

Study on Water Transport and Highly Concentrating Sea Water through Ion-exchange Membrane (III)

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Summary

In order to produce the salt from sea water the concentration is increased by about 5 times by electro dialysis procedure before evaporation. Recently it is desired that the sea water should be concentrated by 8 or 9 times to obtain the salt in the higher efficiency. In principle it is necessary to reduce the water transport based on the electroosmotic and osmotic flows. Preparation of the ion-exchange membrane, which has low water content, is one of the solutions for this process. However, it decreases the effective fixed charge density (effective ion capacity) and increase the membrane electric resistance. In the previous report it was confirmed that the effective ion-exchange capacity and ionic mobility were reduced in the system of salt-aqueous organic solutions in which the dielectric constant was smaller than in water. In this study the ion pairing between a counter-ion and a co-ion in the membrane was also theoretically considered in addition to that between a counter-ion and a membrane fixed charge group, and the experimental results compared with the theoretical ones. Experimental results showed that the ion pairing between a counter-ion and membrane fixed charge groups was increased, if water content of the membrane was decreased, or the membrane fixed charge density was increased. The theoretical results agreed with the experimental results, qualitatively. It was suggested that the increase of ion-exchange capacity in the state of the low water content was not necessarily advantageous in order to develop the ion-exchange membrane for highly concentration sea water.