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Advanced oxidation for aromatic amine mineralization after aerobic granular sludge treatment of an azo dye containing wastewater

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ABSTRACT

Advanced oxidation processes (AOP), namely ozonation and UV irradiation, were tested to evaluate the possibility of complete mineralization of the metabolites resulting from biodecolorization of the azo dye Acid Red 14. These were present in the effluent collected from an aerobic granular sludge bioreactor operated on a 6-h cycle, including a 5-h reaction step comprising two stages, a 2-h anaerobic followed by a 3-h aerobic. This effluent was examined by high-performance liquid chromatography (HPLC) and 4-amino-1-naphthalenesulfonic acid (4A1NS) was found to be the major metabolite, derived in a stoichiometric amount from the complete bioreduction of the added dye. AOP application results indicated that 85% removal of the 4A1NS amine can be obtained after 5 min of ozonation or 20 min of UV irradiation. UV-visible spectrum and HPLC profiles were different in the effluents from the two AOP, suggesting different conversion patterns, namely concerning aromatic compounds. Chemical oxygen demand (COD) removal was found to be negligible, under 5%, in both cases. However, a simulated recirculation of the AOP-treated effluents back to the biological treatment stage resulted in significant COD removal yields in the 15%–20% range. It was concluded that the tested, simple AOP are promising post biological treatment options for promoting the mineralization of the tested azo dye's persistent metabolites.

Keywords: Advanced oxidation processes; Ozonation; UV irradiation; Aromatic amines; Azo dye; Aerobic granular sludge

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