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Ciprofloxacin degradation using low-grade titanium ore, persulfate and artificial sunlight for industrial wastewater

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The presence of pharmaceutical compounds in surface water represents several risks in both environmental and public health; particularly, ciprofloxacin is a genotoxic agent and generates antibiotic resistance in several organisms. Human and animal excrete and industrial discharges are the main sources of this emerging pollutant. The present study evaluates free radical persulfate activation with iron oxides from a low-grade titanium ore and artificial sunlight as an advanced oxidation technology, for degradation of ciprofloxacin in aqueous phase at laboratory scale. The material was characterized by XRD, N_2 adsorption/desorption and SEM. Central compose design with three factors and two responses, was used in order to optimize dosages of persulfate between 0.07 and 0.23 g L^{-1}, and titanium low-grade ore from 0.2 to 0.6 g L^{-1} and, for studying initial concentration of ciprofloxacin from 0.01 to 0.03 g L^{-1} reported in literature, both surface water and toxic industrial discharges. Trials were performed in a raceway reactor into a sunlight simulator under average radiation condition of Mexico City (400 Wm^2). Aliquots were collected at preselected time intervals during degradation experiments. Ciprofloxacin and residual persulfate concentrations were measured by liquid chromatography and spectrophotometry respectively. Exploratory trials showed 100% degradation of ciprofloxacin induced by free radical persulfate; however, the optimization in several variables with constraints highlighted an optimal combination of persulfate, iron oxide and initial ciprofloxacin of 0.25, 0.11 and 0.021 g L^{-1}, for achieving the lowest final ciprofloxacin concentration and residual persulfate simultaneously of 0.0003 and 0.038 g L^{-1} respectively, in the first 20 minutes.

Biography

J A Macías Vargas has completed his MSc from Universidad Autónoma Metropolitana and is attending his doctoral studies at Universidad Nacional Autónoma de México. He had taught for 10 years at private and public universities and was Deputy Director of Climate Change at National Institute of Ecology-SEMARNAT (Mexican Federal Government).

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