Kenji Hori[1], Akio Kamimura[1] and Nobutaka Endo[1]

[1]Department of Applied Chemistry and Chemical Engineering, Yamaguchi University

[2] Applied Medical Engineering Science, Graduate School of Medicine, Yamaguchi University

Summary

We made hydrogel membranes that has permselectivity between nitrate and fluoride ions. A temperature-responsive polymer was obtained by *in situ* polymerization of *N*-isopropylacrylamide in a poly(vinyl alcohol)(PVA) solution. A non-charged membrane was prepared from the polymer and by crosslinking it with a glutaraldehyde(GA) solutions, changing PVA content, C_{PVA}, and GA concentration, C_{GA}, in order to investigate the effect of hydrophilicity of the membrane on the permeability of nitrate and fluoride ions. An anion exchange membrane was also prepared from the polymer obtained and poly(allylamine). The permeation experiment in a dialysis system consisting of the non charged membrane and mixed salt solutions shows that the permeability coefficient of fluoride ions, P_F, is higher than that of nitrate ions, P_{NO3}, when C_{PVA} is low. On the other hand, P_{NO3} is higher than P_F when C_{PVA} is high because the hydrophilicity of the membrane decreases with C_{PVA}. Both P_{NO3} and P_F decrease with increasing C_{GA} because the hydrophilicity of the membrane decreases with increasing C_{GA}. These results indicate that the permselectivity of anions with same sign and same valence through a membrane can be controlled by changing the hydrophilicity of the membrane.

The water content of the anion exchange membrane at 25°C has higher values than that at 50°C and the values both at 25°C and at 50°C increase with increasing of the PAAm content in the membrane, C_{PMMA}. The membrane potential experiments show that the membrane charge density of the anion exchange membrane at 50°C has higher values than that at 25°C because of the difference of the water content at the two temperatures. The permselectivity across the anion exchange membrane will also be controlled by changing temperature.