Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2023.29750

303 (2023) 142–150
August

Removal of erythromycin antibiotic from the aqueous media using magnetic graphene oxide nanoparticles

Parya Fatholahi[a], H. Salehzadeh[b], Katayon Hosseini[c], K. Wantala[d], H.P. Shivaraju[e], D. Jenkins[f], B. Shahmoradi[g,h,*]

[a]*Department of Environment, Faculty of Natural Resources, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran, email: paryafathollahi@yahoo.com*
[b]*Student Research Committee, Kurdistan University of Medical Sciences, Sanandaj, Iran, email: hamzeh.salehzadeh@gmail.com*
[c]*Department of Environmental Science, Qeshm Branch, Islamic Azad University, Qeshm, Iran, email: katayon_hoseini@yahoo.com*
[d]*Department of Chemical Engineering, Faculty of Engineering, Khon Kaen University, Khon Kaen, Thailand, email: kitirote@kku.ac.th*
[e]*Department of Environmental Sciences, JSS Academy of Higher Education and Research, Sri Shivarathreeshwara Nagara, Mysuru, Karnataka 570015, India, email: shivarajuenvi@gmail.com*
[f]*Wolfson Nanomaterials & Devices Laboratory, School of Computing, Electronics and Mathematics, Faculty of Science & Engineering, University of Plymouth, Devon, PL4 8AA, UK, email: D.F.Jenkins@plymouth.ac.uk*
[g]*Department of Environmental Health Engineering, Faculty of Health, Kurdistan University of Medical Sciences, Sanandaj, Iran, email: bshahmorady@gmail.com/bshahmoradi@muk.ac.ir*
[h]*Center for Solid Waste Research (CSWR), Institute for Environmental Research (IER), Tehran University of Medical Sciences, Tehran, Iran*

Received 4 February 2023; Accepted 2 July 2023

ABSTRACT

The presence of antibiotic drugs in the aquatic environment causes many health and environmental problems. The purpose of this study was to investigate the removal efficiency of erythromycin antibiotic from aqueous media using magnetic graphene oxide nanoparticles. Therefore, in the batch system, to assess the adsorption efficiency, the effect of different parameters such as pH (3–11), adsorbent dose (0.01–0.05 g), a contact time (10–120 min), initial concentration of erythromycin antibiotic (1–100 mg/L), and temperature (288–313 K) was evaluated. The results showed that the maximum amount of erythromycin adsorption occurred in conditions of pH = 3, the antibiotic concentration of 100 mg/L, contact time of 120 min, a temperature of 313 K, and an adsorbent dose of 0.01 g. Thermodynamic parameters showed that the adsorption process of erythromycin antibiotic in the temperature range of 288 to 313 K is spontaneous and endothermic. The coefficients of determination and adsorption rate constant calculated using the pseudo-second-order model were R^2 = 0.99 and k_2 = 0.0004, respectively. The calculation based on the first-order model found R^2 = 0.2 and k_1 = –0.0199; it confirms that the pseudo-second-order model describes the laboratory data better than the first-order model. Meanwhile, the adsorption isotherms showed that antibiotic adsorption follows the Langmuir equation. According to the results of this research, a magnetic nanographene adsorbent with a high efficiency of 63.93% can be used to remove erythromycin from aqueous media.

Keywords: Antibiotic; Adsorption; Graphene oxide; Isotherms; Kinetics

* Corresponding author.