Synthesis and Characterization of Nano Iron Based Materials and Their Application for the Anionic and Cationic Dye Removal

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Abstract

Removal of pollutants from ground waters and surface waters is one of the essential environmental fields that are being considered internationally. Permeable reactive barriers (PRB's) facilities that contain iron powder as afilling material are being tested for treating surface waters. Due to its large surface area and surface activity, iron nanoparticles are being proposed to replace iron powder in PRB's. Direct injection of iron nanoparticles into underground water bodies is also being tested. So far, this material has widely been reported to effectively remove various types of organic and inorganic pollutants.

In this study, iron nanoparticles along withnano iron supported on natural zeolite and aluminahave been produced via reduction of iron ions using sodium borohydride. The zeolite and alumina substrates decreasedthe aggregation of the nanoparticles, thereby enhancing their surface activity and uptake capacity.The iron nanoparticles with their based materials were characterized using XRD, FTIR, SEM, EDX, BET-N2and TGA. The produced iron nanomaterials were then used in the removal of aqueous methylene blue and methyl orange as two models of cationic and anionic dyes. The experiments investigated the effects of contact time and concentration of dyes in order to assess the kinetic behavior of the dye removal process and the dye uptake capacity on iron nanoparticles and nano iron based materials. In addition, iron nanoparticles were studied as a Fenton-like catalyst for dyedegradation.The iron materials demonstrated impressive kinetic and loading behavior in the dye removal from aqueous solutions.

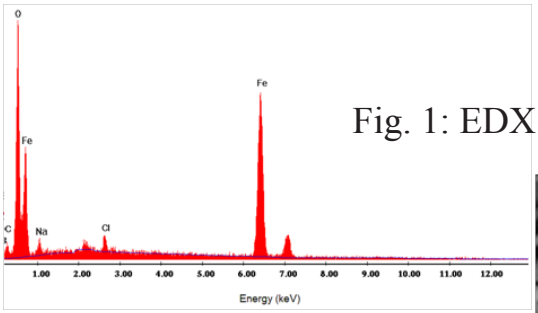

Fig. 1: EDX spectrum of iron nanoparticles

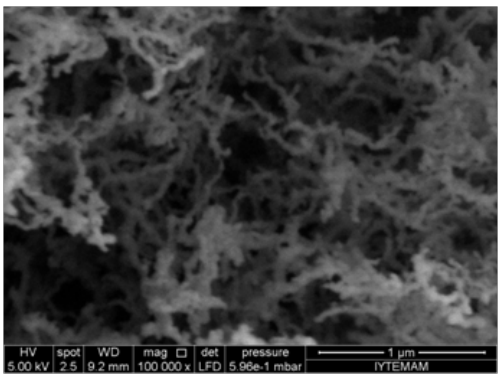

Fig. 2: SEM Image of Iron nanoparticles showing theirchain-like morphology