Solubility of iodine in grassland and forest soils in Rokksho, Japan

A. TAKEDA[1], Y. UNNO[1], H. TSUKADA[1,2], Y. TAKAKU[1] AND S. HISAMATSU[1]

[1]Institute for Environmental Sciences, Aomori, Japan takeda@ies.or.jp

[2] Present address, Fukushima University, Fukushima, Japan

Iodine-129 (half-life, 1.6×10^7 y) is one of the important radionuclides discharged from the nuclear fuel reprocessing plant in Rokkasho for assessment of radiation dose to the public. Solubility of discharged ^{129}I in surface soil is a key process for predicting its behavior in the terrestrial environment. To study long-term behavior of ^{129}I in soil, stable I (^{127}I) can be used as its useful analogue. In this study, variation of ^{127}I solubility from soil into deionized water was obtained and discussed in relation with various soil characteristics. Chemical forms of ^{127}I in soil solution collected from the soil were also determined. In addition, time-dependency of I solubility from the soils are investigated by a short-term incubation experiment for the soils with ^{125}I spiked and ^{129}I derived mainly from the reprocessing plant.

Surface soil samples were collected at grassland and forest area around the reprocessing plant. The I in the sample was extracted by deionized water with a soil/extract weight ratio of 1:10 and determined by an ICP-MS. Concentrations of I^- and IO_3^- in the soil solution obtained by direct centrifuging the soil samples were determined by a HPLC, and that of total I was measured by the ICP-MS. In the incubation experiment, carrier-free $^{125}I^-$ was added to the soil samples followed by keeping under field moisture capacity up to 30 d. The ^{125}I was occasionally extracted by deionized-water with the soil/extract ratio and determined. The water-extracted ^{129}I in the soils was also measured by means of AMS.

The water-extracted I concentration in the surface soils was positively correlated with organic carbon concentration in the extracted solution. Major forms of I in the soil solutions were I^- and organic-I, which was defined as the difference between total I and a sum of I^- and IO_3^-. At the earliest stage of the incubation, proportion of the water-extracted fraction of spiked ^{125}I was similar to that of ^{129}I in the soil and slightly decreased with time. The results suggested that I deposited to the land surface is immobilized rapidly, and the migration of I would be affected by that of the dissolved organic matter in the surface soils.

This study was performed under a contract with the government of Aomori Prefecture, Japan.