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AREA: Environmental catalysis, photocatalysis and electrocatalysis.

Photocatalytic degradation of red dye using $TiO_2/CoFe_2O_4$/KIT-6

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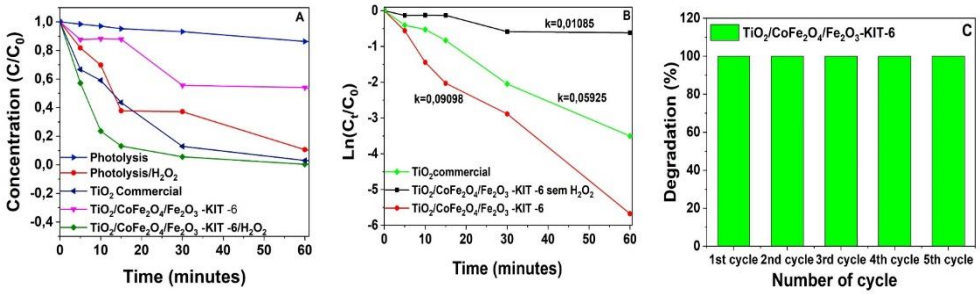
Abstract

Several harmful organic substances, such as industrial dyes, pharmaceutical products and agrochemicals, have been detected in wastewater. In this way, concern is raised because they are chemically stable, toxic species and cause serious problems to the ecosystem and human health, even at low concentrations. Therefore, it is necessary to develop methodologies and materials capable of solving this problem. Thus, the present work aimed to synthesize and characterize the solid based on $TiO_2/CoFe_2O_4/Fe_2O_3$-KIT-6, evaluating its performance in the photocatalytic degradation of the dye remazol red ultra RGB. The mesoporous support followed the traditional route proposed by Kleitz (2003) and the active phases were incorporated through incipient impregnation, containing 20% cobalt ferrite ($CoFe_2O_4$) and 10% anatase (TiO_2). The Photocatalyst was characterized by XRD and UV-VIS, photocatalytic tests of the red remazol dye (25 ppm) were carried out under constant temperature, 120W radiation and 10mM H_2O_2 concentration. The main results are shown in Figure 1.

Figure 1 - Main results: (a) Photocatalytic tests; (b) Kinetics curves; (c) Reuse tests.



The desired phases were obtained as observed in XRD diffractograms in Figure 2S with some distortions due to interactions with the support, also presenting a band gap energy of 1.56 eV as can be seen in Figure 3S. The best dye degradation result was with the $TiO_2/CoFe_2O_4$/KIT-6 photocatalyst in the presence of H_2O_2 (Figure 1A), which showed high stability for 5 reaction cycles (Figure 1C). Although the result of commercial TiO_2 is close to that of the $TiO_2/CoFe_2O_4$/KIT-6 photocatalyst with H_2O_2, its kinetics are slower. Furthermore, the $TiO_2/CoFe_2O_4$/KIT-6 material has the advantage of being easily separated from the reaction medium by applying an external magnetic field. The proposed photocatalyst, within the heterogeneous Photo-Fenton system, presents a degradation rate close to that of commercial TiO_2, having an advantage over it in terms of separation, since its magnetic properties provide easy recovery of the material from the action of a external magnetic field gradient.

Keywords: $CoFe_2O_4$, TiO_2, KIT-6, Photocatalysis

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