Synthesis and Characterization of Carbon Dots Coated Al_2O_3 Nanofibers Nanocomposite for Pb^{2+} ion Adsorption and Reuse for Latent Fingerprint Detection.

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Abstract

This study reports a new approach of preparation of carbon dots coated aluminum oxide nanofibers (CDs/Al_2O_3NFs) nanocomposite and reusing the spent adsorbent of Pb^{2+}-CDs/Al_2O_3NFs nanocomposite for latent fingerprint detection (LFP) after removing Pb^{2+} ions from aqueous solution. CDs/Al_2O_3NFs nanocomposite was prepared by using CDs and Al_2O_3NFs with adsorption processes. The prepared nanocomposite was then characterized by using UV-visible spectroscopy (UV-visible), Fourier transforms infrared spectroscopy (FTIR), Fluorescence, X-ray diffraction pattern (XRD), scanning electron microscope (SEM), Transmission electron microscopy (TEM), Energy-dispersive X-ray spectroscopy (EDS), Zeta potential, X-ray photoelectron spectroscopy (XPS). The size of the CDs average was 51.18 nm. The synthesized CDs/Al_2O_3NFs nanocomposite has proven to be a good adsorbent in Pb^{2+} removal from water with optimum pH 6, dosage 0. 2 g / L. The results were suited by Freundlich models rather than the Langmuir, which was indicated the linear fit of Freundlich models with (R^2 = 0.9896). This adsorption was related to the multilayer adsorption processes of Pb^{2+} ions on the CDs/Al_2O_3NFs nanocomposite surface. The adsorption capacity of CDs/Al_2O_3NFs nanocomposite showed the best removal of Pb^{2+} ions with q_m = (177. 83 mg/g), when compared to the previous reports. This adsorption followed the pseudo-second order kinetics and intra particle diffusion processes. ΔG and ΔH values indicated spontaneity and the

endothermic nature of the adsorption process. CDs/Al_2O_3NFs nanocomposite therefore showed potential as an effective adsorbent. Furthermore, the metal loaded on the adsorbent Pb^{2+}-CDs/Al_2O_3NFs has proven to be sensitive and selective for LFP detection on various porous substrates. Hence Pb^{2+}-CDs/Al_2O_3NFs nanocomposite can be reused as a good fingerprint labelling agent in LFP detection so as to avoid secondary environmental pollution by disposal of the spent adsorbent.

Keyword: CDs/Al_2O_3NFs nanocomposite, Lead adsorption, Isotherm, kinetics, Thermodynamics, Reusable for latent fingerprint detection.