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The sorption of cesium on Beishan soil under different physicochemical conditions studied by batch and EDS techniques

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Adsorption of Cs⁺ to Beishan soil (BS) as function of pH, foreign ions, temperatures, contact time and humic substances was studied in detail under ambient conditions using batch techniques. The results suggested that the adsorption of Cs⁺ was strongly dependent on ionic strength, whereas nearly independent of pH values, and the values of K_d were 1388.78 mL/g in 0.01 mol/L NaClO₄ and 740.14 mL/g in 0.1 mol/L NaClO₄ solution, respectively. The foreign ions competed with Cs⁺ in the sequence: K⁺ > Na⁺ > Li⁺ and Mg<sup>2+</sup»Ca²⁺≈Na⁺; however, the influence of anions was not obvious which might be attributed to the very low complexing ability with anions (i.e., Cl⁻, ClO₄⁻ and NO₃⁻). The adsorption reaction of Cs⁺ to BS was very fast; the values of E_a were 8.944 kJ/mol. The positive ΔH₀ and negative ΔG₀ meant that the holistic process of Cs⁺ adsorption to BS was an endothermic and spontaneous process. The adsorption isotherms of Cs⁺ were well simulated by the Langmuir model at higher concentration of NaClO₄, whereas Freundlich model was better than Langmuir model at low ion strengths (i.e., 0.001 mol/L NaClO₄); and the values of q_{max} obtained from the Langmuir model ranged from ~3.33×10⁻⁷ to ~5.00×10⁻⁷ mol/g. Humic substances (FA and HA) enhanced significantly the adsorption of Cs⁺ to BS.The EDS analysis indicated that the adsorbed Cs⁺ were mainly distributed to the fray edges of BS, the locations of these adsorbed Cs⁺ coincided with the sodium depletion area, implying the replacement of Na⁺ by Cs⁺ adsorption.

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