

Fenton and solar photo-Fenton processes for the removal of chlorpyrifos insecticide in wastewater

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Abstract

The degradation of chlorpyrifos in water by Fenton ($\text{H}_2\text{O}_2/\text{Fe}^{2+}$) and solar photo-Fenton ($\text{H}_2\text{O}_2/\text{Fe}^{2+}$ /solar light) processes was investigated. A laboratory-scale reactor was designed to evaluate and select the optimal oxidation condition. The degradation rate is strongly dependent on pH, temperature, H_2O_2 dosing rate, and initial concentrations of the insecticide and Fe^{2+} . The kinetics of organic matter decay was evaluated by means of chemical oxygen demand (COD) measurement. Overall kinetics can be described by a pseudo-second-order rate equation with respect to COD. The optimum conditions were obtained at pH 3, H_2O_2 dosing rate $120 \text{ mg}\cdot\text{min}^{-1}$, $[\text{Fe}^{2+}]_0$ 5.0 mM, initial COD $1330 \text{ mg}\cdot\ell^{-1}$ and 35°C for the Fenton process. However, in the solar photo-Fenton process, the degradation rate increased significantly. To achieve 90% of COD removal, the solar photo-Fenton process needs 50% less time than that used in the Fenton process which translates to a 50% gain of H_2O_2 .

Keywords: chlorpyrifos; degradation kinetic; Fenton; solar photo-Fenton; COD removal