Desalination and Water Treatment
www.deswater.com
10 (2009) 134–138
October
1944-3994 / 1944-3986 © 2009 Desalination Publications. All rights reserved.
doi: 10.5004/dwt.2009.818

An approach to theoretical prediction of permeate flux decline in ultrafiltration

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Received 22 July 2008; Accepted in revised form 2 September 2009

ABSTRACT

Permeate flux decline was predicted by means of Song and Elimelech's [1] model. Theoretical results were compared with those obtained in ultrafiltration experiments where TMP and crossflow velocity were varied. Polyethylene glycol (PEG) of 35000 Da was used in the feed solution in a concentration of 10 g/L. The experiments were performed with monotubular ultrafiltration ceramic (Al_2O_3–TiO_2) membranes of 5 kDa (Tami Industries, France). The model predicted a reduction in the influence of transmembrane pressure (TMP) on permeate flux as TMP increased. This was consistent with the experimental results for the lowest crossflow velocity tested (1 m/s). For higher crossflow velocities the reduction in the influence of TMP on permeate flux as TMP increased was higher than that predicted by the model. Model predictions were better for low crossflow velocities, as expected with a model that considers cake formation as the main fouling mechanism. Rapid initial pore blocking may be the main cause of the discrepancies observed between experimental results and theoretical predictions.

Keywords: Permeate flux decline; Ultrafiltration; Polyethylene glycol; Pore blocking; Cake formation

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Presented at EuroMed 2008, Desalination for Clean Water and Energy Cooperation among Mediterranean Countries of Europe and the MENA Region, 9–13 November 2008, King Hussein Bin Talal Convention Center, Dead Sea, Jordan.