

Treatment of wastewater from a food and beverage industry using conventional wastewater treatment integrated with membrane bioreactor system : a pilot scale case study

ABSTRACT

This study compares the performance of the Hollow Fiber (HF) and Flat Sheet (FS) types of membrane bioreactors (MBRs) for the treatment of food and beverage (F&B) industry wastewater in a pilot-scale study of a wastewater treatment plant (WWTP). HF and FS membrane configurations were evaluated at two different Mixed Liquor Suspended Solid (MLSS) levels: 6000 mg/L and 12,000 mg/L. The performance of each configuration was evaluated in terms of Chemical Oxygen Demand (COD) and Total Suspended Solid (TSS) removals for effluent quality measurement. The transmembrane pressure (TMP), flux rate, and silt density index (SDI) were monitored and calculated for membrane fouling assessment. The results show that the rejection rates of COD and TSS for HF and FS membrane types were more than 84% for the two different MLSS levels. During the study, the HF membrane recorded 0.3 bar transmembrane pressure, which complies with the recommended range (i.e., two to three times of chemical cleaning). On the other hand, the FS membrane operates without chemical cleaning, and the TMP value was below the recommended range at 0.2 bar. It was found that the flux values recorded for both the HF and FS systems were within the recommended range of 40 L/m²/h. Analysis of SDI revealed that the calculated index ranged between 1 and 2.38 and was within the allowable limit of 3. Both types of MBR consistently achieved an 80% to 95% rejection rate of COD and TSS. Effluent quality measurement of treated F&B wastewater in this pilot-scale study using a WWTP integrated with an MBR indicated a good achievement with compliance with the Malaysia industrial effluent discharge standards.

Keyword: Food and beverage wastewater; Wastewater treatment plant; Membrane bioreactor; Hollow fiber; Flat sheet; Mixed liquor suspended solid and dissolved air floatation