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Removal of boron from aqueous solution using cryptocrystalline magnesite

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Abstract

The present study aimed to evaluate the efficiency of using cryptocrystalline magnesite to remove boron ions from aqueous systems. Batch experimental protocols were used to evaluate the adsorption capacity of magnesite for boron. Parameters optimized included: time, dosage, chemical species concentration and pH. Optimum conditions were observed to be 30 min of agitation, 1 g dosage of magnesite per 100 mL of aqueous solution and 20 mg/L initial boron concentration. Removal of boron from aqueous solution was observed to be independent of initial pH of the aqueous solution. The adsorption of boron onto magnesite was observed to fit better to pseudosecond-order kinetics than pseudo-first-order-kinetics hence proving chemisorption. The intraparticle diffusion model revealed that the adsorption of boron from aqueous system occurs through multiple reaction phenomena. Adsorption isotherms proved that the removal of boron by magnesite fitted well to both Langmuir and Freundlich adsorption isotherms hence proving that both mono- and multi-site adsorption processes are taking place. Under optimized conditions, magnesite was able to attenuate the boron concentration to <0.01 mg/L which is below levels stipulated in World Health Organization guidelines. It was concluded that this comparative study will be helpful for further application of magnesite in remediation of boron-contaminated aqueous systems.