

Development for Monitoring and Concentrated Separation of Endocrine Disruptors in Sea Water by Pervaporation Method

Akon Higuchi and Mariko Hara

Department of Industrial Chemistry,
Faculty of Engineering, Seikei University

Endocrine disrupting chemicals are realized as one of the most major environmental problems. Signals from fish and wildlife populations and evidence from experimental toxicology have led to a fact that some chemicals are affecting reproduction and development of animals including human beings. In this study, we examined concentration and removal of endocrine disruptors from aqueous solution and aqueous salt solution by pervaporation method through hydrophobic polydimethylsiloxane membranes. Pervaporation is a membrane process used to separate liquid mixtures originally. The pervaporation process was being developed to separate water from alcohol, especially in an azeotropic mixture, to separate dissolved volatile organic compounds from water and to separate between organic solvents. The goal of this study is to examine the concentration and separation of endocrine disruptors having relatively low vapor pressure and higher molecular weight than conventional organic solvents from aqueous solution. The concentrated endocrine disruptors will be effective for the analysis and monitoring system of the endocrine disruptors by Gas/mass chromatography, because the direct analysis of trace endocrine disruptors in sea water is impossible from the conventional Gas/mass chromatography due to their trace concentration.

N-butylbenzene (n-BB, M.W. 134) and 1,2-dibromo-3-chloropropane (DBCP, M.W. 236) preferentially permeated through polydimethylsiloxane membranes in pervaporation compared to water. N-BB was effectively removed from 10 ppm aqueous solution of n-BB in pervaporation measurements at 25 °C. The separation factor was calculated to be approximately 300. DBCP was also concentrated in the permeate in the pervaporation measurements on the condition that the interface between the membrane and cold trap was heated at more than 100 °C. This is because the permeated chemicals through the membranes can be effectively removed from the air phase near the membrane in the permeate side at high temperature. This contributes to the enhancement of the driving force of their diffusion through the membrane.