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A study on sorption of Cd(II) onto chitosan derivatives

K. A. S. Samaranayaka and C. S. K. Rajapakse*

Department of Chemistry, Faculty of Science,
University of Kelaniya, Sri Lanka
**Email: shashikala@kln.ac.lk*

Pollution of water sources, specially drinking water sources, is becoming a serious problem in the world today. Unlike organic pollutants, heavy metals are non-biodegradable and even trace amounts of some of the heavy metals such as cadmium is highly toxic and may cause deleterious health effects in humans. In recent years the search for efficient, readily available and more affordable adsorbents that have high metal-binding capacities for the removal of toxic heavy metals in drinking water has intensified and in this research, chemically modified chitosan [cross-linked chitosan beads (CLCB) and physically modified chitosan] and chitosan coated activated carbon (CCAC) were prepared and their sorption properties for Cd(II) uptake were studied.

Chitosan derivative CLCB was prepared using glycerol diglycidyl ether as the cross linking agent and composite bio-adsorbent CCAC has been prepared by coating chitosan onto commercially available activated carbon to improve their mechanical strength and metal adsorption ability compared to that of unmodified chitosan. The modified adsorbents were characterized using Fourier Transform Infrared Spectroscopy (FTIR) and Scanning Electron Microscopy (SEM). The equilibrium data were evaluated using Langmuir, and Freundlich isotherms and adsorption equilibrium data of Cd(II) adsorption onto CLCB and CCAC at 30 ^{0}C were correlated with the Langmuir isotherm model. The maximum monolayer adsorption capacity; Langmuir constant, q_o obtained for adsorption of Cd(II) onto CLCB and CCAC were 79.4 μg/g and 84.0 μg/g, respectively, which were significantly higher than the values for the adsorption of Cd(II) onto unmodified chitosan. The kinetic data were fitted with the pseudo second order model for initial Cd(II) concentrations of 50 μg/L. The findings from this research indicate that the CLCB and CCAC have enhanced Cd(II) sorption abilities compared to that of unmodified chitosan. Therefore, the modified chitosan derivatives could be used as efficient bio-adsorbents to remove Cd(II) from polluted drinking water.

Keywords: Adsorption isotherms, Cadmium, Cross-linked chitosan beads, Chitosan coated activated carbon,