Dynamic 2-D modeling of concentration polarization in a reverse osmosis spiral wound membrane

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Spiral wound configurations dominate the desalination and water treatment systems. For reverse osmosis process, spiral wound membranes which are relatively more tolerant to its contaminations are appropriate. In this study, a dynamical model is developed to analyze and estimate concentration polarization for a spiral wound membrane system. A frequently used membrane unit is the spiral wound type module which can be represented by a paralle-plate channel with one porous wall which is the semipermeable reverse osmosis membrane. To investigate the significant transport phenomena for the case of laminar flow, in particular concentration polarization and permeate flux decline, a computer simulation model was developed. Solving partial differential equations(PDEs) is a common problem in research work in the area of chemical engineering. Since it is usually very difficult to solve them theoretically, numerical methods are dominantly used. Two transport phenomena are occuring in a reverse osmosis channel. The equation of momentum balance and convex-diffusion equation was solved using the cubic spline collocation method.