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Utilization of fly ash zeolite for boron removal from aqueous solution

Joanna Kluczka*, Jolanta Trojanowska, Maria Zołotajkin

Faculty of Chemistry, Department of Inorganic and Analytical Chemistry and Electrochemistry, Silesian University of Technology, B. Krzywoustego 6, Gliwice 44-100, Poland
Tel. +48 322371383; Fax: +48 32 2372277; email: joanna.kluczka@polsl.pl

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ABSTRACT

A novel zeolite synthesized from fly ash was characterized and studied for the removal of boric acid from aqueous solution. The adsorption behavior of fly ash zeolite (FAZ) for boron was investigated using a batch system and the influence of pH, temperature, adsorption time, initial boron concentration and adsorbent dose on the removal of boron was studied. The results showed that the adsorption was dependent on the pH of the solution and was maximal at around pH 7. The removal of boron increased while the adsorbent dose increased and the temperature decreased. The adsorption equilibrium was achieved after 2 h. The experimental data were fitted better using the Freundlich isotherm than the Langmuir, and Dubinin–Radushkevich models. The boron adsorption capacity and percentage removal from the solution containing 50 mg B L^{-1} amounted to 2.3 mg g^{-1} and 93%, respectively, while pH 7, adsorption time = 0.5 h, and adsorbent dose = 20 g L^{-1}. The thermodynamic calculations indicated the spontaneous and exothermic nature of the adsorption process. The kinetic studies revealed the physisorption as a dominating mechanism of boron removal using FAZ. The pseudo-second-order model adequately described the boron adsorption on FAZ.

Keywords: Boron removal; Fly ash zeolite; Adsorption isotherms; Kinetics; Thermodynamics

*Corresponding author.

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