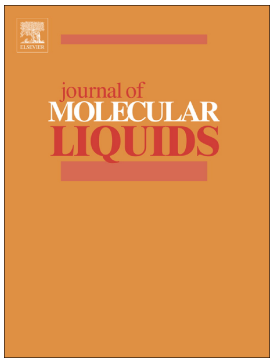

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Soleiman Mosleh, Mahmood Reza Rahimi, Mehrorang Ghaedi, Arash Asfaram, Ramin Jannesar, Fardin Sadeghfar

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A rapid and efficient sonophotocatalytic process for degradation of pollutants: statistical modeling and kinetics study

Soleiman Mosleh [a], Mahmood Reza Rahimi [b*], Mehrorang Ghaedi [c*], Arash Asfaram [d], Ramin Jannesar [e], Fardin Sadeghfar [f]

[a] Department of Gas and Petroleum, Yasouj University, Gachsaran 75918-74831, Iran.

[b] Process Intensification Laboratory, Chemical Engineering Department, Yasouj University, Yasouj 75918-74831, Iran.

[c] Chemistry Department, Yasouj University, Yasouj 75918-74831, Iran.

[d] Medicinal Plants Research Center, Yasuj University of Medical Sciences, Yasuj, Iran.

[e] Pathology Group, Yasuj Medical School, Yasuj, Iran.

[f] Researcher of Chemistry Department, Yasouj University, Yasouj 75918-74831, Iran.

Abstract

$Cu/Fe_3O_4@SiO_2$ nanocomposites were synthesized and pre-specified by X-ray powder diffraction (XRD), field emission scanning electron microscopy (FESEM), energy dispersive X-Ray (EDX) and band gap energy via diffuse reflectance spectroscopy (DRS) techniques which due to their reasonable band gap (2.58 eV) is suitable candidate for visible light-driven photocatalyst. The prepared nanocomposites were used as photocatalyst for degradation of tartrazine (TR) and methylene blue (MB) in binary mixture under an efficient sonophotocatalytic reactor. The effect of seven effective parameters including initial concentration of TR and MB (5-25 mg L^{-1}), photocatalyst dosage (0.10-0.50 mg L^{-1}), solution flow rate (40-120 mL min^{-1}), oxygen flow rate (0.20-0.60 L min^{-1}), pH (2.0-10) and irradiation time (5-25 min) was studied and optimized using central composite design. The maximum sonophotocatalytic degradation percentages at optimum condition were found to be 99.98% and 99.96% for TR and MB, respectively. The kinetic studies strongly confirmed ability of pseudo first order reaction based on the Langmuir-Hinshelwood model for explanation of data and experimental results confirmed that understudy process is rapid and effective approach.

Keywords: $Cu/Fe_3O_4@SiO_2$-NCs, Visible light-driven photocatalyst, Sonophotocatalysis, Optimization, Dyes.

1. Introduction

* Corresponding authors: E-mail: mrrahimi@yu.ac.ir (M. R. Rahimi);
m_ghaedi@mail.yu.ac.ir; m_ghaedi@yahoo.com (M. Ghaedi)