

Studies on K⁺ Selective Sensor by Use of Self-Organized Hosts

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Summary

We have developed an idea of allosteric binding of metal cation M_2 into the host organized by complexation of "pre"host with transition metals M_1 . Herein the open chain compound, bis(β -diketone)-oligophenylenether 1 as a class of "pre"host was self-organized by the complexation with Cu^{2+} , Zn^{2+} , Ni^{2+} to metal-assisted crown ethers 2(M_1).

The crystal structure of the complex between 2(Cu) and K^+ picrate was determined by the X-ray analysis. Here, the planar tetradentate coordination of two β -diketonate units was finally established and furthermore the important contribution of β -ketonate anions to the coordination to K^+ was strongly suggested.

The extraction of metal picrates by these metal-assisted hosts exhibited maximum extraction at K^+ and Sr^{2+} cations in the series of alkali and alkaline earth metal cations, respectively. The difference of the organizing transition metals was found to have significant influence on the relative extractability of alkali to alkaline earth group ions.

External ligation by such ligands as phenathroline, quinoline or quinoline-carboxylic acid improved the extraction of metal cations and enabled the extraction of cation only without incorporating additional counter anions.

The extraction of metal cations by these metal-assisted hosts was significantly influenced by the choice of counter cation. When anilidonaphthalenesulfonate was employed, the extraction percentage showed the highest values to give much higher ones compared with the case of dibenzo-18-crown-6. The system responded to the variation of K^+ concentrations in the aqueous phase up to as low as 10^{-5} M by the use of technique of fluorescence detection.