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Development and characterization of chitosan coated biopolymer sorbent for the removal of fluoride ion from aqueous solutions

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ABSTRACT

A novel biosorbent, chitosan coated calcium alginate (CCCA), was developed by coating chitosan, a naturally and abundantly available cationic biopolymer, onto an anionic biopolymer calcium alginate for the removal of fluoride ion from aqueous solutions. The results were compared with calcium alginate (CA) beads obtained from natural biopolymer sodium alginate. Further the biosorbents were characterized by FTIR, SEM and TGA techniques and surface area analysis. Defluoridation of water was studied by using the biosorbent under batch equilibrium and column flow experimental conditions. The effect of various process parameters such as pH, contact time, concentration of fluoride and amount of biosorbent was investigated in order to optimize the process. The equilibrium data were used to study the kinetics of defluoridation process such as pseudo first order, pseudo-second order and Weber–Morris intraparticle diffusion models. The data were fitted to Langmuir and Freundlich adsorption isotherms. The column flow adsorption data were utilized to obtain break through curves. The maximum monolayer adsorption of fluoride on CA and CCCA were found to be 29.3 and 42.0 mg/g. The experimental results demonstrated that chitosan coated calcium alginate beads could be used for the defluoridation of drinking water.

Keywords: Defluoridation; Adsorption; Chitosan; Characterization; isotherms

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