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Cerium oxide nanoparticles anchored onto graphene oxide for the removal of heavy metal ions dissolved in water

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ABSTRACT

The aim of this study is to investigate the possibility of using cerium oxide (CeO_2) nanoparticles (NPs) attached to reduced graphene oxide (rGO) as an alternative adsorbent for cadmium (II), lead (II) and chromium (VI) removal from aqueous solution. The new nanomaterials (CeO_2/rGO) were obtained following two different strategies, in-situ growth and self-assembly approach. The adsorption capacities for each heavy metal were investigated at a fixed pH (5.5–6), a range concentration of heavy metal from 5 to 250 mg/L and a fixed concentration of 0.05 mg of CeO_2/rGO nanomaterial. The experimental data were fitted using the Langmuir, Freundlich and Temkin isotherms models. The experimental data of each nanomaterial for the removal of Pb(II) were approximated best by the Langmuir model, while for the removal of Cd(II) Langmuir and Freundlich showed good regression coefficients. The study showed that CeO_2 NPs attached to rGO could be used as an efficient adsorbent material for the adsorption of cadmium and lead from aqueous solution. The nanomaterial obtained by *in-situ* growth registered the highest adsorption capacity for the removal of lead (95.75 mg Pb^{2+}/g CeO_2/rGO-HMT), while in the case of cadmium the highest adsorption was obtained with the nanomaterial synthesized following the self-assembly approach (31.26 mg Cd^{2+}/g CeO_2/rGO-AM).

Keywords: Cerium oxide nanoparticles; In-situ growth; Self-assembly; Graphene oxide; Heavy metals removal; Nanocomposite

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