An Unsteady-state Model for Concentration Polarization in Commercial Spiral Wound RO Membrane: Effect of Feed Temperature

권태옥, 이재욱[1], 문일식*
순천대학교 화학공학과; [1]서남대학교 환경화학공학부
(ismoon@sunchon.ac.kr*)

Despite many advantages of reverse osmosis (RO) membrane, its application has been limited due to concentration polarization (CP) and fouling. The spiral wound membrane element is the most widely used for the wastewater treatment systems. It has been known that spiral wound membrane is more suitable for wastewater treatment due to the fact that it is relatively more tolerant to fouling from contaminants. On the other hand, permeate flux in RO membrane is very sensible to changes in the feed temperature. Hence, the influence of feed temperature on CP in a commercial membrane was investigated. Moreover, an unsteady-state model was formulated by employing the non-conservative mass balance equation in the feed channel, considering the fluid flow profiles based on feed spacer mixing. The model was evaluated for numerical stability and convergence under various feed and operating conditions. The model results were verified experimentally using a 2.5 inch pilot-scale spiral wound RO unit. The time-dependent model proposed in this work can be successfully applied for the analysis of long-term flux decline due to fouling and membrane degradation.