Sorption separation of cadmium from aqueous solutions by alginite material: kinetic and equilibrium study

Vladimír Frišták, Martin Pipíška, Mária Novákova, Juraj Lesný, Alena Packová

ABSTRACT

Alginite, as a component of some types of kerogen alongside amorphous organic matter, was used for adsorptive separation and removal of Cd²⁺ ions from aqueous solutions. Alginite material was characterized by X-ray diffraction, ATR-FTIR, cation exchange-capacity and specific surface area analyses. Evaluation of alginite sorption properties showed the effect of solution pH value in the range from 2 to 6 on sorption capacity of alginite. At a slightly acidic conditions (pH 6.0–6.5), the alginite samples exhibited a sufficient sorption capacity and stability. The pseudo-second-order kinetic model described the sorption data better than the pseudo-first-order kinetic model. The equilibrium of cadmium sorption by alginite was reached within 120 min. Maximal sorption capacity (Q_{\text{max}}) calculated from experimental equilibrium data (Langmuir adsorption isotherm) was 23.62 mg/g. Sorption energy of Cd²⁺ ions calculated from Dubinin–Kaganer–Radushkevich model confirmed the ion-exchange mechanism of cadmium removal for alginite sorbent. The alginite from central European geological maar (Pula, Hungary) can be utilized for production of new non-conventional sorbents or mineral filters for removal of toxic metals.

Keywords: Alginite; Cadmium removal; Sorption isotherms; ATR-FTIR