Adsorption of zinc (II) onto MnO$_2$/CS composite: equilibrium and kinetic studies

Dinh Van-Phuc[a,*], Le Ngoc-Chung[b], Nguyen Van-Dong[c], Nguyen Ngoc-Tuan[d]

[a]*Dong Nai University, 04 Le Quy Don Street, Tan Hiep Ward, Bien Hoa City, Dong Nai Province, Vietnam,*
email: dinhvanphuc82@gmail.com
[b]*Dalat University, 01 Phu Dong ThienVuongstreet, Dalat City, Lam Dong Province, Vietnam, email: chungln@dlu.edu.vn*
[c]*VNUHCM-University of Science, 227 Nguyen Van Cu Street, District 5, Hochiminh City, Vietnam.*
[d]*Nuclear Research Institute, Dalat, Lam Dong, Vietnam*

ABSTRACT

In this work, manganese dioxide/chitosan (MnO$_2$/CS) was used to remove Zn(II) from an aqueous sample over a concentration range of 30–100 mg/L, adsorption time of 15–180 min, and pH of 2–5. The maximum sorption (>80%) was achieved at pH 4 after 80 min with an initial concentration of 50 mg/l and 0.1 g of MnO$_2$/CS. The experiment data were analyzed using the non-linear Freundlich, Langmuir, Redlich–Peterson, Sips, Temkin and Dubinin–Radushkevich (D–R) isotherm models. Langmuir isotherm offers maximum sorption capacity (q_m) of 24.21 mg/g (RMSE = 1.575 and χ = 0.8034), while the Temkin and Dubinin–Radushkevich (D–R) isotherm models indicated that adsorption followed a physical process. Furthermore, kinetic studies showed that the adsorption processes partially followed the pseudo-second-order equation. In addition, intra-particle diffusion model was used to ascertain the sorption process mechanism. MnO$_2$/CS has also been used to remove Zn(II) from the wastewater produced by the galvanized iron manufacturing industry.

Keywords: MnO$_2$/chitosan composite; Adsorption; Zinc; Equilibrium; Kinetic; Galvanized iron

* Corresponding author.