Optimization of Reverse Electrodialysis performance based on Equivalent Circuit Model

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Reverse electrodialysis (RED) is the operation of recovering the electrical energy generated while the cations and anions are selectively transmitted through the ion exchange membranes (IEMs) when two solutions having different concentration are mixed. The RED cell has a structure in which cation exchange membranes and anion exchange membranes are alternately stacked, and brine and fresh water alternately flow through a channel between the IEMs. The performance of cell is influenced by the concentration and flow rate of brine and fresh water, the transport number of IEMs, the number of stacks, and the cell internal structure. In this study, the RED performance according to the concentration, flow rate of brine and fresh water and stack number were predicted by using equivalent circuit model (ECM) considering the parasitic current of the flow path and the suitability of the model was confirmed by comparing with experimental results. The experiments were carried out using a commercial IEM (Selimion, AMV, CMV) and conducted at various concentration of fresh water and the number of stacks of IEMs. The RED performance is optimized using the ECM.