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Waste tire chunks as a novel packing media in a fixed-bed sequence batch reactors: volumetric removal modeling

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ABSTRACT

Waste tires feature environmentally sensitive and new recycling techniques are necessary. The present study evaluated waste tire chunks (WTCs) as a novel media for biological growth and biofilm development in fixed-bed sequence batch reactor (FBSBR) as an alternative method of recycling scrap tires. To assess WTCs as a biofilm carrier, two types of operation means sequencing batch reactor (SBR) and adding WTCs into SBR (FBSBR) were used to treat municipal wastewater. The FBSBR was fed with four concentrations synthetic wastewater at four hydraulic retention times (HRTs). An experimental model was used to study the kinetics of substrate consumption in biofilm. Soluble chemical oxygen demand (SCOD) removal efficiency was 90%–96% for the FBSBR compared with 85%–95% in an SBR. The use of WTCs as a media for biomass production was assessed by monitoring the mixed liquor suspended solid (MLSS) concentrations vs. COD removal for both reactors. The results revealed that the sludge production yield (Y_{obs}) was significantly less in the FBSBR compared with the SBR. It also produced less sludge and recorded a lower stabilization ratio (volatile suspended solids/total suspended solids). The findings show that the Stover–Kincannon model was the best fit ($R^2 > 99\%$).

Keywords: Waste tire; Packing media; FBSBR; Biofilm; Modeling; Sludge yield

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