

Topic: Submerged Anaerobic Membrane Bioreactor for Palm Oil Mill Effluent: Identification of main determining mechanisms for Control and Performance

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ABSTRACT

The aim of this study was to investigate the effect of sludge retention time (SRTs) on treatment performances of two-stage submerged anaerobic membrane bioreactors (SAnMBR) treating palm oil mill effluent (POME). The characteristics of sludge and microbial on filterability and biofouling were evaluated at different SRTs. SAnMBR with SRTs of 15, 30 and 60 d were setup for treating POME at hydraulic retention times (HRT) 2 day. The average permeate flux was fixed at $2.4 \text{ L/m}^2 \cdot \text{h}$. During operation, the membrane was regenerated by using two steps: membrane rinsing during each experiment as soon as trans-membrane pressure (TMP) reached 125-130 mbars, and backwashing and chemical cleaning at the end of each experiment when analyzing the membrane surface and foulant material. The results indicated that total COD removal efficiencies higher than 97% was achieved at all operating conditions. Maximum biogas production rate was $0.35 \text{ L CH}_4/\text{g COD}_{\text{remove}}$ at SRT 30 d. An increase in SRT enhanced growth of biomass and accumulation of soluble microbial products (SMP), which accelerated membrane fouling. The fouling occurred was the cake deposit, especially for SRT 60 d. Scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDX), atomic force microscopy (AFM), Fourier transform infrared (FTIR) analysis indicated that fouled membrane surfaces were covered with a cake layer containing organic and inorganic elements whose concentrations were higher when working at a higher SRT. In these experiments the soluble microbial products (SMP) and extracellular polymeric substances (EPS) played a secondary role because of the dominant effect of the cake layer.

Keyword: Submerged anaerobic membrane bioreactors, Membrane fouling, Solids retention time, Palm oil mill effluent, Trans-membrane pressure.