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Fabrication and characterization of novel iodine doped hollow and mesoporous hematite (Fe_2O_3) particles derived from sol-gel method and their photocatalytic performances

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Abstract

In this work, iodine (I) doped hollow and mesoporous Fe_2O_3 photocatalyst particles were fabricated for the first time through sol-gel method. Phase structure, surface morphology, particle size, specific surface area and optical band gap of the synthesized Fe_2O_3 photocatalysts were analyzed by X-ray diffraction (XRD), field emission scanning electron microscope (FESEM), X-ray photoelectron spectroscopy (XPS), BET surface analysis, particle size analyzer and UV–vis diffuse reflectance spectrum (UV–vis DRS), respectively. Also, electrochemical properties and photoluminescence spectra of Fe_2O_3 particles were measured. The results illustrated that high crystalline, hollow and mesoporous Fe_2O_3 particles were formed. The optical band gap values of the Fe_2O_3 photocatalysts changed between 2.104 and 1.93 eV. Photocatalytic efficiency of Fe_2O_3 photocatalysts were assessed via MB solution. The photocatalytic activity results exhibited that I doping enhanced the photocatalytic efficiency. 1% mole iodine doped (I-2) Fe_2O_3 photocatalyst had 97.723% photodegradation rate and 8.638 $\times 10^{-2}$ min^{-1} kinetic constant which showed the highest photocatalytic activity within 45 minutes. Moreover, stability and reusability experiments of Fe_2O_3 photocatalysts were carried out. The Fe_2O_3 photocatalysts showed outstanding stability after four sequence tests. As a result, I doped Fe_2O_3 is a good candidate for photocatalysts.

Keywords: Sol-gel; Hematite; Mesoporous; Iodine doping; Photocatalytic Activity.

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