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Study on Simultaneous Material Transport through Charged Mosaic Membrane

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Introduction:

The charged mosaic membranes having cation and anion exchange mixed groups within membrane were researched. The composite charged mosaic membrane was investigated from simultaneous transport such as solute and solvent flux. On the other hand, the reflection coefficient and salt flux coefficient were estimated by taking account of the cross constants of the phenomenological equation. In previous studies[1], we reported transport coefficients of solvent and solute with mono-mono valent electrolyte solution across charged mosaic membrane. In this research, we are reported the divalent electrolyte solutions as $MgSO_4$ across charged mosaic membrane.

Experiments:

The charged mosaic membrane were made two different ion exchange groups and the ion groups, cation and anion exchange groups were arranged parallel with each other inside membrane and the array of charge groups links continuously from one membrane to the other membrane. The membrane characteristics are given the Table 1 and Fig.1.is the experiments apparatus.

Table 1. The structure characteristics of charged mosaic membrane

Membrane thickness	50um
Cation exchange group	$-C_5H_5{}^+CH_3$
Microsphere content(wt%)	23.4~26.1
Anion exchange group	$-C_6H_5SO_3{}^-$

The flux measurements were carried out by a set of two glass cells. The membranes were tightly inserted between two cells by using silicon rubbers in oder to avoid leak of water from the contact surfaces. The experiments temperature were kept at 25°C by the circulating constant water surround the cells during experiment.

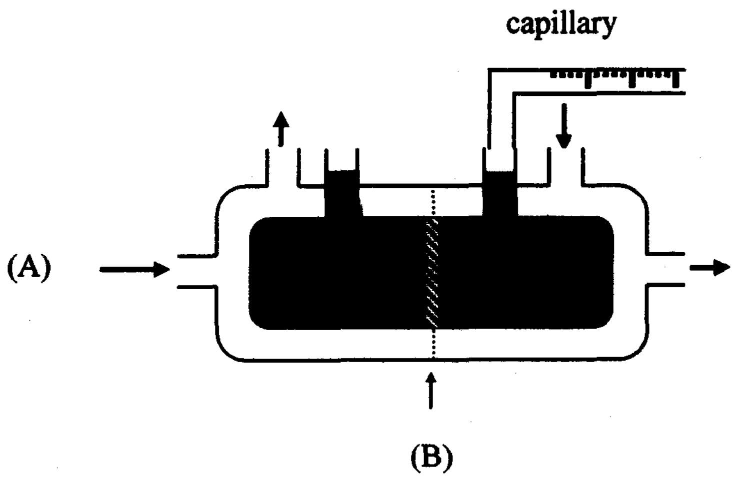


Fig.1. The schematic of membrane experimental apparatus: (A) Circulating water for supported constant temperature at 25°C, (B) charged mosaic membrane, glass cell content is 25ml,respectively.

Results and discussion

The volume change versus time in system was used sucrose as impermeable solute indicated linear relation (Fig.2.). All the other relations with various added $MgSO_4$ concentration in system also indicated linearity. This means the systems are in steady state within examined time. Taking account of membrane area for the slopes of straight lines, one can obtain volume flux and solute flux. *Lp* is filtration coefficient that means water permeability of water affinity with membrane .

Lp's value were given against added $MgSO_4$ concentration and the result indicated the water affinity in membrane was not affected by existence of electrolytes in outer solutions.

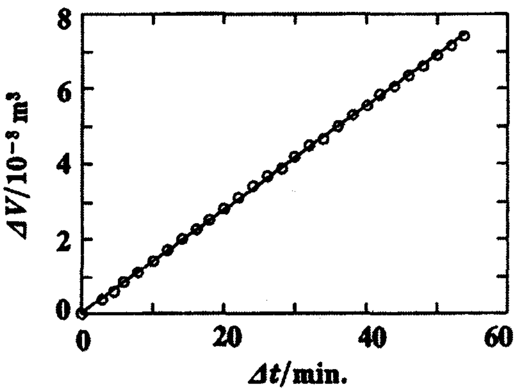


Fig. 2 ΔV vs. Δt in water/M/0.5 mol dm^{-3} saccharose system.

Reflection coefficient, σ were almost the same as those in previous studies and the negative values in the examined concentration ranges as reported in before. Negative σ implies the preferential salt transport over solvent transport and is very important for practical pressure dialysis.

Salt permeability coefficient, ω in system were estimated in the same manner as volume fluxes[2]. Solute fluxes for $MgSO_4$ were increased and the permeability coefficients were decreased with $MgSO_4$ concentration, but with respect to solute flux was not recognized.

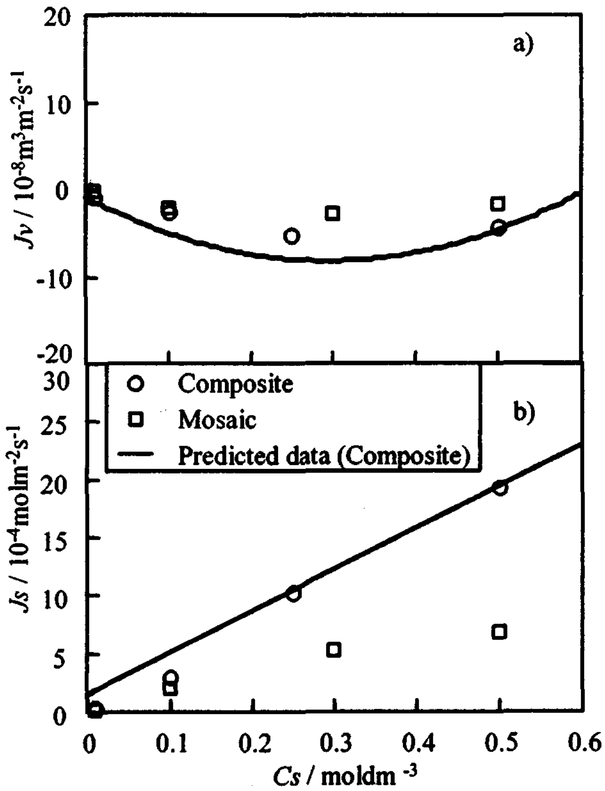
Fluxes of *Jv* and *Js* were defining by K-K equations[3]. The equations is below.

$$Jv = Lp\,(\sigma + 1)\,\Delta\Pi \qquad (1)$$

$$Js = \omega\,\Delta\Pi - C(1 - \sigma)\,Lp\,\Delta\Pi \qquad (2)$$

As results, the equations, *Jv*, *Js*, are reduced the measured value and were given in

Fig.3. As seen in Fig.3, the predicted solid lines were satisfactorily accord to the experimental results in charged mosaic membrane[4].



Figs.3a) and b) Comparison of experimental data with predicted data of composite membrane in Volume and Salt Fluxes.

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