New Separation Methods of Mosaic Membrane Systems

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Summary

New separation methods using mosaic membrane systems, (1) neutralization dialysis, (2) coupling of electron transport with ion transport, and (3) selective transport of non-electrolyte, were investigated and reported in this paper.

(1) Neutralization dialysis is a very effective deionization method. The salt solution in the deionization compartment is separated from an acid solution and a base solution by a cation-exchange membrane and an anion-exchange membrane, respectively. The cations are exchanged with proton, the anions are exchanged with hydroxide ion across each membrane, and the deionization and neutralization occur simultaneously in the deionization compartment. The pure water with the specific resistance of over 10 MΩ·cm was obtained and very weak acids and bases were also removed from the deionization compartment by this method.
(2) A circulating current enhances transports of ions and electrons in a mosaic membrane system with ion-exchange membranes and electron-transport membranes. Electron transport is readily coupled to ion transport in a new mosaic membrane with electron-transport regions and ion-exchange regions. Electrons and ions are transported by the driving forces of the redox potential gradient or the concentration gradient. Redox chain reactions are generated in the mosaic membrane system as the electron flow in biological membranes and electrons were transported in this system by the visual light irradiation.
(3) Aldehydes and sugars were selectively transported across an anion-exchange membrane via their adduct-formation reactions with bisulfite ion, the complex-formation reaction of sugars with borate ion, and their acid-dissociation reactions. The aldehyde flux was dependent on the aldehyde concentration in the source phase solution and the existence of a limiting value was predicted and confirmed experimentally. Organic solutes can be selectively transported or concentrated via this method by specific reactions of the organic solutes with inorganic ions.