

## Selective Separation of Potassium Ion in Seawater by Crown Ether Derivatives

Masahiro Muraoka

Department of Applied Chemistry, Faculty of Engineering, Osaka Institute of Technology

### Summary

Much attention has been devoted to the characteristic complexation properties of crown ethers and the related analogous compounds toward a variety of cations. A lot of methods to evaluate the complexation properties of host molecules toward guest cations have been developed in the field of supramolecular chemistry. Liquid membrane transport of metal cations is an important one of such evaluation methods and is also one of the effective separation techniques for metal cations. In a bulk liquid membrane transport system, 18-crown-6 was found to be a selective ionophore toward  $K^+$  based on the size fitness of the cation and the crown ring. Monoaza-18-crown-6, 15-crown-5 and 12-crown-4 ethers can selectively transport  $K^+$ ,  $Na^+$ , and  $Li^+$ , respectively. Compared with a bulk liquid membrane, a supported liquid membrane is considered to be more practical; whereas, the stability of the membrane must become a serious problem because of the much smaller volume ratio of organic membrane to aqueous phase. From this standpoint, we examined some solvents suitable for a supported liquid membrane transport and found that a mixture of 2-(perfluorohexyl)ethanol and 2-(perfluorooctyl)ethanol was an efficient solvent when used with a polytetrafluoroethylene (PTFE) membrane filter as the support. In this transport system, a monoaza-18-crown-6 derivative having a 2-(perfluorohexyl)ethyl group as the substituent was used as the selective carrier for  $K^+$ . Recently, a lipophilic monoazacryptand consisting of two 18-crown-6 rings and one 20-crown-6 ring was found to show an excellent  $K^+$  selectivity superior to the corresponding monoaza-18-crown-6 in a bulk liquid membrane transport. In this paper, we describe preparation and transport ability of a lipophilic monoazacryptand [20.18.18] derivative containing a 2-(perfluorooctyl)ethyl substituent in a supported membrane transport system in comparison with the corresponding monoaza-18-crown-6 and 15-crown-5 ethers.

In competitive passive transport of  $K^+$ ,  $Na^+$ , and  $Li^+$  under neutral conditions, the  $K^+$  selectivity increased in the order: monoaza-15-crown-5 < monoaza-18-crown-6 < monoazacryptand; whereas, the transport velocity increased in the order: monoaza-15-crown-5 < monoazacryptand < monoaza-18-crown-6. On the other hand, only monoazacryptand successfully transported  $K^+$  in the transport from the neutral source phase to the acidic receiving phase. This result was reasonably explained by considering the excellent  $K^+$  complexing ability of monoazacryptand in comparison with that of monoazacrown ethers.