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Removal of Cr (VI) from Water through Adsorption Process Using GO/PVA as Nanosorbent

Authors : Syed Hadi Hasan, Devendra Kumar Singh, Viyaj Kumar

Abstract : Cr (VI) is a known toxic heavy metal and has been considered as a priority pollutant in water. The effluent of various industries including electroplating, anodizing baths, leather tanning, steel industries and chromium based catalyst are the major source of Cr (VI) contamination in the aquatic environment. Cr (VI) show high mobility in the environment and can easily penetrate cell membrane of the living tissues to exert noxious effects. The Cr (VI) contamination in drinking water causes various hazardous health effects to the human health such as cancer, skin and stomach irritation or ulceration, dermatitis, damage to liver, kidney circulation and nerve tissue damage. Herein, an attempt has been done to develop an efficient adsorbent for the removal of Cr (VI) from water. For this purpose nanosorbent composed of polyvinyl alcohol functionalized graphene oxide (GO/PVA) was prepared. Thus, obtained GO/PVA was characterized through FTIR, XRD, SEM, and Raman Spectroscopy. As prepared nanosorbent of GO/PVA was utilized for the removal Cr (VI) in batch mode experiment. The process variables such as contact time, initial Cr (VI) concentration, pH, and temperature were optimized. The maximum 99.8 % removal of Cr (VI) was achieved at initial Cr (VI) concentration 60 mg/L, pH 2, temperature 35 °C and equilibrium was achieved within 50 min. The two widely used isotherm models viz. Langmuir and Freundlich were analyzed using linear correlation coefficient (R2) and it was found that Langmuir model gives best fit with high value of R2 for the data of present adsorption system which indicate the monolayer adsorption of Cr (VI) on the GO/PVA. Kinetic studies were also conducted using pseudo-first order and pseudo-second order models and it was observed that chemosorptive pseudo-second order model described the kinetics of current adsorption system in better way with high value of correlation coefficient. Thermodynamic studies were also conducted and results showed that the adsorption was spontaneous and endothermic in nature.

Keywords : adsorption, GO/PVA, isotherm, kinetics, nanosorbent, thermodynamics
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