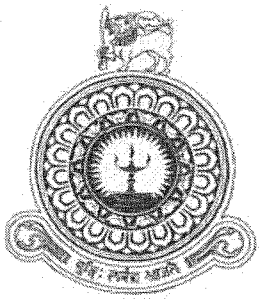

Application of nanomaterials and their activated carbon compounds for removal of heavy metal ions from contaminated water.

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Abstract

In this study application of nanomaterials, prepared by using granular activated carbon (GAC) with nano particles of maghemite (γ-Fe_2O_3) and zinc oxide, to remove toxic heavy metals from contaminated water was investigated. The maghemite nanoparticles of 20 nm were synthesized using our own greener method and zinc oxide nanoparticles were synthesized according to the procedure found from the literature. Those nanoparticles were characterized using Transmission Electron Microscopy (TEM) and Fourier Transform Infrared Spectroscopy (FT-IR). Batch experiments were carried out to determine the adsorption capacities of composite material using adsorption isotherms. Adsorption data were evaluated according to both Langmuir and Freundlich isotherm models to investigate which model is compatible with the isotherm data. Those isotherm models provide the basic understanding about the adsorption processes.

Results revealed, that FeO-GAC composite is a more effective adsorber for heavy metals than ZnO-GAC composite.

Zinc ion adsorption by FeO-GAC composite follows the Langmuir model ($R^2_{Zn} = 0.9875$), while Arsenic ion adsorption also followed the similar pattern where $R^2_{As} = 0.9923$, adsorption of manganese ions and cadmium ions follows the Freundlich model ($R^2_{Mn} = 0.7932$), and ($R^2_{Cd} = 0.9078$).

Adsorption of manganese from ZnO-GAC composite follows the Langmuir model ($R^2_{Mn} = 0.7207$) while arsenic adsorption follows the Freundlich model ($R^2 = 0.9869$), cadmium adsorption data using ZnO-GAC composite as an adsorbent failed to show effective results.

Adsorption capacity data reveals the possibility of using these composites for industrial applications.