No. 1502

Development of Thermoresponsive Ion-Exchange Material to Obtain Valuable Metals from the Seawater

Masaki OKADA

Nihon University

Summary

Towards the development of acquisition technology for valuable metal ions from the sea water, it has been aimed to develop a new ion-trapping material and to propose a selective condensation process for the specific ionic species. Previously acquisition methods for the metal ions using various ion-exchange materials have been studied. And existing researches showed excellent results on selective concentration of target metal ions. However, there is environmentally and economically problem because of a use of the acid solution to release the concentrated metal ions. Therefore, this application study aimed at the development of the ion-exchange material having a high selectivity for a specific ion was based on point of view of environmental impact. In this research, it was applied a metal-organic frameworks (MOFs), which has a controllability on diameter of pore size and on the characteristics of the pore inside, to a condensation of Li^+ existing trace amount in the seawater. MOFs have regular structures that are composed of various metal ions (or clusters) and organic linker, and it is possible to apply various physical and chemical properties by molecular size and functional group on the organic linker. The MOFs, which have freedom on design, has attracted attention as a porous material to replace the zeolite used in commercially process. In specially, the synthesis of new MOFs toward to use as a gas storage material or catalyst has been tried very energetically. On the other hand, the MOF have not been actively attempted use in an aqueous solution system because the structure is formed by coordination bond. In this research, the acquisition characteristic of Li^+ was assessed, and an influence of the treatment in aqueous solution on the structure was studied. As a result, a selective capture capacity for Li^+ was confirmed when the MIL-53 was used. The trapped amount of Li^+ was about 10 mgs g^{-1}-MIL-53 from the sample solution of the initial concentration 100ppm under a temperature of 308 K. On the other hand, the trapped amount of Mg^{2+} or Na^+ under the same condition was a few mg g^{-1}-MIL-53. Therefore, we evaluated the desorption behavior of Li^+. As a result, about 60% of the trapped ion was recovered by treatment with warm water (318 K).