Elimination of bio-refractory chlorinated herbicides like atrazine, alachlor, and chlorbromuron from aqueous effluents by Fenton, electro-Fenton, and peroxi-coagulation methods


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ABSTRACT

Alachlor, atrazine (broad-leaf herbicides), and chlorbromuron (photosynthesis inhibitor) have been used worldwide to control weeds in crops. Their extensive use have led to widespread contamination of soils, and water which has consequently led to increasing concern about the environmental fate of these substances, since these herbicides are persistent in the environment and exhibit relatively slow rate of decomposition. Several advanced oxidation processes have been used to degrade such bio-refractory organic contaminants present in wastewater. The Fenton process is classified among these processes and has been used for the removal of many hazardous organics from wastewater efficiently. This study reports the removal of alachlor, atrazine, and chlorbromuron from aqueous effluents by classical Fenton, electro-Fenton, peroxi-coagulation, and photoperoxi-coagulation processes in slightly acidic aqueous solutions. A UV lamp was used to assist the peroxi-coagulation process. Herbicide concentration decrease during the oxidation processes was followed by HPLC and chemical oxygen demand (COD) analyses. The reaction for the removal of these herbicides follows apparent-first-order kinetics. Photoperoxi-coagulation was better than electro-Fenton process. The use of UV-light irradiation during the herbicide elimination by peroxi-coagulation achieved total COD removal at 75 min for all the three herbicides treated. In the absence of UV-light irradiation, COD removals of 96, 97, and 93% were achieved for 83.3 mg/L alachlor, 62.0 mg/L of atrazine, and 35.0 mg/L of chlorbromuron, respectively.

Keywords: Atrazine; Alachlor; Chlorbromuron; Fenton; Herbicides

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