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Development of Charge Mosaic Membranes with High Ionic Permselectivity and High Mechanical Strength (II): Optimization of Porous Support Layer Structure

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Summary

The aim of this study is to prepare CM membranes having enough mechanical strength to perform piezodialysis. Hence, we optimize porous suport layer strucure of CM membranes prepred by coating method.

A CM membrane was prepared by coating the two solutions of PVA-based polyanion: poly(vinyl alcohol-co-2-acrylamido-2-methylpropane sulfonic acid) (AP-2) and polyanion: poly(dially ldimethyl- ammonium chloride) (PDADMAC) on a support membrane. The membrane obtained was annealed at 160°C for 30min, and further cross-linked by immersing it in glutaraldehyde solutions with various concentrations. The CM membrane was soaked in an aqueous solution of methyl violet for 24h to stain the the cation-exchange domain in violet color so that the thickness of the domain size could be measured by using a microscope. To determine permselectivity for electrolytes, permeation experiments were performed in a diffuion dialysis system consisting of a CM membrane and two aqueous solutions.

The microscope image of the membranes indicated that the thickness of the charged layer and the support membrane were ca. 30 □m, and the width of cation- and anion-exchange layers were ca. 400-500 □m and 300 □m, respectively. The membrane potential data indicated that the charge density of the cation-exchange layers was higher than that of the anion-exchange ones. The permeation experiments of KCl and sucrose showed that the permselectivity for KCl through the CM membrane prepared in this study was about 13 times higher than that through Desalton®, which was prepared by a micro-phase separation method. The CM membrane showed higher mechanical strength then commercial ion-exchange membranes. From these results, the ionic permselectivity will increase by optimizing the coating conditions and cross-linking conditions. Hence, the CM membranes will have potential application to desalination at low salt concentrations.