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Photo-Fenton Degradation of Organic Compounds by Iron(II)-Embedded Composites

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Abstract : One of the most important classes of pollutants is represented by dyes. The synthetic character and complex molecular structure make them more stable and difficult to be biodegraded in water. The treatment of wastewaters containing dyes in order to separate/degrade dyes is of major importance. Various techniques have been employed to remove and/or degrade dyes in water. Advanced oxidation processes (AOPs) are known as among the most efficient ones towards dye degradation. The aim of this work is to investigate the efficiency of a cheap Iron-impregnated activated carbon Fenton-like catalyst in order to degrade organic compounds in aqueous solutions. In the presented study an anionic dye, Indigo Carmine, is considered as a model pollutant. Various AOPs are evaluated for the degradation of Indigo Carmine to establish the effect of the prepared catalyst. It was found that the Iron(II)-embedded activated carbon composite enhances significantly the degradation process of Indigo Carmine. Using the wet impregnation procedure, 5 g of L27 AC material were contacted with Fe(II) solutions of FeSO4 precursor at a theoretical iron content in the resulted composite of 1 %. The L27 AC was impregnated for 3h at 45°C, then filtered, washed several times with water and ethanol and dried at 55 °C for 24 h. Thermogravimetric analysis, Fourier transform infrared, X-ray diffraction, and transmission electron microscopy were employed to investigate the structural, textural, and micromorphology of the catalyst. Total iron content in the obtained composites and iron leakage were determined by spectrophotometric method using phenantroline. Photo-catalytic tests were performed using an UV - Consulting Peschl Laboratory Reactor System. UV light irradiation tests were carried out to determine the performance of the prepared Iron-impregnated composite towards the degradation of Indigo Carmine in aqueous solution using different conditions (17 W UV lamps, with and without in-situ generation of O3; different concentrations of H2O2, different initial concentrations of Indigo Carmine, different values of pH, different doses of NH4-OH enhancer). The photocatalytic tests were performed after the adsorption equilibrium has been established. The obtained results emphasize an enhancement of Indigo Carmine degradation in case of the heterogeneous photo-Fenton process conducted with an O3 generating UV lamp in the presence of hydrogen peroxide. The investigated process obeys the pseudo-first order kinetics. The photo-Fenton degradation of IC was tested at different values of initial concentration. The obtained results emphasize an enhancement of Indigo Carmine degradation in case of the heterogeneous photo-Fenton process conducted with an O3 generating UV lamp in the presence of hydrogen peroxide. Acknowledgments: This work was supported by a grant of the Romanian National Authority for Scientific Research and Innovation, CNCS - UEFISCDI, project number PN-II-RU-TE-2014-4-0405.

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