Effect of hydraulic retention time (HRT) on pentachlorophenol (PCP) and COD removal in a pilot GAC-SBBR system for the post-treatment of recycled paper mill wastewater


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ABSTRACT

This study investigates the feasibility of using a pilot-scaled sequencing batch biofilm reactor (SBBR) with an option for granular activated carbon (GAC), at different hydraulic retention times (HRT) for the post-treatment of treated recycled paper industry wastewater containing potentially persistent and toxic pollutants, especially adsorbable organic halides (AOX). The environmental problems associated with AOX include their accumulation in the food chain and their persistence in nature. The pilot plant consists of a high-density polyethylene (HDPE) biofilm reactor with a diameter of 1.2 m, and a maximum water depth of 1.8 m, that is packed with 1111 g/L of 2–3 mm granular activated carbon (coconut shells). The effect of HRT on AOX (specifically PCP) and COD removal was investigated at varying hydraulic loading rates of 0.3–0.8 m³/(m² day). The HRT was investigated at three different levels varying from 1 to 3 days and the most suitable retention time, resulting in maximum overall removal of COD and PCP, was determined. The study demonstrated that at a workable HRT of 3 days and an average organic loading rate of 0.008 kg COD/m³ d, the PCP and COD removal efficiencies of the reactors were 100% and 86.9 ± 2.4%, respectively, at optimum pH of 7–8 and DO of 4–6 mg/L.

Keywords: Pilot GAC-SBBR; HRT; Adsorbable organic halides (AOX); Recycled paper industry; Pentachlorophenol (PCP); Post-treatment

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