Parameters affecting the photocatalytic degradation of Imazapyr herbicide in aqueous solution using Ca_xMnO_y/TiO_2 composite

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In this study, the commercial titanium dioxide TiO_2 (Hombikat, UV-100) mixed with different weight fraction of birnessite (1-wt % to 50-wt%) was investigated for the photo-degradation of methylene blue dye and Imazapyr herbicide.
Upon preparation, composites were characterized by N_2-physisorption, elemental analysis, scanning electron microscopy (SEM), UV-visible absorption and X-ray diffraction (XRD).
The highest degradation of methylene blue was achieved with two synthetic birnessite [1,2] samples with varied calcium content.

Experiments were investigated in order to assess the influence of various parameters, such as the initial pH of the solution to be degraded, concentration of Imazapyr, temperature at which the catalysts must be calcined, the amount of the catalyst, on the efficiency of the photocatalyzed degradation of Imazapyr.

Ti-5Ca0.1Mn composite showed a maximum degradation efficiency of Imazapyr herbicide at pH 7. Photocatalytic degradation followed first order-kinetics Fig.1.
The photocatalytic activity, in terms of rate constant was found to increase from $0.15 min^{-1}$ to $0.225\ min^{-1}$ for Imazapyr herbicide, respectively in presence of commercial titanium dioxide TiO_2 and Ti-5Ca0.1Mn composite.

This enhancement is a result of the availability of more sorption sites on the attributed composites, due to the deposition of manganese oxide mainly on the surface of pure titanium during synthesis.[3]. The residues of Imazapyr and its breakdown products were analyzed using mass spectrometry electrospray ionisation MS-ESI Bruker esquire 3000 plus and nuclear magnetic resonance (NMR).

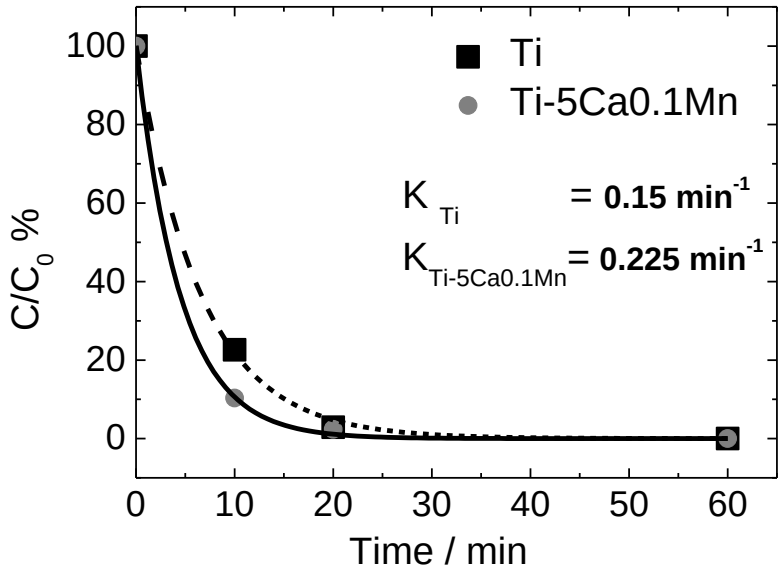

Figure 1. Concentrations of Imazapyr as a function of time for Ti and Ti-5Ca0.1Mn composite ;(C(Imazapyr)= 5 μM); stirring speed = 1000 min-1, m catalyst= 100 mg).

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