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Investigation into Fouling Mechanisms of Reverse Osmosis Membrane for Sea Water Desalination by Using AFM Nano-Contact Force Experiments

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Summary

This study investigated the mechanism of chlorite degradation and foulant adsorption for reverse osmosis (RO) membrane. By immersing the membrane in liquid sodium hypochlorite (NaClO), the membrane was chemically degraded. The chlorine (Cl) degraded level was changed as a function of the immersing time. With the longer immersing, the filtering ability of sodium chloride (NaCl) became low, i.e. the salt rejection and flux decreased significantly. The molecular structure on the RO membrane surface was investigated by Fourier transform-infrared spectroscopy (FT-IR) and X-ray photoelectron spectroscopy (XPS) spectra in order to clarify the scheme of chemical reaction. It is expected that the chlorine degradation displaces the membrane to chlorine ion, resulting in encouragement of hydrogen bonding, and letting the membrane surface hydrophilicity. Next, to measure surface adhesion (hydrophilicity and hydrophobicity), atomic force microscopy (AFM) was used. For this AFM measurement, colloidal probe of chemical modified microsphere was prepared. The microspheres with hydroxyl group (OH) and hydrophobic matter (C18) were separately glued to the AFM silicon tip with epoxy resin. With this AFM tip, contact force measurements were conducted in order to investigate the absorption characteristics of RO membrane with respected to the Cl degraded level. Furthermore, to investigate the relationship between chlorite degradation and fouling absorption, filtration tests using dextran, as organic matter of polysaccharide, were carried out. From these results, this study clarified the degradation mechanism of reverse osmosis (RO) membrane, which leads to the changing of foulants adsorption.