

Effects of soil clay minerals on radiocesium transport in soil

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In 2011 the fallout of radiocesium, Cs-134 and Cs-137, originated from the Fukushima-Daiichi Nuclear Power Plant contaminated soils in the Pacific coast side of northern Japan. The most of the fallout-radiocesium on the soil surface was reported to be remained in the surface layer in Fukushima Prefecture. There are two major soils with different clay minerals in Miyagi Prefecture, a northern next neighbor of Fukushima Prefecture: (1) volcanic ash origin soil with allophane found in the northern part of Miyagi Prefecture, and (2) granite origin soil with vermiculite found in the southern part of Miyagi Prefecture. Column experiments were conducted in a constant temperature room. The soils were uniformly packed in the columns and saturated with distilled water supplied from the bottom of the columns. A 160 mL of KCl solution with 1.5 kBq/kg exchangeable radiocesium was supplied with a rate of 10 mL/h from the top of the soil columns. Effluent from the bottom of each soil column was collected every two hours and analyzed for the concentrations of Cs-134 and Cs-137, dD and dO-18, and KCl. After applying 800 mL distilled water with a rate of 10 mL/h from the top of the soil columns, the soil columns were dissected with 1 cm thick and analyzed for the concentrations of Cs-134 and Cs-137. No or less than the detection limit of Cs-134 and Cs-137 was found in the effluents of all the columns although the solution containing the radiocesium was completely drained out with 2 pore volumes of effluent. The distributions of Cs-134 and Cs-137 in the volcanic ash origin soil and the granite origin soil were very different. The radiocesium reached near the bottom of the column for the volcanic ash origin soil whereas the radiocesium stayed near the soil surface for the granite origin soil. This difference might be attributed to different clay minerals contained in the soils. Our results implied that the prediction of radiocesium transport in soil should be accounted for clay minerals.

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