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Novel *Strychnos potatorum* seeds derived activated carbon incorporated polyacrylamide composite for the removal of Cr (VI) residues from aqueous media

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Excessive amounts of Cr(VI) which are released to the environment mainly due to industrial waste water disposal, instigate a solemn threat to human health. Chromium is extensively used in metallurgy, leather, paints and textile industries. Its compounds are highly toxic due to its ability to cross the cell membranes and its strong oxidation properties. This causes adverse health effects such as lung cancers, ulcers, allergic reactions, kidney, gastric and liver damage. Even though many adsorbents with binding ability towards these pollutants have been developed, it is yet a challenge to develop a low cost, efficient adsorbent. With this regard, in this study, a novel composite has been developed using polyacrylamide and *Strychnos potatorum* seed derived activated carbon (PAAC) and characterized using FTIR-ATR and SEM. The incorporation of activated carbon into the polyacrylamide matrix increased the mechanical strength and the stability of the composite material. Batch adsorption experiments have been conducted by varying contact time, initial Cr(VI) concentration and adsorbent dosage at pH 4 and at 25 ^{o}C. Adsorption isotherm and kinetics studies were performed. Batch adsorption results showed that the optimized parameters for the adsorption of Cr onto PAAC sample were contact time of 180 min, initial concentration of 5 mg/L and adsorbent dosage of 0.25 g. Under these optimized conditions, a quantitative Cr reduction percentage of 57% and maximum adsorption capacity (q_{max}) of 0.55 mg/g was achieved for Cr(VI) at pH 4 at 25 ^{o}C. Obtained adsorption capacity is acceptable since Cr(VI) is present in residual concentrations in water. Experimental data were best fitted to Freundlich isotherm than Langmuir isotherm model. Therefore, adsorption on a heterogeneous surface can be predicted. Cr(VI) adsorption kinetics were well described by pseudo second order rate model. Adsorption thermodynamic studies indicated the spontaneous nature of the adsorption. FTIR analysis revealed the presence of various functional groups that are responsible for the adsorption. Based on the results observed, it can be concluded that the novel PAAC composite could be used as a cost effective, stable and efficient adsorbent for Cr(VI) removal from water.

Keywords: Cr(VI), *Strychnos potatorum*, Polyacrylamide, Composite, Adsorption