Desalination and Water Treatment
www.deswater.com

34 (2011) 112–116
October

1944-3994/1944-3986 © 2011 Desalination Publications. All rights reserved
doi: 10/5004/dwt.2011.2810

The influence of particles on biofouling behavior in spiral wound membrane elements

Emile R. Cornelissen[a,*], Audrey Berteloot[b], Danny Harmsen[a], Erwin Beerendonk[a], Dick van der Kooij[a]

[a]*KWR Watercycle Research Institute, Nieuwegein, The Netherlands*
Tel. +31 306069538, +31 6 53508928 (mobile), email: emile.cornelissen@kwrwater.nl
[b]*Ecole Nationale Supeririure de Chime de Mulhouse (ENSCMu), Mulhouse, France*

Received 3 September 2010; Accepted 3 January 2011

ABSTRACT

Spiral-wound membrane (SWM) elements for nanofiltration (NF) and reverse osmosis (RO) need pre-treatment to prevent clogging of the feed spacer channel by particles and/or biomass. Usually rapid sand filtration or ultrafiltration is applied for this purpose. The effect of (the removal of) particles on biofouling processes in spiral-wound membrane (SWM) elements was investigated in this work by using a pilot set-up consisting of three parallel SWM elements. Local tap water supplemented with acetate to promote biofouling was fed to (i) a reference element, (ii) an element with one hour of daily dosing of copper sulfate to control biofouling and (iii) a third element with an additional pre-filtration to eliminate particles from the feed water of the element. The additional filter element behaved similarly to the reference element with respect to membrane transfer coefficient (MTC) decrease and pressure drop increase. Also results for membrane autopsy for biological and organic parameters were similar. The results demonstrated that the applied particle removal did not have a significant effect on the biofouling behavior in SWRO elements.

Keywords: Biofouling; Particulate fouling; Copper sulfate; Spiral wound membrane; Reverse osmosis; Membrane fouling

1. Introduction

Membrane fouling, in particular biofouling, is one of the main drawbacks in the application of spiral-wound nanofiltration (NF) and reverse osmosis (RO) membrane elements potentially leading to operational problems and deterioration of the water quality [1]. In order to control membrane fouling, two basic strategies are employed in practice, i.e., intensification of the pre-treatment before NF/RO and regular membrane cleaning of spiral wound membrane (SWM) elements. A common way to detect membrane fouling is the monitoring of operational parameters during membrane filtration specifically the increase in pressure drop which cannot differentiate particulate fouling and biofouling [2]. The aim of this study is to systematically investigate the effect of particles on biofouling.

2. Experimental part

A pilot study was carried out using three parallel 2.5-inch SWM elements (DOW Filmtec; TW30-2521) in cross-flow operation at a recovery of 10% per element, i.e., (i) a reference element, (ii) an element with one hour of daily copper sulfate dosing (1 g/l at pH 2) to inactivate biomass and (iii) a third element with an

*Corresponding author.

Presented at the AMS6/IMSTEC10, The 6th conference of the Aseanian Membrane Society in conjunction with the 7th International Membrane Science and Technology Conference, Sydney Australia, November 22–26, 2010