ELSEVIER

Desalination 249 (2009) 200–209

DESALINATION

www.elsevier.com/locate/desal

Online estimation of fouling development for SWRO system using real data

Do Yeon Kim[a], Myoung Ho Lee[a], Sangho Lee[b], Joon Ha Kim[c], Dae Ryook Yang[a,*]

[a]*Department of Chemical and Biological Engineering, Korea University, Seoul, 136-713, Republic of Korea*
Tel. +82-2-3290-3298; Fax: +82-2-926-6102;
email: dryang@korea.ac.kr
[b]*Korea Institute of Construction Technology, Gyeonggi-Do, 411-712, Republic of Korea*
[c]*Department of Environmental Science and Engineering, Gwangju Institute of Science and Technology, Gwangju 500-712, Republic of Korea*

Received 13 November 2008; revised 17 December 2008; accepted 24 December 2008

Abstract

Fouling is one of the most serious problems in seawater desalination using reverse osmosis (SWRO) which is important to lower the production cost of desalinated water. For efficient operation of the SWRO plant, accurate models are crucial to decide the optimal operating condition and cleaning operation. The model for RO membrane system has been studied by many researchers and its usefulness has been increased as its accuracy has been improved. However, the prediction of fouling is difficult due to its extremely complicated mechanism of growth involving various foulants. In this study, the development of the fouling is predicted by monitoring the membrane resistance across the membrane and the friction coefficient through spiral-wound membrane from the operation data. Using nonlinear recursive least-squares (NRLS) method, the two properties are identified from the operating data based on the one-dimensional model of the SWRO system. By this method, the degree of fouling can be inferred from the two properties and potential cleaning time can be predicted. It can also assess the effectiveness of membrane cleaning. Using the actual data of an existing plant, the trends of resistance and friction coefficient could be monitored and the effect of cleaning pattern of the real plant can be evaluated by recursive parameter estimation online.

Keywords: Seawater desalination; Reverse osmosis; Fouling estimator; Process simulation; Nonlinear recursive least-squares

*Corresponding author.

Presented at the 2nd joint workshop between the Center for Seawater Desalination Plant and the European Desalination Society, Gwangju Institute of Science and Technology, Korea, October 8–9, 2008.

0011-9164/09/$– See front matter
doi: 10.1016/j.desal.0000.00.000