

Investigation of the reaction pathway for degradation of emerging contaminant in water by photo-Fenton oxidation using fly ash as low-cost raw catalyst

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Abstract

In this work, fly ash from a Brazilian thermal power plant was employed as a low-cost raw catalyst for Procion red degradation by photo-Fenton process. The ash was characterized by X-ray fluorescence (XRF), X-ray diffraction (XRD), nitrogen adsorption/desorption isotherms (BET), Fourier-transform infrared spectroscopy (FTIR) and scanning electron microscopy (SEM) coupled with energy-dispersive X-ray spectrometry (EDX). The material had an iron content of 4.10 wt%, distributed homogeneously on the solid surface. The ash particles showed mainly spherical morphology between 0.5 and 20 μm . The catalyst presented promising activity, reaching 93% of dye decolorization at 60 min of reaction, and 85% of organic load removal at 240 min. The predominant oxidizing species involved on the degradation of dye molecules during the photo-Fenton reaction were the hydroxyl radicals ($\text{HO}\cdot$). The material showed remarkable stability and reusability after five successive cycles of reuse. The reaction intermediates were identified by LC/MS analysis and a reaction pathway was proposed.

Keywords

Fly ash; Photo-Fenton; Degradation; Dye; Mechanism; Scavenger