New Polymeric Adsorbents Prepared by Surface Template Polymerization for the Highly Selective Adsorption of Li(I) in Sea Water

Akihiro Sakoguchi and Fumiyuki Nakashio
Department of Applied Chemistry, Faculty of Engineering, Sojo University

Summary

Our goal in this study is to develop the new polymeric adsorbents for the highly selective adsorption of Li(I) in sea water.

Li(I) selective polymeric adsorbents were prepared by means of a surface template polymerization. Fluorine-containing β-diketone (1,1,1,2,2-pentafluoro-3,5-hexadecanedione, C_{11}pFβDK) was newly synthesized and used as the functional host with neutral phosphorus compound (trioctylphosphine oxide, TOPO). C_{11}pFβDK and TOPO have a high extractability to Li(I), therefore Li(I) forms a complex with the functional hosts at the oil-water interface of W/O emulsions. Li(I) complex is imprinted on the surface of organic resins after the oil phase, in which divinylbenzene was used as the cross-linking agent, in the W/O emulsions is polymerized.

The Li(I)-imprinted polymers prepared with C_{11}pFβDK and TOPO exhibited high adsorption ability towards Li(I) over Na(I). On the other hand, the Li(I)-imprinted polymers prepared with C_{11}pFβDK or TOPO alone did not adsorb Li(I). Li(I) was synergistically adsorbed with the Li(I)-imprinted polymers prepared with the functional hosts (C_{11}pFβDK and TOPO), which Li(I) was synergistically extracted with.

The ability of the Li(I)-imprinted polymers prepared with C_{11}pFβDK and TOPO to adsorb Li(I) is significantly higher than that prepared with 1-phenyl-1,3-tetradecanedione (C_{11}PhβDK) and TOPO. Fluorine of the functional molecule, C_{11}pFβDK, is considered to play an important role in Li(I) adsorption.

We also synthesized the new bifunctional extractant, 15-phenyl-13,15-dioxopentadecyl-diphenyl phosphinate (PhβDK-C_{12}-DPhP) and used the extractant as the functional host for preparing the Li(I)-imprinted polymers. PhβDK-C_{12}-DPhP and the Li(I)-imprinted polymers prepared with PhβDK-C_{12}-DPhP showed comparatively low ability to extract and adsorb Li(I), respectively. We will synthesize new fluorine-containing bifunctional extractants and prepare the Li(I)-imprinted polymers with the new extractants to achieve high adsorption ability towards Li(I).