Characterisation of organic foulants on full-scale UF membranes during filtration, backwash and chemical cleaning episodes

Oriol Gibert\textsuperscript{a,b,c,*}, Marc Vera\textsuperscript{a,d}, Sandra Cruz\textsuperscript{d}, Maria Rosa Boleda\textsuperscript{d}, Miquel Paraira\textsuperscript{d}, Jordi Martín-Alonso\textsuperscript{d}, Sandra Casas\textsuperscript{b}, Xavier Bernat\textsuperscript{b}

\textsuperscript{a}Chemical Engineering Department, EEBE, Universitat Politècnica de Catalunya (UPC)-BarcelonaTech, c/Eduard Maristany 10-14, Barcelona 08019, Spain, Tel. +34 934011818; email: oriol.gibert@upc.edu (O. Gibert)
\textsuperscript{b} CETaqua, Water Technology Centre, Ctra. d’Esplugues 75, Cornellà de Llobregat 08940, Spain, Tel. +34 933124750; email: scasas@cetaqua.com (S. Casas), Tel. +34 933124819; email: xbernat@cetaqua.com (X. Bernat)
\textsuperscript{c} Barcelona Research Center in Multiscale Science and Engineering, EEBE, Universitat Politècnica de Catalunya (UPC)-BarcelonaTech, c/Eduard Maristany 10-14, Barcelona 08019, Spain
\textsuperscript{d} Aigües de Barcelona S.A., c/General Batet 5-7, Barcelona 08028, Spain, Tel. +34 933424846; email: mverac@aiguesdebarcelona.cat (M. Vera), Tel. +34 933422147; email: scruz@aiguesdebarcelona.cat (S. Cruz), Tel. +34 933422635; email: mboledav@aiguesdebarcelona.cat (M.R. Boleda), Tel. +34 933422688; email: mparaira@aiguesdebarcelona.cat (M. Paraira), Tel. +34 933422675; email: jma@aiguesdebarcelona.cat (J. Martin-Alonso)

Received 2 June 2017; Accepted 9 August 2017

**ABSTRACT**

Understanding organic fouling on ultrafiltration (UF) membranes during water filtration and cleaning episodes has become one of the major factors driving UF technology forward. The aim of this study was to quantify and characterise the organic foulants on an UF membrane at a full-scale drinking water treatment plant when it is fed with surface water and groundwater with different dissolved organic carbon (DOC) contents. DOC characterisation was performed by high-performance size-exclusion chromatography and fluorescence excitation–emission matrix (FEEM). The masses of DOC (and its fractions) retained by the membrane over a whole filtration period (and detached during cleaning episodes) were calculated through mass balances. Under river water feeding conditions, DOC was retained by 22%, being biopolymers the most retained DOC fraction (59%), followed by humic substances (17%) and other minor organic fractions. Routine backwashing resulted in the detachment of only 8% of the total mass of DOC retained, with biopolymers as the most detached fraction (27%). Within biopolymers, proteins appeared to contribute more to hydraulically irreversible fouling than polysaccharides. Under groundwater feeding conditions, no apparent retention of DOC was observed. FEEM analyses showed neither significant removal of fluorescent components during filtration nor detachment from the UF membrane during routine backwashing.

*Corresponding author.*

**Keywords:** DOC characterisation; Drinking water; Fouling reversibility; Organic fouling; Ultrafiltration