



Scaling prediction in electro dialytic desalination

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ABSTRACT

The application of thin intermembrane spacers with densely distributed membrane abutments allows the single-pass electro dialysis with different linear velocities in the diluate and concentrate compartments, which results in the increase in recovery ratio. When applied to the desalination of sparingly soluble salts solutions, such method allows achieving high supersaturation in the concentrate stream, which increases the risk of the membrane scaling. To avoid the scaling, the limiting condition, binding apparatus hydrodynamic conditions and scaling kinetics, can be assumed during module design. In the previous research, the condition was that the crystallization induction time has to be larger than the sum of the electro dialyzer's mean residence time and its standard deviation. Experiments with electro dialysis reversal (EDR) showed however, that even with this assumption unfulfilled, there is no significant decrease in the performance between the polarity cycles. Thus, a new limiting condition was proposed, based on the assumption of additivity of mean residence time and a square root of its variance, and linear increase of saturation level along the concentrate channel. The presented algorithm for evaluation of scaling risk turn out to be successful in case of calcium sulfate solutions, but not in case of calcium carbonate solutions.

Keywords: Electro dialysis; Electro dialysis reversal; Scaling; Calcium sulfate; Calcium carbonate; residence time distribution

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