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Abstract

The implementation of both an osmotic membrane and a microfiltration (MF) membrane into a biological reactor is a promising solution for wastewater treatment. It has the potential for enhanced phosphorus recovery, if the main part of water leaves through the forward osmosis (FO) membrane and phosphorus leaves the reactor with the MF permeate. In this study, the hybrid osmotic membrane bioreactor was built to and operated for 46 days to concentrate phosphorus in sludge. A mathematical model was developed to simulate the development in phosphorus concentration at varying MF and FO flows. The simulation and experimental data shows that the dissolved phosphorus concentration depends on the bioreactor volume relative to MF flow and excess sludge outtake, defining the nutrient retention time (NRT). Analysis of mass balances of dissolved phosphorus and mathematical modelling showed that concentrations of phosphorus of above 40 mg/L could be extracted from the reactor, above which phosphorus precipitate in the reactor. Longer NRT also leads to elevated conductivity, which contributes to higher sludge osmotic pressure, hence lower FO flux, deflocculation and inhibition of microbial activity. Therefore, it is