



The Effects of Dissolved Organic Matter and Cesium Concentration on Cesium Transport in weathered granite soil

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To understand migration of radiocesium (Cs) in soils is an important issue after the accident of Fukushima Dai-ichi nuclear power plant, Japan. Soil organic matters would affect Cs transport in soils. In particular, dissolved organic matters (DOMs) have the two possibilities of promoting Cs migration. First, DOMs in soil solution can carry Cs to deeper soil layer. Second, DOMs on soil can inhibit Cs fixation in soil. In addition, the Cs concentration in the applied solution can also affect the sites active on its adsorption (clay surface, six-membered ring and Frayed edge site). In this study, we investigated the effect of DOM on the migration of Cs using two different concentrations of Cs solution.

Soil sample was a weathered granite called as Masa in local dialect. It was collected at an abandoned forest in Iitate, Fukushima, Japan. DOM solution was extracted from a litter from a forest in Chichibu, Saitama. Dissolved organic carbon (DOC) in the DOM extract was 20mg-C/L.

The Cs solutions with two different concentrations, high concentration and low concentration were used. High concentration solution was 1.5×10^{-4} mol / L prepared by using stable CsCl (^{133}Cs). Low concentration solution was 4.5×10^{-17} mol / L made by diluting ^{137}Cs solution. Cs-DOM mixed solutions were also used as an applied solution by mixing DOM solution with Cs solutions.

An acrylic plastic column was used for the transport experiments. The soil column was prepared by packing air dried soil sample. After that, different solutions were applied at a constant ponding depth. Sequence of flowing solution were 4 types as follows: (i)Cs solution to NaCl solution (pH6, ionic strength of 1mM), (ii)Cs-DOM mixed solution to NaCl solution, (iii) Cs solution to DOM solution and (iv) Cs solution to NaCl solution in soil which was adsorbed DOM in advance. Cs concentration of the effluent was measured. Some effluent solution was divided water-soluble Cs from Cs-organic matter complexes by ultrafiltration.

In the experiment using the high concentration Cs solution, there was no significant difference in the outflow concentration of Cs among all conditions ((i) - (iv)). On the other hand, in the experiments using low concentration solution the Cs concentration in effluents of (ii) and (iv) was larger than the that of (i) in Cs supplied phase. In addition, the ultrafiltration for some samples of the Cs-DOM mixed solution (supplied solution) , and effluents of (ii) and (iv) showed all Cs in the solution were the water - soluble form. These findings suggest DOM did not work as a carrier for Cs, but promoted Cs transport by inhibiting Cs adsorption.

In conclusion, DOM facilitated Cs transport by adsorption nearby high selective sites and inhibiting fixation.

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