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Membrane Fouling in Integrated System for Complete Usage of Seawater Resources and Applicability of Nanofiltration

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Summary

Membrane fouling caused by adsorption of organic foulants onto membrane surfaces is a difficult problem. In this study, (1) effectiveness of the surface modification of microfiltration (MF) membrane for seawater pretreatment and (2) ability of both anti-organic fouling and anti-scaling of nanofiltration (NF) membranes on the market were examined.

By the surface modification of ceramic MF membrane with 2-methacryloyloxyethyl phosphorylcholine (MPC) polymer that is a well-known artificial biomaterial, the membrane showed a high anti-fouling ability. Higher rejection by keeping original water permeability was observed. The change in pore size was estimated by analyzing the flux dependency of real rejection with membrane transport theory. Furthermore effects of the surface treatment conditions on molecular weight cut-off ability were also examined. The cut-off ability of the membrane with pore size 50 nm showed ca. thousands molecular which is the same level of ultrafiltration (UF) membranes.

The NF membranes used in this study had ca. a thousand molecular weight cut-off, which means lots of organic foulants in seawater can be rejected. The performance, permeate flux and rejection, of the membrane depended on ion concentration and ion composition. Permeability of the divalent ion of NF membranes varied in each membrane in the assessment of efficiency using artificial seawater. On the other hand, scale occurred with successive concentration of artificial seawater and the ability of the membrane was decreased. There are problems for application such as fouling and scaling, however NF membrane seems to be hopeful especially for separation of divalent ion.