World Academy of Science, Engineering and Technology
International Journal of Chemical and Materials Engineering
Vol:14, No:12, 2020

Synthesis and Characterization of CNPs Coated Carbon Nanorods for Cd2+ Ion Adsorption from Industrial Waste Water and Reusable for Latent Fingerprint Detection

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Abstract : This study reports a new approach of preparation of carbon nanoparticles coated cerium oxide nanorods (CNPs/CeONRs) nanocomposite and reusing the spent adsorbent of Cd2+- CNPs/CeONRs nanocomposite for latent fingerprint detection (LFP) after removing Cd2+ ions from aqueous solution. CNPs/CeONRs nanocomposite was prepared by using CNPs and CeONRs with adsorption processes. The prepared nanocomposite was then characterized by using UV-visible spectroscopy (UV-visible), Fourier transforms infrared spectroscopy (FTIR), 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 average size of the CNPs was 7.84nm. The synthesized CNPs/CeONRs nanocomposite has proven to be a good adsorbent for Cd2+ removal from water with optimum pH 8, dosage 0. 5 g / L. The results were best described by the Langmuir model, which indicated a linear fit (R2 = 0.8539-0.9969). The adsorption capacity of CNPs/CeONRs nanocomposite showed the best removal of Cd2+ ions with qm = (32.28-59.92 mg/g), when compared to previous reports. This adsorption followed pseudo-second order kinetics and intra particle diffusion processes. ΔG and ΔH values indicated spontaneity at high temperature (40oC) and the endothermic nature of the adsorption process. CNPs/CeONRs nanocomposite therefore showed potential as an effective adsorbent. Furthermore, the metal loaded on the adsorbent Cd2+- CNPs/CeONRs has proven to be sensitive and selective for LFP detection on various porous substrates. Hence Cd2+-CNPs/CeONRs 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.

Keywords : Cd2+-CNPs/CeONRs nanocomposite, cadmium adsorption, isotherm, kinetics, thermodynamics, reusable for latent fingerprint detection
Conference Title : ICNN 2020 : International Conference on Nanotechnologies and Nanomaterials
Conference Location : Kuala Lumpur, Malaysia
Conference Dates : December 17-18, 2020