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Transport of ¹²⁵I⁻, ¹³⁷Cs⁺ and ⁸⁵Sr²⁺ in granitoidic rocks and soil

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Transport of ¹²⁵I⁻, ¹³⁷Cs⁺ and ⁸⁵Sr²⁺ radionuclides in crushed granitoidic rocks and homogenized soil was studied. Two simple methods for calculation of transport parameters of these radionuclides in flow column experiments with groundwater (GW) as transport medium have been described. The first method is based on the assumption of a reversible linear sorption of reactive solutes (radionuclides) on solid phase (with constant distribution, K_d, and retardation, R_{exp}, coefficients), whereas the second one is based on the assumption of a reversible non-linear sorption (characterized with non-linear sorption isotherm, i.e. with non-constant K_d and R_{exp}). Both methods use the experimental breakthrough curves (BTCs), which are constructed using the measured activities at the outlet from the column. The BTCs are fitted with the integrated form of the simple 1-D advection-dispersion equation (ADE) expressed analytically for pulse application of radiotracer to the liquid phase (GW) before entering into columns. In case of the first method, the integrated form of ADE is modified by two correction coefficients, namely, the peak position and peak height coefficients by means of which the very good agreement between experimental and calculated data is usually obtained. The second method is more sophisticated because not only the calculation of the values of retardation coefficients changing during transport is needed, but also the Freundlich equation parameters of non-linear isotherm have to be sought. Both methods were tested in the evaluation of the transport parameters of a given radionuclides in beds of diorite, gabbro, granite and tonalite granitoides and clayey loamy sandy soils. The results of two different approaches have been compared.

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