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Optimisation of a modified submerged bed biofilm reactor for biological oleochemical wastewater treatment

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Highlights of the present study:

- Discussed oleochemical wastewater that mainly possesses high organic content
- Evaluated industrial effluence without proper biological wastewater treatment
- Discovered that a SBBR is an effective biological wastewater treatment method
- Optimised wastewater treatment and analysis of variance obtained by RSM

Abstract

Oleochemicals industry effluence mainly contains a high chemical oxygen demand (COD) in a range of 6,000-20,000 ppm. An effective biological wastewater treatment process must be carried out before wastewater is discharged into the environment. In this study, a submerged bed biofilm reactor (SBBR) was adapted to the biological oleochemical wastewater treatment plant observed in the present study. The effect of wastewater flow rate (100-300 mL/min), Cosmoball® percentage in the SBBR system (25-75%), and percentage of activated sludge (0-50%) were investigated in terms of COD reduction. The Box-Behnken design was used for response surface methodology (RSM) and to create a set of 18 experimental runs, which was needed for optimising the biological oleochemical wastewater treatment. A quadratic polynomial model with estimated coefficients was developed to describe COD reduction patterns. The analysis of variance (ANOVA) shows that the wastewater flow rate was the most effective factor in reducing COD, followed by activated sludge percentage and Cosmoball® carrier percentage. Under the optimum conditions (i.e., a wastewater flow rate of 103.25 mL/min a Cosmoball® carrier percentage of 71.94%, and an activated sludge percentage of 40.50%) a COD reduction of 98% was achieved. Thus, under optimum conditions, as suggested