



Fouling characteristics of microfiltration membranes during the filtration of jet loop membrane bioreactor (JLMBR) activated sludge

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ABSTRACT

The main objective of this study was to characterize the activated sludge of jet loop membrane bioreactor (JLMBR) in order to determine its effects on the membrane biofouling. The sludge characteristics were evaluated in terms of MLSS (mixed liquor suspended solid), EPS (extracellular polymeric substance), SMP (soluble microbial product), relative hydrophobicity (RH) and viscosity. The membrane filtration tests were performed at a cross-flow microfiltration system by using cellulose acetate (CA) and cellulose nitrate (CN) filters with 0.2 and 0.45 μm of pore sizes. The jet loop bioreactor was operated at a batch mode for 36 d with an organic load of 3 kg COD $\text{m}^{-3}\text{d}^{-1}$. The COD treatment efficiency was achieved at 95%. It was found that the sludge properties changed with MLSS concentration. The viscosity of sludge increased and the RH of sludge decreased with increase in MLSS concentration. The EPS concentration of the sludge was much higher than SMP concentration. The carbohydrate contents of EPS and SMP were higher than the protein contents. The flux decline models and the resistance analysis were used to investigate the biofouling mechanism. In the resistance analysis, it was found that the pore blocking resistance (R_p) of CA membrane with pore size of 0.45 μm (CA045) was higher than the cake layer resistance (R_c), (3.56 and $1.02 \times 10^{12} \text{m}^{-1}$). R_c was more higher than R_p for the other membranes. R_p of membranes were found to be 33.6%, 77.1%, 23.4% and 21.9% of the total resistances (R_t) for CA02, CA045, CN02 and CN045, respectively. It was concluded that the high EPS content in JLMBR was the main fouling parameter for membranes. It was also found that the affinity of membrane types against EPS varied.

Keywords: Jet loop membrane bioreactor; Membrane biofouling; Crossflow microfiltration

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