Development for Monitorning and Concentrated Separation of Endocrine Disruptors in Sea Water by Pervaporation Method - Concentration and Separation of Dioxin and Agricultural Chemicals

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Summary

Endocrine disrupting chemicals, such as dioxin and polychlorinated biphenyl (PCB), are affecting the development and reproduction of humans and animals, and are therefore, of major concern to the environment. In this work, separation from aqueous solutions of several endocrine disruptors such as dibenzo-p-dioxin, diethylphthalate (DEP) and co-planar PCB (3,3',4,4'-tetrachlorobiphenyl, TCB) has been investigated by pervaporation. The relationship between the separation factor of endocrine disruptors and their physical properties, i.e. saturated vapor pressure and hydrophobicity ($\log K_{ow}$, octanol-water partition coefficient) was discussed.

Pervaporation experiments through polydimethylsiloxane (PDMS) membranes were performed using aqueous feed solutions of several endocrine disrupting chemicals. The theoretical relationship between α (separation factor) and physical parameters (i.e., $\log p_{vap}$ and $\log K_{ow}$ [octanol-water partition coefficient]) has been developed in this study as follows.

$$\alpha \propto \log K_{ow} \cdot p_{vap} \text{ (ED)} \qquad\qquad (1)$$

Figure 1 shows the relationship between the separation factor of endocrine disruptors and $\log K_{ow} \cdot p_{vap}$ (ED) based on the theoretical equation Eq. (1). A relative good relationship ($r^2 = 0.773$) was obtained in the figure as theoretically predicted.

We also succeeded to remove endocrine disrupting chemicals by PV of sea water at Enoshima island.
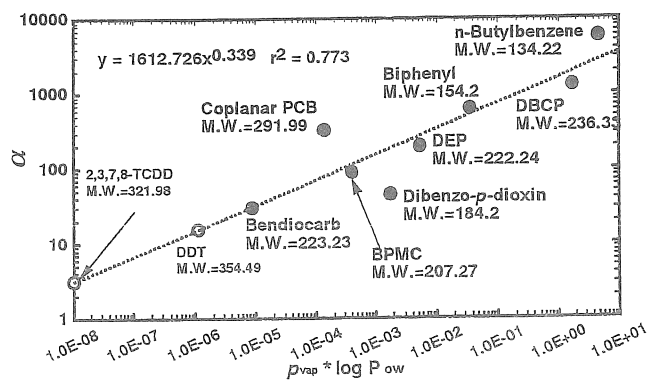

Fig. 1 Relationship between Separation Factor and $p_{vap} {}^* \log P_{ow}$ in PV through 300 μm PDMS Membrane at $T_{feed} = 90$ºC and $T_{interface} = 150$ºC.