*Desalination and Water Treatment*
www.deswater.com
11 (2009) 15–22
November
1944-3994 / 1944-3986 © 2009 Desalination Publications. All rights reserved.
doi: 10.5004/dwt.2009.837

# In-situ monitoring of inorganic and microbial synergistic fouling during nanofiltration by UTDR

Yanlin Hou, Yanan Gao, Ying Cai, Xincheng Xu, Jianxin Li*

*Key Laboratory of Hollow Fiber Membrane Material and Processes, Ministry of Education, School of Material Science and Chemical Engineering, Tianjin Polytechnic University, No. 63 Chenglin Road, Tianjin 300160, China*
*Tel. +86-22-24528072; Fax. +86-22-24528001; email: jxli0288@yahoo.com.cn; jxli@tjpu.edu.cn*

Received 31 March 2009; Accepted 31 August 2009

**ABSTRACT**

This study describes an ultrasonic time-domain reflectometry (UTDR) as an non-invasive real-time technique for in-situ monitoring of the early-stage $CaSO_4$ and microbial synergistic fouling on nanofiltration (NF) membranes. The fouling experiments were carried out with 1.0 g/L and 1.5 g/L calcium sulfate solution at the operating pressure of 0.7 MPa, the temperature of 25±0.5°C and the flow rate of 0.13 cm/s. The number of bacteria incubated from lake was 5 × 106 cell/ml. A commercial nanofiltration membrane was utilized in this study. The permeate flux, rejection and ultrasonic measurements were made at regular intervals during crossflow NF. Results show that the flux obtained in the experiment with bacteria declined subtly slower than that without bacteria in the early phase, and then declined to the same level in the later phase of the fouling process. The rejection obtained in the experiment with bacteria was higher than that without. Furthermore, the acoustic measurements indicate that the fouling layer obtained with bacteria was thicker and looser than that without bacteria under the condition of low concentration solution. However, the layer becomes thicker and denser under the condition of high concentration solution. It implies that bacteria could accelerate deposition of inorganic scaling on NF membrane. Independent measurement such as flux-decline date, SEM analysis and weight measurement corroborate the ultrasonic measurement. Overall, this study suggests that the ultrasonic technique, due to its powerful capabilities and its use in monitoring devices, can be of great significance in the membrane industry.

*Keywords*: Nanofiltration; Membrane fouling; $CaSO_4$ and microbial synergistic fouling; Ultrasonic time-domain reflectometry

* Corresponding author.

*Presented at CESE-2009, Challenges in Environmental Science & Engineering, 14–17 July, 2009, Townsville, Queensland, Australia.*