VIETNAM NATIONAL UNIVERSITY - HCMC
HO CHI MINH CITY UNIVERSITY OF TECHNOLOGY

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DISSERTATION INFORMATION

Title: ***Synthesis of graphene oxide-based metal oxide nanocomposites for adsorptions of heavy metals, organic dyes from water.***

Major: **Chemical Engineering** Major code: **9520301**

PhD candidate: **Lu Thi Mong Thy**

Advisors: **1: Assoc. Prof. Dr. Mai Thanh Phong**

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Major Contributions of This Dissertation:

The overall purpose of this dissertation is to successfully synthesize graphene oxide-based metal oxide nanocomposites (Fe_3O_4/GO and $MnFe_2O_4$/GO). The resulting material can be potentially utilized for the adsorption of heavy metals (As(V), Pb(II), Ni(II)) and organic dyes (methylene blue (MB)) in water with good efficiency of recovery by an external magnetic field.

Two kinds of nanocomposite materials, including Fe_3O_4/GO and $MnFe_2O_4$/GO, have been successfully synthesized by the co-precipitation method. The fabrication procedure is simple and suitable for domestic conditions. The fabricated materials possess an even distribution of oxide nanoparticles with a diminutive and uniform size from 10 to 25 nm, which exhibit a good efficiency of recovery and reusability by using an external magnetic field (magnet). The material retains its high magnetic ability and stability during the adsorption process.

The dissertation has successfully determined the suitable ratio of Fe_3O_4/GO and $MnFe_2O_4$/GO to adsorb heavy metals (As(V), Pb(II), Ni(II)) and MB in water. Kinetic, isothermal, and thermodynamic adsorption models of the resulting materials for As(V), Pb(II), Ni(II), and MB were also determined. Besides, the simultaneous influence of different factors on the adsorption process was investigated by experimental planning according to response surface methodology with high model reliability (R^2 greater than 0.96). Additionally, the recovery and reusability of the materials exhibit a good performance with high efficiency (more than 70%). The adsorption mechanism of the

materials has been also determined, which chiefly depends on the electrostatic interactions, surface complexes, and π – π interactions, as well as on the influence of the pH of the adsorbent solution. The mechanism is consistent with the Lewis acid-base theory.

The results of the dissertation have shown the potential application of two materials Fe_3O_4/GO and $MnFe_2O_4$/GO in the treatment of water contaminated with heavy metals and organic dyes. At the same time, the results also pave the way for further studies on the application of graphene oxide-based magnetic metal oxide nanocomposites to the actual treatment of environmental pollutants in water.

Advisors **Ph.D. candidate**

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