Kinetic analysis of the adsorption of lead (II) onto an antarctic sea-ice bacterial exopolysaccharide

ABSTRACT

Hypertension and kidney impairment are two of the many adult health problems that have been related to lead exposure. Women who are expecting a child are especially susceptible to the dangers of lead since it can have devastating consequences on the developing embryo. Existing techniques for the remediation of lead pollutant include membrane separation, ion exchange, precipitation and biosorption. Of all of this technology, biosorption has several positive aspects which include low operating expenses, very efficient detoxification of toxicants at low concentrations and low amount of disposal materials. The biosorption of the biosorption of lead(II) onto an Antarctic sea-ice bacterial exopolysaccharide is remodeled using nonlinear regression and the optimal mode was determined by a series of error function assessments. Statistical analysis showed that the best kinetic model for adsorption in salt-free water was pseudo-1st order while the best kinetic model for adsorption in seawater was pseudo-2nd order model. All error function analyses also supported these two best models. The kinetic constants values for salt-free water and seawater shows large difference in terms of adsorption in salt-free water and seawater. A higher equilibrium biosorption capacity for lead (II) or qe values were exhibited for both k1 and k2 rate constants in sea water indicating a more efficient adsorption in seawater. Adsorption in seawater increased the qe values from 51.11 (mg/g) (95% confidence interval from 49.75 to 52.44) to 92.98 (mg/g) (95% C.I. from 91.01 to 94.95) In addition, the h value, (mg/g.min) indicates a stronger driving force to accelerate the diffusion of adsorbate from seawater onto the adsorbent. The results suggest fundamental difference of sorption mechanism and functional groups are involved in salt-free and seawater.