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Impact of organic fractions identified by SEC and fluorescence EEM on the hydraulic reversibility of ultrafiltration membrane fouling by secondary effluents

Jens Haberkamp[a]*, Mathias Ernst[b], Hendrik Paar[a], Daniela Pallischeck[a], Gary Amy[c], Martin Jekel[a]

[a]*Technische Universität Berlin, Chair of Water Quality Control, Sekr. KF 4, Str. des 17. Juni 135, D-10623 Berlin, Germany*
Tel. +49 (30) 747 35 429; Fax +49 (30) 747 35 414; email: jens.haberkamp@alumni.tu-berlin.de
[b]*Technische Universität Berlin, Centre for Water in Urban Areas, Sekr. KF 4, Str. des 17. Juni 135, D-10623 Berlin, Germany*
[c]*King Abdullah University of Science and Technology, Water Desalination and Reuse Research Center, Thuwal 23955-6900, Saudi Arabia*

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ABSTRACT

Loss of membrane filtration performance due to organic fouling is still a significant drawback for the application of low-pressure membranes in tertiary wastewater treatment. The present study investigates the relevance of different organic fractions present in secondary effluents in terms of hydraulically reversible and irreversible fouling of hollow-fibre ultrafiltration membranes. A good correlation between the hydraulically reversible filtration resistance and the total organic biopolymer concentration according to size exclusion chromatography (SEC) was observed. Qualitatively biopolymers consist mainly of polysaccharides as well as proteins with high molecular weight. Polysaccharides are retained by the membrane pores, but can be removed by simple UF backwashing. On the other hand, fluorescence excitation–emission matrix (EEM) analysis indicates that the extent of the hydraulically irreversible fouling correlates with the presence of protein-like substances. Removal of protein-like substances by biological slow sand filtration or chemical coagulation results in the significant reduction of the hydraulically irreversible fouling, which is presumably due to proteins in the molecular range of biopolymers. In contrast to the comparatively low sensitivity of colorimetric methods for the analysis of proteins and polysaccharides, the combined application of size exclusion chromatography and fluorescence EEM analysis is a promising tool for the determination of the organic fouling propensity of secondary effluents.

Keywords: Organic fouling; Ultrafiltration; Tertiary sewage treatment; Fluorescence analysis; Size exclusion chromatography; LC-OCD; EEM

* Corresponding author.