

Novel Reverse Osmosis with the Active Layer Thickness of Less than 10 nm Prepared by Molecular Layer-by-Layer Method

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Summary

In this study, we used molecular layer-by-layer (mLbL) deposition technique to synthesize polyamide active layers without nano-scale imperfections. In the first part of this study, the hydrolysis conditions of polyacrylonitrile (PAN) support membranes were optimized. Experimental data showed that the hydrolysis of PAN was favored at higher NaOH concentration. Also, the pressure from the backside of PAN membrane hindered the penetration of the NaOH aqueous solution into the inside of PAN membrane, resulting in higher water permeability of PAN membrane without sacrificing the hydrolysis efficiency at the surface of the PAN membrane. In the second part of this study, the influence of the number of mLbL deposition cycles on the membrane performance was investigated. It was found that water permeability of RO membranes with 5 and 10 mLbL deposition cycles showed higher than that of commercial RO membrane investigated in this study. Also found was that the NaCl rejection of RO membranes with 15 and 20 mLbL deposition cycles was higher than that of the commercial RO membrane. Modeling analysis showed that the higher NaCl rejection by RO membranes with 15 and 20 mLbL deposition cycles was due to less presence of nano-scale imperfections.