

Membrane reactor design as a tool for better membrane performance in a biofilm MBR (BF-MBR)

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ABSTRACT

Coupling biofilm reactors with membrane filtration as biofilm membrane bioreactors (BF-MBR) is an interesting alternative technology to activated sludge membrane bioreactors (AS-MBR). Biofilm technology for wastewater treatment can provide a substantially lower suspended solids environment for membrane filtration compared to activated sludge processes. Potential benefits are; less membrane clogging/sludging problems, lower fouling potentials, ease of membrane cleaning, reduced energy consumption for air-scouring, and new membrane module/reactor designs. This study was aimed to investigate alternative membrane reactor designs as a tool to improve membrane performance in a BF-MBR process. Three different designs were investigated. A simplified model was developed to predict and analyze the performance of the membrane reactor designs chosen. Results showed that solids control can be achieved, in particular the MLSS concentration, as well as a reduction of the colloidal submicron particle fraction, thereby reducing membrane fouling. Modification of the membrane reactor in a BF-MBR process is beneficial. The alternative designs investigated in this study included introducing an integrated flocculation zone in the membrane reactor coupled with a sedimentation zone beneath the membrane module. The modified membrane reactor design provided a significantly lower concentration of MLSS and COD around the membranes, and subsequently a more sustainable membrane performance due to much lower overall fouling rates.

Keywords: Biofilm membrane bioreactor; Membrane reactor; Suspended solids control; Membrane fouling

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