Concentration Coefficients of Radioiodine in Different Chemical Forms from Sea Water to Fishery Products

Masaomi TAKAHASHI, Yuichi TAKAKU, and Shun'ichi HISAMATSU
Department of Radioecology

Abstract

Radioiodine takes various chemical forms in the environment. Ion forms of I^- and IO_3^- were found in ocean for ^{129}I discharged from the first Japanese commercial nuclear fuel reprocessing plant located in Rokkasho. Since the concentration factor of iodine from seawater to marine products strongly depends on the chemical form of iodine, it is necessary for realistic assessment of radiation dose from the discharged radioiodine via marine products to use the concentration factor of each chemical form of iodine. This study aims to establish the concentration factor of radioiodine in I^- and IO_3^- for marine products (seaweed, shellfish and benthos). In FY 2012, 1) the concentration coefficients of I^- and IO_3^- for green algae (*Ulva pertusa*) were decided using an iodine radiotracer and 2) the chemical form of stable iodine in *U. pertusa* was analyzed by using X-ray absorption fine structure (XAFS) analysis.

The concentration coefficient of I^- or IO_3^- for *U. pertusa* was measured with iodine radiotracer (^{125}I). The seaweed samples were incubated for 3 d at 15°C in the seawater with added ^{125}I as I^- or IO_3^-. The biological activity of the seaweed samples was checked by ^{13}C absorption experiment. Since the biological activity 3 d after the start of the incubation was lower than that before, we used the data for 2 d after the start. The concentration of ^{125}I in *U. pertusa* samples increased with the period of incubation in both forms. The ^{125}I concentration in *U. pertusa* samples exposed to $^{125}I^-$ was much higher than that for $^{125}IO_3^-$. The ^{125}I concentration in seawater in the incubation bottle decreased during the exposure experiment relative to the $^{125}I^-$ concentration. The concentration factor of $^{125}I^-$ for *U. pertusa* was estimated to be 140 with a one-compartment dynamic model considering decline of $^{125}I^-$ concentration in seawater, while that of IO_3^- was ~8. Those results showed that the iodine concentration coefficient of *U. pertusa* strongly depends on the chemical form of iodine.

Since XAFS analysis of chemical forms of stable iodine in the natural *U. pertusa* samples was hard to do due to the low iodine concentration, a *U. pertusa* sample was incubated in seawater with added I^- to get an iodine concentration of 5 μg g^{-1} seawater (total iodine concentration in natural seawater is approximately 50 ng g^{-1}). The XAFS analysis of the incubated seaweed sample showed that iodine in the sample consisted of 34% I^- and 66% organic iodine.

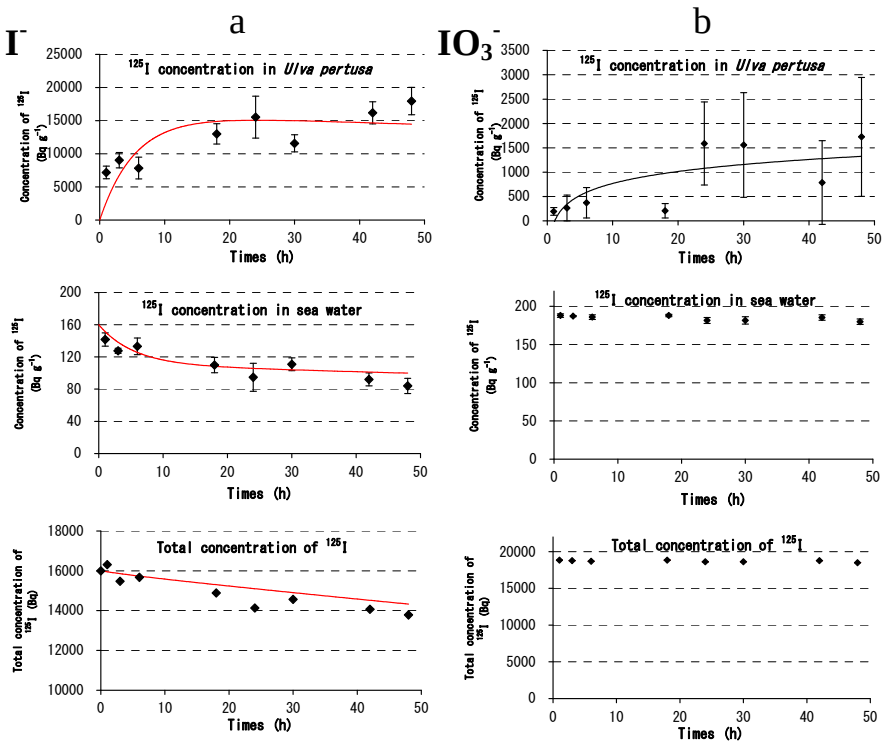

Fig. 1 Concentration of ^{125}I in *Ulva pertusa* and seawater samples, and total content of ^{125}I in seawater.

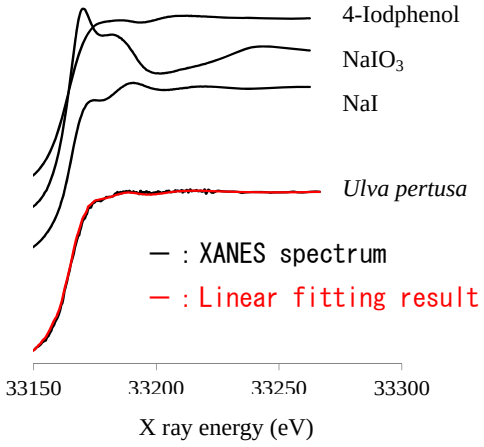

Fig. 2 XANES spectrum of *Ulva pertusa*.