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Heterogeneous Fenton-like LFO catalyst for the degradation of organic pollutant in wastewater

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ABSTRACT

$LaFeO_3$ (LFO) nanoparticles were successfully prepared by hydrothermal method at different calcination temperatures. The LFO samples were characterized by X-ray diffraction (XRD), thermogravimetric analysis (TGA), scanning electron microscopy (SEM), transmission electron microscopy (TEM), N_2 adsorption-desorption analysis and UV-Vis absorption spectra. The best sample was calcined at 800 ^oC having particles size in the range of 50-60 nm. Under visible light irradiation and in the presence of H_2O_2, LFO exhibited the strongly photocatalytic activity with almost 100% of Rhodamine B (RhB) degraded after 90 min. LFO is a promising catalyst for the degradation of organic pollutants.

Introduction

In recent year, environmental pollution issue, especially wastewater pollution has been increasing alarmingly. Due to the rapid development of textile industry and lack of modern technologies for textile wastewater treatment, a considerable amount of harmful organic dyes has been discharged into environment [1]. The presence of dyes in effluent can be easy visible and undesirable because it causes some serious problems to aquatic life and human health disorders [2]. Meanwhile, the most notable ones include Rhodamine B (RhB), methylene blue (MB) and methyl orange (MO) which have been used as colored substances for printing or dyeing cotton, leather, silk, wool [3]. Experimental research has proven the negative effects arising from RhB and MO on human well-being and ecological environment, including carcinogenicity, toxicity, and mutagenicity and cannot degradation in a long time [2]. At the moment, when the aquatic life and human health have been interested, we can see wastewater treatment targeting at minimizing the levels of these organic compounds has become essential.

In the pass, various methods have been suggested to handle the dye removal from water such as biodegradation, coagulation, adsorption, advanced oxidation processes (AOPs) and the membrane process but all of these methods have not been as effective as expected [2]. Recently, perovskite-based materials have been reported as excellent visible-light-driven photocatalysts [4]. Several types of perovskite materials have been studied widely, such as titanate perovskites [5], tantalate perovskites [6] and ferrite perovskites [7]. Especially, lanthanum ferrite perovskite ($LaFeO_3$) possesses narrow band gap energy which enables to function under visible light. Due to this property, ($LaFeO_3$) has attracted a lot of attention. Some studies have shown the good photocatalytic activity of LFO for the degradation of dyes, such as 35% RhB was degraded within 3 hours [8]; 80% RhB was removed [9]; degraded 83% of MO [10]. Obviously, the photocatalytic performance of LFO was not high, thus the synthesis of LFO catalysts with better