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Synthesis and characterization of magnetic nano-porous graphene functionalized with carboxyl for hexavalent chromium adsorption in aqueous solution

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ABSTRACT

In the present study, magnetic nano-porousgraphene (NPG) was synthesized and functionalized with carboxyl (COOH) in order to fabricate a recoverable magnetic composite (COOH@NPG/Fe_3O_4) as an adsorbent to remove hexavalent chromium (Cr(VI)) from aqueous solution. The synthesized adsorbent was also assimilated for higher efficiency and faster separation of pollutants from aqueous solutions. For magnetization of the adsorbent, nano-porousgraphene (NPG) was synthesized via chemical co-precipitation method and then functionalized with carboxyl (COOH). To minimize the adverse effects of magnetized nanoparticles, they can easily be separated by an external magnetic field. The morphological structure of adsorbent was characterized by several techniques (XRD, TEM, SEM, FTIR and VSM). The effect of various experimental parameters including solution pH, contact time, adsorbent dose, temperature and initial Cr(VI) concentrations was studied on the adsorption efficiency in batch experiments. The experimental equilibrium data had high correlation with the Langmuir isotherm and pseudo-second-order kinetic models, respectively. According to the obtained results of thermodynamic studies, the adsorption process was spontaneous and endothermic in nature and the adsorption process was optimum in higher temperature. The results suggested that COOH@NPG/Fe_3O_4 has a good potential for Cr(VI) removal in contaminated-wastewater treatment. The adsorbent can easily be separated from aqueous solutions and thus does not impose any secondary pollution in the environment.

Keywords: Water pollution; Heavy metal; Nano-adsorbent; Magnetic

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