Characterization of an electrodialytic cell: automation and process control

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ABSTRACT

Electrodialysis uses ion-exchange membranes to reduce the ionic content of electrolyte solutions by means of an electric field. The flow of ions removed through this process is limited by the effect of concentration polarization on the interfaces between the membranes and adjacent solutions. This work provides a methodology applicable to a single electrodialytic cell consisting of an anion membrane, a spacer of demineralize, a cation membrane and a spacer of concentrate, the whole system located between two metal plates containing two electrodes (anode and cathode). All the items are commercially available and belong to a pilot electrodialysis reversal (EDR) plant Aquamite I of Ionics. The experimental procedure is based on the establishment of successive potential electric differences between the electrodes in order to determine current intensities at different work pressures. Thus, the current–voltage curves are drawn from where it follows the intensities of limiting current intensity ($I_{lim}$) for each feed pressures applied to the cell and for a range of salinity prepared with sodium chloride solution. The results allow the potential relationship between the limiting current densities ($i_{lim}$) and the product flow ($Q_p$) to be established and extrapolated to a complete pilot plant EDR.

Keywords: Ion-exchange membranes; Electrodialysis reversal; Optimization; Desalination; Polarization; Hydrodynamic regime

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