Study of Scale Removal with Charged Membranes

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Summary

To prevent scale forming is a key technology to make use of sea water to various industrial field. Divalent ions such as calcium, carbonate and sulfate ion are principal ingredients which form scales (precipitation fouling). The purpose of this study is to verify the separation ability of monovalent ions and divalent ions with charged reverse osmosis membranes experimentally and theoretically. The extended Nernst-Planck equation is applied by considering the effective charge densities to analyze the separation ability of single and mixed electrolyte solutions. Low pressure type of reverse osmosis membranes were used to separate coion mixture (sodium chloride/ sodium sulfate) , counterion mixtures (sodium chloride/ magnesium chloride) and artificial sea water. Uni- and divalent ion in coion mixtures was found to be separated effectively. Especially, monovalent ion (chloride ion) showed negative rejection. Those in counter- ion mixtures were not separated so efficiently as in coion mixtures. Uni- and divalent coions in artificial sea water was efficiently separated. By applying the extended Nernst-Planck equation, two transport parameters (effective charge density and structural parameters) were obtained from the experimental data of the single electrolyte solution. Rejection in mixtures is found to be able to predicted by using the transport parameters obtained from of the single electrolyte experiment.