Title: Arsenic and Lead Removal From Electroplating Wastewater By Polyhydroxybutyrate Functionalized Carbon Nanotubes Nano-Adsorbent

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Abstract: This study investigated the removal of Arsenic (As) and Lead (Pb) from industrial electroplating wastewater via batch adsorption by polyhydroxylbutyrate functionalized carbon nanotubes (CNTs) as nano-adsorbent. Bimetallic Fe-Co supported on $CaCO_3$ was utilized to produce multi-walled carbon nanotubes (MWCNTs) via the catalytic chemical vapor deposition (CCVD) techniqye. Purification of the as-prepared MWCNTs by a mixture of HNO_3 and H_2SO_4 was effected and was further functionalized using known mass of polyhydroxylbutyrate (PHB) and the functionalized CNTs coded as PHB-CNTs. PHB-CNTs were characterized by HRSEM-EDS, BET, XRD and FT-IR. The electroplating wastewater was subjected to physico-chemical characterization before and after treatment with PHB-CNTs using standard methods. The adsorption process as a function of contact time, adsorption dosage and temperature was measured using As and Pb as indicator parameter. The HRSEM/XRD/BET confirmed that the PHB-CNTs were homogenously dispersed; highly graphitic in nature with fewer impurities and of high surface area of 253.199 m^2/g with pore size of 3.293 nm. The FTIR analysis showed the presence of functional groups (C=C, C-OH, C=O and O-C=O). The maximum removal of As and Pb by the nano-adsorbent at equilibrium time of 70 min are 100 % and 99.91 % respectively. Equilibrium and kinetic sorption for removal of As and Pb from electroplating wastewater are better described by Temkin isotherm and fitted well to the pseudo-second-order model respectively. Thermodynamic analysis of the adsorption process revealed that the standard enthalpy change (ŒH°) of the reaction was positive and endothermic in nature. The Gibbs free energy change (ŒG°) was negative which showed feasibility and spontaneity.