

## Influence of intermittent aeration and relaxation on a side-stream membrane bioreactor for municipal wastewater treatment

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### ABSTRACT

This paper is focusing on filtration of municipal wastewater with intermittent aeration and relaxation periods for a side-stream MBR in which filtration is performed with outside/in hollow-fibre membranes. In this semi-industrial scale side-stream MBR, hollow fibres are put in an external cartridge where sludge at low velocity and air are circulating around and inside the fibre bundle (in a confined system). Short-term experiments were performed under high fouling conditions but low energy consumption in order to determine and to characterise the influence on fouling of intermittent aeration and permeation. Discontinuous aeration is divided in two periods with two different air flow rates, a high one during a short duration and a lower one during a longer period. Relaxation was also studied by alternating on and off permeation periods. After that, aeration and permeation sequences were coupled. Results showed that for the same global air flow rate injected and for the same filtered volume, a punctually high aeration flow rate combined with a low aeration flow rate for the rest of time is better than a continuous one. Furthermore, filtration cake is removed more easily at the end of the experiment if aeration is discontinuous. Nevertheless, the aeration rate should be sufficient (above  $0.112 \text{ Nm}^3 \text{ h}^{-1}$  corresponding to specific aeration demand per membrane square meter ( $SAD_m$ ) of  $0.074 \text{ Nm}^3 \text{ h}^{-1} \text{ m}^{-2}$  and specific aeration demand per permeate cubic meter ( $SAD_p$ ) of  $0.373 \text{ Nm}^3 \text{ m}^{-3} \text{ h}^{-1}$ ) to prevent fouling. Lower fouling was obtained by discontinuous permeation in comparison to continuous permeation. Moreover specific aeration energies are only slightly higher for discontinuous permeation but the cake density is significantly lower and the deposit can be more easily removed by backwash. This study confirms the interest of operation with relaxation periods.

*Keywords:* Activated sludge; Fouling; Gas flow rate; Hollow fibre membranes; MBR Relaxation

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