

Using novel organometallic precursors for a facile mechanical milling synthesis of NiCr_2O_4 nanostructures with remarkable photocatalytic activity

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Abstract

Ball milling method was used to prepare NiCr_2O_4 nanostructures via a facile and solvent-less using new set of organometallic starting reagents including $\text{Ni}(\text{Sal})_2$ as nickel source and $[\text{Cr}(\text{en})_2]\text{Cl}_2 \cdot 2\text{H}_2\text{O}$ as chrome source. Key factors controlling characteristics of final products were investigated such as ball mill time, speed of ball mill, mass ratio of ball to powder and process control agent on morphology of as-prepared NiCr_2O_4 nanostructures. The morphology and microstructure of as-synthesized products were characterized by XRD, SEM, FTIR and EDX. Finally, the photocatalytic activity of nickel chromite nanostructures were studied by performing the photocatalytic degradation of an azo dye (Acid Red 1) at different irradiation time. Accordingly, after 150 min of irradiation on the degradation of the azo dye the results indicated that significant amount of the dye was degraded. The pseudo-first-

order kinetic models were used and the rate constants were evaluated with pseudo first order rate constants of $2.47 \times 10^{-3} \text{ min}^{-1}$. The effects of particle size and morphology on the photocatalytic activity were evaluated as well.

Keywords: Nickel chromite; Ball mill; Photocatalyst; Organometallic; Azo dye.