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# Control of fouling in MBRs through nanospheres addition

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ABSTRACT

In the last decade, the membrane bioreactor (MBR) industry expanded and nowadays this technology is diffused worldwide for wastewater treatment. Nevertheless, membrane fouling is still a critical issue and most research is focused on this aspect in order to control the fouling phenomenon, such as the definition of foulant agents, which are mainly extracellular polymeric substances. One of the main drawbacks related to fouling in MBRs is the sudden jump of the transmembrane pressure, often attributed to the collapse of the fouling layer, which in turn leads to a reduction of the pores size. A potential solution to this problem can be the addition of particles as to reduce the compressibility of the fouling layer through the engineering of the cake structure. Aim of the present work is to test this hypothesis through the addition of nanospheres of different diameter in a hollow fiber MBR unit at lab scale. The nanospheres are inert and non-compressible, and have been chosen for their capability to form well-structured layers. In order to analyze the MBR filtration performance, a synthetic solution has been prepared, in which a foulant agent (sodium alginate) has been spiked. A filtration model has been provided as to interpret the results and their eventual dependence on diameter and concentration of the nanospheres. Results obtained at constant flux in dead-end mode show that the presence of particles changes cake resistance and leads to the formation of non-compressible fouling. However, the addition of particles leads to better filtration performances, no matter what the diameter or concentration may be. Nevertheless, further research is required with the aim of testing the hypothesis with real wastewater. This study may, therefore, enlarge the choice of membrane fouling reducers by taking into consideration their ability to form more structured fouling.

*Keywords:* Extracellular polymeric substances (EPS); Membrane bioreactor (MBR); Membrane fouling; Nanotechnology; Wastewater

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