

Development of Salt Production System Based on Highly Concentration of Seawater

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Summary

Highly concentration techniques of seawater are promising for developing highly efficient salt production systems and lowering a salt production cost. Seawater is concentrated by about 5 times using present electro dialysis process. In principle, if a water transport can be reduced to one-half its present value by employing the ion exchange membrane which carries low water permeability, a saturated seawater should be obtained.

In view of designing a novel ion exchange membrane, we have analyzed mass transfer parameters by determination and thermodynamic consideration of electro-osmotic and osmotic coefficients of ion exchange membranes, calculating mass transfer rates from the data of salt manufacturing, and simulation of transport phenomena for designing plants. After evaluation of resulting data, the optimal characteristics of the membrane for highly concentrating seawater have been estimated. The electro-osmotic (β) and osmotic (L_p) coefficients for concentrating to 5.5 M solution (saturated seawater) were $0.6 \times 10^{-3} \text{ cm}^3 \text{ C}^{-1}$ and $1.83 \times 10^{-8} \text{ cm}^3 \text{ N}^{-1} \text{ s}^{-1}$, respectively.

Novel ion exchange membranes based on polymeric materials carrying hydroxyl group, crystalline polystyrene and porous polyethylene embedded sulfonated polystyrene have been fabricated. The crystalline polystyrene membrane gave low water permeability and high salt permeability and will be useful for the highly concentration of seawater.