Fabrication of $\text{TiO}_2@\text{FeS}_2$ Nanocomposite for Photocatalytic Degradation of Organic Dyes in the Industrial Wastewater

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This study was conducted on synthesis of titanium dioxide (TiO_2) and Iron disulfide (FeS_2) nanocomposite ($\text{TiO}_2@\text{FeS}_2$ NC) as a photocatalyst for degradation of methyl orange (MO) as chemical pollutants in the industrial wastewater. The TiO_2 , FeS_2 and $\text{TiO}_2@\text{FeS}_2$ NC were synthesized through chemical methods. The morphology and crystal structure of prepared samples were studied using FESEM and XRD analyses. The results showed humongous mixture of TiO_2 and FeS_2 in $\text{TiO}_2@\text{FeS}_2$ NC. Optical study revealed that the band-gap values for TiO_2 , FeS_2 and $\text{TiO}_2@\text{FeS}_2$ NC films were obtained 3.07, 2.74, and 2.88 eV, respectively. Electrochemical characterization exhibited that specific capacitance of $\text{TiO}_2@\text{FeS}_2$ NC was more than TiO_2 and FeS_2 due to effective incorporation Ti and Fe ions to nanocomposite structure and higher effective surface area. The results of photodegradation studies showed the complete degradation of 20 mg/l of MO in the presence of $\text{TiO}_2@\text{FeS}_2$ NC photocatalyst were achieved under 65 and 58 minutes UV and visible light irradiations, respectively. Results showed that the degradation efficiency of TiO_2 film was significantly improved 20% and 33% by mixing FeS_2 in $\text{TiO}_2@\text{FeS}_2$ NC under UV and visible irradiation, respectively.

Keywords: Photocatalytic degradation; Methyl orange; TiO_2 and FeS_2 nanocomposite; Band gap; Degradation efficiency

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