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Effect of Fenton oxidation on the toxicity of carpet manufacturing effluents

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ABSTRACT

Treatment of wastewater generated in carpet manufacturing is a problematic issue, mainly because of the toxic impact of chemicals used in different processes. Fenton oxidation may be a suitable approach for reducing toxicity but the cost of chemicals may be prohibitive to adopt this process as the main treatment phase. In this context, this study explored the feasibility of implementing either Fenton or Fenton-like oxidation process as a pretreatment stage before the biological treatment of carpet manufacturing effluents. It also included optimization of operation parameters using response surface methodology. Optimization was mainly focused on molar ratios of H_2O_2/COD and H_2O_2/Fe along with the reaction time for Fenton and Fenton-like advanced oxidation. For the Fenton process, the optimum H_2O_2/COD and H_2O_2/Fe^{2+} molar ratios were determined as 0.06 and 0.60 mol/mol, respectively. Different optimum values of 0.29 and 4 mol/mol, respectively, were applied to the same molar ratios for the Fenton-like oxidation. The Fenton process yielded 81% and 68% for COD removal and toxicity reduction, respectively. Similarly, removal yields of 62% for COD and 76% for toxicity were achieved by means of the Fenton-like oxidation. This process proved to be suitable as a pre-treatment step, where adequate toxicity reduction was achieved to allow effective COD removal in the following biological treatment phase.

Keywords: Advanced oxidation; Carpet manufacturing wastewaters; Fenton oxidation; Fenton-like oxidation; Toxicity

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