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Strategies to enhance the removal of the persistent pharmaceutically active compound carbamazepine by membrane bioreactors

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ABSTRACT

Carbamazepine, which is an anti-epileptic drug, is ubiquitously present in municipal wastewater. Owing to its recalcitrant chemical structure, carbamazepine is not significantly removed during conventional biological treatment or even by membrane bioreactor (MBR). With the ultimate aim of providing insights into the strategies to enhance carbamazepine removal, the effect of key operational parameters, namely, loading rate (2–750 μg/L·d), pH (5–9), mixed liquor suspended solids (MLSS) concentration (1–15 g/L) and dissolved oxygen (DO) (<0.5–5 mg/L) on the removal of carabamazepine by MBR was systematically studied. Results obtained in this study revealed negligible influence of pH and of MLSS concentration (beyond 5 g/L) on the removal of carbamazepine. The removal rate, however, was significantly enhanced under a DO concentration of less than 0.5 mg/L, suggesting that an alternating anoxic-oxic environment in MBR would achieve high removal. Significantly enhanced (287 mg/g vs. 0.02 mg/g) adsorption of carbamazepine on powdered activated carbon (PAC) as compared to MBR sludge indicated that simultaneous PAC adsorption in MBR may achieve enhanced removal.

Keywords: Carbamazepine; Enhanced removal; Membrane bioreactor; Pharmaceutically active compound; Dissolved oxygen; Wastewater

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