NEW SEPARATION METHOD WITH CHARGE-MOSAIC MEMBRANE SYSTEM

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Summary

We have developed a macromosaic membrane system, where anion-exchange membranes and cation-exchange membranes are alternately arranged, and we have realized the neutralization dialysis, the coupling of electron transfer to ion transport, and the selective transport of organic nonelectrolytes in the system.

The neutralization dialysis needs a pair of ion-exchange membranes and a cell similar to a macromosaic cell and is a very effective deionization method on the basis of Donnan dialysis. The ion-exchange rate across the membrane, which is the important factor governing the desalination efficiency, was affected by the salt, acid, and alkaline concentrations and the temperature and a pure water of 3 Mohm·cm specific resistance can be readily attained by this method.

If some of the anion exchange membranes in the system is replaced by electron transfer membranes where ions can not be permeated but electron can be permeated, electrons instead of anions are permeated across the membrane and a circulating current is generated. Redox reaction is an electron transfer phenomenon and it can be readily coupled to ion transport in the membrane system comprising multiple steps of redox reactions. Redox reaction causes ion transport or vice versa in this system as in biological systems.

Organic non-electrolytes can be readily transported through an ion-exchange membrane if they are converted to electrolytes in the membrane. Aldehydes react with bisulfite to form hydroxyalkanesulfonates (HASA), which are the conjugate bases of strong acids, and are able to be transported efficiently across an anion-exchange membrane. Aldehydes can be separated readily from other types of organic solutes via this method.