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Research on Fouling Mechanism and Development of Anti-fouling Processes in Membrane Salt-production System - The Utilization of Microbubble Technology, Strong UV Radiation and Absorption Method -

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Summary

In this study, the survey of the adherent dirt on membrane surfaces as well as the properties of the raw and the sand-filtered sea water, and a membrane washing solution was investigated at an ion-exchange membrane salt-production plant. Reduction effects of the air or ozone microbubble, the ultraviolet (UV) radiation and the absorption treatments on the contents of various substances and microorganisms causing membrane fouling were also examined. Furthermore, a detergent effect of air microbubble treatment on the adherent dirt of the membrane surface was investigated.

Sand-filtered system decreased remarkably the contents of SS and most organic substances including planktons and bacteria, but low removal rate of polysaccharides was revealed. Polysaccharides trap various substances such as bacteria, small particles of organic and inorganic matters. For the reduction of membrane fouling, therefore, an effective removing system of polysaccharides from the sand-filtrated sea water is required. The utilization of microbubble, in particular ozone microbubble, technique was effective for the elimination of organic substances, except for planktons, from the sand-filtrated water, though effects of the sand-filtrated water including microbubbles on the structures and the functions of ion exchange membrane and on the electrodialysis apparatus in itself are not clear. An application of UV ray decreased significantly the number of living bacteria, but it was not so effective on the removal of most other fouling substances. The removal rate of hydrotalcite-filtration was also not so high.

In this study, it was also found that the membrane washing solution used in a salt-making plant was polluted by organic substances including microorganisms. For preventing the membrane from the secondary pollution, the utilization of cleaned solution was also required.

The utilization of microbubble-treated water for membrane washing decreased significantly the amount of adherent dirt on the membrane, when the current run at a speed of 40 and 60 mm per second. This result suggests that the utilization of microbubble-treated water in the washing process of membrane being in the assembled electrodialysis apparatus in salt-making plants is very effective.