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Determination of cation exchange capacity of fucoidic sands for Cs⁺ and ²⁺ under dynamic column conditions

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In the framework of the development of remediation scenario of underground areas affected by chemical mining of uranium in the locality of Stráž pod Ralskem a complex geochemical and transport model is generated, which comprises interaction of rocks and groundwater affected by acid leaching. The chemical remediation processes also require the knowledge of the properties of the affected rocks. One of the important rock constituents are fucoidic sands, which constitutes significant part of the cenoman aquifer. Therefore it is a great importance to determine, among others, their cationic exchange capacity (CEC) toward univalent and divalent cations. In this paper results on the study of sorption and desorption behavior of Cs+ and Sr2+ on column of fucoidic sands under dynamic flow conditions are presented and their CEC for these two cations are determined. The determination of CEC is based on the construction of respective breakthrough curves using 137Cs and 85Sr radionuclides as isotopic indicators in laboratory experiments. The samples were taken from several parts of the bore hole in the area of interest. Undisturbed cores of 5 cm in diameter and 10 cm long were put in the glass columns and the cores were perfectly tightened using acrylate resin. For the study of sorption/desorption cycle the so-called background groundwater was applied. The concentration of 10-6 mol/dm3 of Cs+ and Sr2+ in liquid phase individually was established using neutral salts of CsNO3 and Sr(NO3)2, resp. The groundwater was introduced at the bottom of the columns by a multi-head peristaltic pump at about 4 cm3/h of a constant flow-rate. The results show that the CEC capacity of the investigated fucoidic sands for 137Cs and 85Sr is 0.1–1.5 μmol/100g and 0.05-0.5 μmol/100g, respectively, in dependence on the evaluation of corresponding breakthrough curves. Some differences in the behavior of the cores during the experiments have also been explained.

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