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Monovalent-anion Selective and Antifouling Polyelectrolytes Multilayer Anion Exchange Membrane for Reverse Electrodialysis

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Abstract

Reverse electrodialysis (RED) is an emerging membrane - based technology that can be used to capture renewable energy released from mixing seawater and river water. When natural waters are used as feed solutions, the presence of multivalent ions and natural organic matter (NOM) results in a lower open circuit voltage (OCV) and power density. In this research, we modified the surface of standard anion exchange membranes (AEMs) via the facile layer-by-layer (LBL) deposition of poly(styrenesulfonate) (PSS) and poly(ethyleneimine) (PEI). Only moderate increase was introduced to the membrane area resistance. The modified membranes exhibited monovalent - anion selectivity comparable to that of commercial monovalent-ion selective membranes, and largely improved anti-organic fouling potential simultaneously. When tested in a RED process with feed waters containing not only chloride but sulfate and humic acid, the maximum gross power density generated was improved by up to 17 % with polyelectrolyte-modified membranes. Also, the energy conversion efficiency of the modified membranes could be prominently increased by 3 times compared with standard AEM conversion. The results indicate significant efficacy of AEMs with polyelectrolyte multilayers on their membrane surface for RED application.