Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2018.21977

109 (2018) 241–252
March

Efficient removal of malachite green dye from aqueous solution using functionalized GO/Fe_3O_4 nanocomposite: kinetic, equilibrium and thermodynamic studies

Sheng Feng[a,*], Shuguang Liu[a], Zhihui Zhang[b], Shanshan Feng[a], Bin Yuan[a], Ping Cheng[a], Runbai Wang[a]

[a]*School of Environmental and Safety Engineering, Changzhou University, Jiangsu 213164, China, Tel. +86 519 86330080; emails: shfeng@cczu.edu.cn (S. Feng), shguangliu@163.com (S. Liu), fss728@163.com (S. Feng), yuanbinbn@163.com (B. Yuan), 15189703919@163.com (P. Cheng), ruibaiwang@163.com (R. Wang)*
[b]*Jiangsu Key Laboratory of Advanced Catalytic Materials and Technology, Changzhou University, Jiangsu 213164, China, email: zhangzh@cczu.edu.cn*

Received 9 August 2017; Accepted 1 February 2018

ABSTRACT

In this work, we have revealed efficient solvothermal method for the synthesis of the graphene oxide (GO)/magnetite (Fe_3O_4) nanocomposite for the removal of malachite green (MG) from aqueous solution. The nanocomposite was characterized by X-ray diffraction, scanning electron microscopy, transmission electron microscopy, nitrogen adsorption–desorption and vibrating sample magnetometer isotherm analysis. Using adsorption models for equilibrium and kinetic investigation, it was found that the goodness of mathematical fitting of the batch adsorption data on the adsorption isotherms conformed well to the Langmuir isotherm, and the kinetic models could be described by the pseudo-second-order model. The thermodynamic parameters reveal that the adsorption process is spontaneous and endothermic in nature. The prepared GO/Fe_3O_4 nanocomposite showed excellent efficient removal of MG (over 98% for 1.0 g L^{-1}) with high adsorption capacity (220 mg g^{-1}) and rapid separation from water by an external magnetic field because of the efficient combination of the advantages of GO and the Fe_3O_4 nanoparticle. These results proved that the preparation of GO/Fe_3O_4 nanocomposite can be used as an efficient, separable adsorbent to adsorb MG contaminants in water.

Keywords: Graphene oxide; Fe_3O_4; Malachite green; Adsorption; Magnetite; Recycle

* Corresponding author.