

Specific Binding of Metal Ions by Self-Organized Hosts

Yoshiaki Kobuke and Yasutaka Tanaka

*Department of Materials Science, Faculty of Engineering,
Shizuoka University, Johoku, Hamamatsu 432*

Summary

In order to extract and separate varieties of metal ions from seawater, novel ideas for the design of hosts have been developed. In place of "preorganization", which has long been the leading philosophy for the design of crown ethers, a new series of hosts, although linear on synthesis but capable of being organized by the complexation with transition metal ions into macrocyclic or macrobicyclic structures, were designed and synthesized.

According to this line, two or three units of β -diketone and catechol were attached to the ends of oligoethylene glycol or tris(hydroxyethoxy)ethane. These hosts were organized smoothly by the intramolecular complexation with Cu(II) or Cr(III) to give rise to the formation of two- or three-dimensionally organized hosts, respectively.

Alkali and alkaline earth metal ions were extracted efficiently from aqueous into organic phase by the use of these organized hosts. The selectivity obeyed the "fit principle" between the hole size of the hosts and ionic radius of the metal ion. Among the hosts, the Cu(II) complex of bis(acetylacetyl)-oligophenylene glycol showed the highest extraction with an excellent selectivity showing the maximum at K^+ and Sr^{2+} in the alkali or alkaline earth metal ions, respectively. The extraction was much higher than those by the use of dibenzo-18-crown-6. This demonstrates a clear advantage of the use of these self-organized hosts, since β -ketoenolate anion developed by the transition metal complexation assists the extraction of typical metal ions.

Three dimensional arrangement of hosts was found to be easily accomplished by the intramolecular complexation with transition metals.