Degradation of methylene blue organic wastewater by magnetically activated nanofibers

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Methylene blue (MB) is a common contaminant released as effluent after many textile industry procedures. Labelled as an organic dye (OD), MB is one of the most abundant pollutants in the aquatic environment. A large number of techniques for MB removal are being perfectioned, but most of them face the difficulties for scaling-up to industrial and environmental massive applications. In this talk we will show and discuss the elaboration, characterization, and testing of electrospun magnetic nanofibers (MNFs) as a degradation platform for decontamination. A simple and scalable protocol to obtain robust and multifunctional MNFs has been obtained by combining a sonochemical route for a fast synthesis of magnetic nanoparticles (MNPs) and a simple laboratory-made electrospinning setup. The obtained MNFs with average diameter $\phi = 760 \pm 150$ nm showed superhydrophobic behaviour (θ_c = 165º). The presence of MNPs embedded into the nanofibers modify the degradation, exothermic and glass transitions temperatures of the polymer as compared with pure polyacrylonitrile (PAN), suggesting a strong attachment between the MNPs and polymeric chains. The MNFs were remotely activated by inductive heating to verify their catalytic efficacy under acidic (pH=3), neutral (pH=7) and basic (pH=10) environments. We found that the MNFs were stable even after several cycles of heating for degradation of the methylene blue, attaining an efficiency > 80 % in presence of hydrogen peroxide (H_2O_2). We discuss the advantages of our immobilized catalytic system that include chemical robustness, easy separability, and recyclability, together with the capacity of magnetic activation.