No. 1015

Polymeric Pseudo-Liquid Membranes for Recovery of Marine Metal Resources

Masakazu Yoshikawa

Department of Biomolecular Engineering
Kyoto Institute of Technology

Summary

Separation of mixtures with similar or same molecular dimensions will be attained by using a membrane bearing molecular recognition compounds or functional moieties, expressing molecular recognition ability toward the target substrate. In such a case, there are a couple of membrane systems, such as a liquid membrane and a fixed-carrier membrane, in which molecular recognition materials or functional moieties working as molecular recognition sites are attached to polymeric membranes via covalent bond. A liquid membrane with a transporter for a target molecule will directly reflect the affinity between the transporter and a given target substrate. Construction of liquid membrane is easier than that of fixed-carrier membrane, in other words, a liquid membrane would be constructed by one easy operation, dissolution of transporter into solvent. However, liquid membrane has drawback in long-term stability, such as the evaporation of the membrane solution and "wash-out" of the transporter and/or transporter/target molecule complex during the operation. Overcoming those drawbacks mentioned above, liquid membranes would be a promising and mighty method to separate a target substrate from a mixture containing compounds with similar or same molecular dimensions and showing similar or same chemical and/or physical properties. A polymeric pseudo-liquid membrane is expected to give durable liquid membrane systems.

Novel liquid membrane system, which has been named polymeric pseudo-liquid membrane, were constructed from poly(2-ethylhexyl acrylate) (P2EHA), which showed rubbery state under operating conditions, as a membrane matrix and dibenzo-18-crown-6 (DB18C6) as a model transporter. The membrane performance was studied, adopting KCl as a model substrate. The present polymeric pseudo-liquid membranes transported KCl. The transport rate of K^+ was dependent on the concentration of transporter within the membrane and on the square of the concentration difference across the membrane, implying that the membrane transport was attained by carrier-diffusion mechanism. The membrane transport ability was greatly affected by molecular weight of membrane matrix. The K^+ flux was increased with the decrease in molecular weight of membrane matrix, P2EHA. The flux was also dependent on the operating temperature; the transport rate of K^+ was increased with rise in the operating temperature. The present study revealed that polymeric pseudo-liquid membranes are applicable to membrane separation as one of liquid membrane transport systems for the recovery of marine metal resources.