كليه العلوم – قسم الكيمياء

Nanotechnological Approaches for Removal of Some Contaminants from Water

Thesis Submitted by

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List of Contents

List of Figures

Figure title	**Page**

List of Tables

Table title **Page**

Abstract

Student Name: **Mohamed Abdel Mawgoud Farghali Mustafa**

Title of the thesis:

"Nanotechnological approaches for removal of some contaminants from water"

In this work different approaches have been used as excellent sorbents for the removal of different types of water contaminants. In which, one approach used the modified mesoporous zeolite-A /reduced graphene oxide nanocomposite (MZ-A/RGO) prepared by hydrothermal method for the high-performance removal of cationic heavy metals contaminants (Cadmium and Lead), groundwater common heavy metals contaminants (Iron and Manganese) and cationic dyes (methylene blue and crystal violet). Second approach used the octadecyl amine modified mesoporous zeolite-A /reduced graphene oxide nanocomposite (MZ-A/RGO/ODA) for the removal of emulsified crude oil. Third approach use reduced graphene oxide/polypyrrole nanocomposite (RGO/Ppy) for the removal of anionic heavy metal (chromium) and anionic dyes (congo red and orange G), which are toxic pollutants of wastewater. Different characterization techniques were used to characterize the prepared sorbents such as X-ray diffraction, high-resolution transmission electron microscopy, energy dispersive X-ray analysis, Fourier transform infrared spectroscopy and zeta potential measurements. Parameters that included the contact time, initial adsorbate concentrations, pH, sorbent dosages and temperature were varied to investigate the removal efficiency of the different adsorbates by adsorbents. The sorption kinetics data were fitted using pseudo-first-order, pseudo-second-order and Elovich kinetic models. In addition, four different adsorption isotherm models – the Freundlich, Langmuir, Temkin and Dubinin–Radushkevich (D-R) – were applied to study the adsorption mechanisms. The results indicate that the equilibrium state was achieved during the first 20 min for all adsorbates, with the maximum adsorption capacity (q_{max}, mg/g) for Cd^{2+}, Pb^{2+}, Fe^{3+}, Mn^{2+}, MB, CV, emulsified crude oil, Cr(VI), CR and OG were 222.23, 416.67, 333.33, 270.27, 526.32, 714.29, 400.00, 454.55, 714.29 and 476.19, respectively. The adsorption process followed pseudo-second-order kinetics. Furthermore, the Langmuir and Freundlich adsorption isotherm models provided the best fit for the different adsorbates adsorption isotherms. The results indicate that the high removal efficiency of the prepared sorbents for removal of different water contaminants from wastewater.

Keywords:

Modified mesoporous Zeolite-A/reduced graphene oxide nanocomposite; Modified mesoporous zeolite-A /reduced graphene oxide/octadecyl amine nanocomposite; Reduced graphene oxide/polypyrrole nanocomposite; Adsorption; Removal efficiency; Correlation coefficient; Heavy metals; Dyes; Cadmium; Lead; Iron; Manganese; Methylene blue; Crystal violet; Emulsified crude oil; Chromium; Langmuir isotherm model; Freundlich isotherm model; Pseudo second order.

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