

Performance comparison of three different reactors (MBBR, MBR and MBBMR) for municipal wastewater treatment

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ABSTRACT

Membrane bioreactor (MBR) is an innovative wastewater treatment technology in which solid and liquid separation is done through membrane. Advantages of MBR technology involves better effluent quality, less foot print and less waste sludge generation. However, membrane biofouling is a major hindrance in the use of MBR that leads to clogging of membranes. Moving bed biofilm reactor (MBBR) encompasses use of carriers moving by aeration that provide surface to microorganism for attached growth. MBBR increases solid retention time, thus slowing down the growth rate of microorganisms. For better results, both technologies MBR and MBBR can be combined together to make moving bed biofilm membrane reactor (MBBMR), a hybrid technique which improves the removal efficiency, lessens sludge generation and minimizes biofouling. This study investigated the biofilm formation and influence of sponge and plastic carriers in MBBR and MBBMR. This study compared removal efficiency of organic matter and ammonia, effluent production and operational duration as well as waste sludge generation. The results showed COD, BOD and $\text{NH}_4^+\text{-N}$ removal of all technologies above 90%, 95% and 98%, respectively. Hybrid MBBMR with sponge carrier showed the best performance for its high effluent production (34 L/d), longer operational duration (48 d, 193% improvement than simple MBR) and less waste sludge generation (44.2 kg dry sludge/10⁶ L treated wastewater, 56% of MBR) compared with the other technologies, which makes it economically viable among other technologies.

Keywords: Membrane bioreactor (MBR); Moving bed biofilm reactor (MBBR); Moving bed biofilm membrane reactor (MBBMR); Performance evaluation; Wastewater treatment

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