Environmental Engineering and Management Journal

August 2022, Vol. 21, No. 8, 1329-1337
http://www.eemj.icpm.tuiasi.ro/; http://www.eemj.eu

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DEVELOPMENT OF A MODEL FOR WASTEWATER TREATMENT USING MOVING BED BIOFILM REACTOR

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Abstract

Moving Bed Biofilm Reactor (MBBR) addresses both suspended and attached biomass by integrating moveable carriers that provide a large surface area for biofilm growth without biomass recycling. Literature review has been carried out to evaluate the efficiency of MBBR under the influence of various independent variables like filling fraction, loading rates, dissolved oxygen requirements, hydraulic retention time, etc. The petroleum industry sector wastewater generation and treatment standards are summarized followed by the design of MBBR process for treating the petroleum industry wastewater. For the treatment of petroleum wastewater with an 831.2 m^3/d flow rate, 412 mg/L SCOD concentration, 1300 mg/L TCOD concentration and 26.81 g/m^2.d surface area loading rate; the calculated MBBR tank volume is 6812.51 m^3 providing 0.053 g/L SCOD concentration and around 0.2 g/L TCOD concentration in the treated wastewater. Designing of MBBR process is done using Design-Expert version 13.0.1 software with pH (5.0-9.0) and HRT (1.0-5.0 days) as independent variables and type of the material for the carrier media (poly-propylene (PP), low density polyethylene polypropylene (LDPE PP), and polyurethane foam polypropylene (PUF PP)) as a categorical variable. The predicted equation in terms of coded factors and graphs showing the effect of the variables on the COD removal efficiency are discussed. The average COD removal and standard deviation from the model is found to be around 50% and 25% respectively. MBBR can be effectively used for petroleum industry wastewater treatment using the developed model to maximize the removal efficiency, contributing to a major reduction in operating cost and energy demand.

Key words: Carrier media, hydraulic retention time, moving bed biofilm reactor, wastewater treatment

Received: March, 2022; Revised final: July, 2022; Accepted: August, 2022; Published in final edited form: August, 2022

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