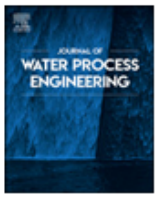
Journal of Water Process Engineering 57 (2024) 104577

Contents lists available at ScienceDirect

Journal of Water Process Engineering

journal homepage: www.elsevier.com/locate/jwpe



# Design and performance assessment of novel $Fe_3O_4$ decorated nanoblend of guar gum/graphene oxide flakes and CuO for mitigation of fluoroquinolones from wastewater

Laishram Saya [a,b,c], W. Rameshwor Singh [a,*], Sunita Hooda [b,*]

[a] Department of Chemistry, Manipur University, Canchipur, Imphal 795003, Manipur, India
[b] Polymer Research Laboratory, Department of Chemistry, Acharya Narendra Dev College (University of Delhi), Govindpuri, Kalkaji, New Delhi 110019, India
[c] Department of Chemistry, Sri Venkateswara College (University of Delhi), Dhaula Kuan, New Delhi 110021, India

ARTICLE INFO

*Keywords:*
Nanoblend
Isotherms
Kinetics
Adsorption
Antibiotic

ABSTRACT

Organic-inorganic nanoblends particularly, polysaccharide-blended-inorganic ones, possess interesting properties and hence versatile applications, due to which they have become the focus of much research attention, lately. The present study reports the fabrication of magnetic guar gum/graphene oxide nanocomposite blended with CuO to obtain a novel nanoblend, mGG/GO/CuO NB, through a two-stepped synthesis route: preparation of GO via Improved Hummers technique followed by mGG/GO/CuO NB preparation using co-precipitation method. The nanocomposite was subsequently investigated for its capacity for adsorptive elimination of ciprofloxacin from aqueous medium. It was identified using typical physico-chemical techniques, such as XRD, Raman, and FTIR spectroscopy; EDX and FESEM for morphological investigation; as well as VSM, $pH_{ZPC}$ and TGA. The Langmuir isotherm model and the pseudo second order model are obtained as the isotherm model and kinetic model that can best depict the adsorption behaviour. The Langmuir isotherm model provided an outstanding maximum adsorption capacity value of 769.23 mg $g^{-1}$ for CPX removal. Thermodynamics studies witness a spontaneous adsorption with an exergonic behaviour supported by a $\Delta G^{\circ}$ value of $-11.74$ kJ $mol^{-1}$ and $\Delta H^{\circ}$ value of $-49.976$ kJ $mol^{-1}$ as well as an increase in $\Delta S^{\circ}$ value ($+189.32$ $mol^{-1}$). Columbic/electrostatic interactions, hydrophobic interactions, hydrogen bonds, and electron-donor-acceptor (EDA) interactions are the main interacting forces predicted to be pivotal in the adsorption mechanism.

## 1. Introduction

In recent times, an overwhelming concern has been persisting across the globe over the availability of clean water as a result of the continuous and severe degradation of the aesthetic qualities of water bodies. This is mainly attributed to the careless discharge of various types of chemicals such as pharmaceuticals, like antibiotics, from industrial effluents, hospitals, labs, etc. [1]. Global animal production has increased the USA alone in 2013. [5] To minimize and control AMR, which has grown to represent a significant danger to global public health, over the last several decades, initiatives have been undertaken to design nanomaterials to serve specific functions.

For the purpose, scientists and researchers from all domains have been paying major attention on the fabrication of sustainable nanocomposites based on biopolymer [6,7]. In this regard, natural polysaccharides have stood out as promising candidates which can act as