

Application of DBNPA dosage for biofouling control in spiral wound membrane systems

A. Siddiqui^{a,*}, I. Pinel^{b,*}, E.I. Prest^b, Sz.S. Bucs^a, M.C.M. van Loosdrecht^b, J.C. Kruithof^c, J.S. Vrouwenvelder^{a,b,c}

^aKing Abdullah University of Science and Technology (KAUST), Water Desalination and Reuse Center (WDRC), Division of Biological and Environmental Science and Engineering (BESE), Thuwal 23955-6900, Saudi Arabia, email: Amber.Siddiqui@kaust.edu.sa (A. Siddiqui), Szilard.Busc@kaust.edu.sa (Sz.S. Bucs), Johannes.Vrouwenvelder@kaust.edu.sa

^bDepartment of Biotechnology, Faculty of Applied Sciences, Delft University of Technology, Van der Maasweg 9, 2629 HZ Delft, The Netherlands, email: I.S.M.Pinel@tudelft.nl (I. Pinel), E.I.E.D.Prest@tudelft.nl (E.I. Prest), M.C.M.vanloosdrecht@tudelft.nl (M.C.M. van Loosdrecht), J.S.Vrouwenvelder@tudelft.nl (J.S. Vrouwenvelder)

^cWetsus, European Centre of Excellence for Sustainable Water Technology, Oostergoweg 9, 8911 MA Leeuwarden, The Netherlands, email: Joop.Kruithof@wetsus.nl (J.C. Kruithof), Hans.Vrouwenvelder@wetsus.nl (J.S. Vrouwenvelder)

Received 19 September 2016; Accepted 8 November 2016

ABSTRACT

Biocides may be used to control biofouling in spiral-wound reverse osmosis (RO) and nanofiltration (NF) systems. The objective of this study was to investigate the effect of biocide 2,2-dibromo-3-nitropropionamide (DBNPA) dosage on biofouling control. Preventive biofouling control was studied applying a continuous dosage of substrate (0.5 mg/L) and DBNPA (1 mg/L). Curative biofouling control was studied on pre-grown biofilms, once again applying a continuous dosage of substrate (0.5 mg acetate C/L) and DBNPA (1 and 20 mg/L). Biofouling studies were performed in membrane fouling simulators (MFSs) supplied with biodegradable substrate and DBNPA. The pressure drop was monitored in time and at the end of the study, the accumulated biomass in MFS was quantified by adenosine triphosphate (ATP) and total organic carbon (TOC) analysis. Continuous dosage of DBNPA (1 mg/L) prevented pressure drop increase and biofilm accumulation in the MFSs during a run time of 7 d, showing that biofouling can be managed by preventive DBNPA dosage. For biofouled systems, continuous dosage of DBNPA (1 and 20 mg/L) inactivated the accumulated biomass but did not restore the original pressure drop and did not remove the accumulated inactive cells and extracellular polymeric substances (EPS), indicating DBNPA dosage is not suitable for curative biofouling control.

Keywords: Biofouling control; Biocide DBNPA; Membranes; Water treatment; Seawater desalination; Wastewater reuse

*Corresponding author.