



Alachlor photocatalytic degradation over uncalcined Fe–TiO₂ loaded on granular activated carbon under UV and visible light irradiation

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ABSTRACT

Alachlor is a recalcitrant carcinogenic contaminant that may easily spread in water sources due to its wide usage as an herbicide. The aim of this study is to synthesize Fe–TiO₂ on granular activated carbon (GAC) support via hydrothermal method for the photocatalytic degradation of alachlor under ultraviolet and visible light irradiation. The effects of Fe–TiO₂ loading, initial alachlor concentration, and initial solution pH were determined using Box–Behnken design (BBD). X-ray diffraction (XRD) analysis of Fe–TiO₂-GAC samples showed anatase TiO₂ peaks as well as the graphite peak from carbon. Scanning electron microscope (SEM) images verified that Fe–TiO₂ was immobilized onto the GAC. In UV photocatalysis, the interaction between Fe and TiO₂ loading and initial alachlor concentration is significant wherein low Fe–TiO₂ loading and 50 ppm initial alachlor concentration increased the removal efficiency. In visible light photocatalysis, low Fe–TiO₂ loading and initial alachlor concentrations of 30 and 70 ppm are significant. The interactions of the initial solution pH with Fe–TiO₂ loading and initial alachlor concentration are also significant in which low solution pH increased alachlor removal for low Fe–TiO₂ loading and low initial concentration. The highest alachlor removal percentages obtained were 99.74 and 99.96% under UV and visible light irradiation, respectively. Total organic carbon analysis confirmed the mineralization of alachlor with 92.44 and 66.49% removal by UV and visible light photocatalysis, respectively.

Keywords: Alachlor; Box–Behnken design; Fe–TiO₂; Granular activated carbon support; Photocatalysis

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