



## Analysis of the effects of ultrasound irradiation over effluent quality and membrane integrity in flat sheet microfiltration MBR systems

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### ABSTRACT

Membrane fouling is one of the main problems regarding the performance of membrane bioreactors (MBRs) and it constitutes an important impediment to the increasing application of this technology. One of the most promising alternative cleaning methods is ultrasound irradiation and for that reason, in this study, the performance of four pilot-scale MBR modules using flat sheet microfiltration membranes working in parallel was evaluated and compared with a conventional MBR system. In these modules, sonication at different frequencies (20, 25, 30 and 40 kHz) and powers (100, 200, 300 and 400 W) was simultaneously applied during the filtration process and parameters such as total suspended solids (TSS) and volatile suspended solids activated sludge concentrations and effluent chemical oxygen demand (COD) concentration, turbidity, viscosity, colour or particle size distribution were analyzed. Moreover, operational parameters such as temperature or TMP were also evaluated, and scanning electron microscope (SEM) and Fourier transform infrared spectroscopy (FTIR) analyses were carried out once the membranes were replaced. Although parameters such as effluent COD concentration, absorbance at 254 nm, colour at 436 nm, viscosity and activated sludge TSS did not show significant differences at different US frequencies, other parameters such as effluent turbidity or particle size distribution reached values too high compared with those obtained for the effluent from the microfiltration MBR system, especially at lower frequencies (20 kHz) and higher powers (400 W). Moreover, SEM images demonstrated that membrane integrity was negatively affected especially at these conditions and membrane pore size was enlarged due to sonication.

*Keywords:* Cleaning methods; Fouling; Membrane bioreactors; Microfiltration; Ultrasound

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