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

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Abstract

Radioiodine discharged from the first Japanese commercial nuclear fuel reprocessing plants located in Rokkasho has been found in different chemical forms such as I^- and IO_3^- in the ocean. Since the concentration coefficient of iodine from seawater to marine products strongly depends on the chemical form of the iodine, it is necessary for realistic assessment of radiation dose from the discharged radioiodine via marine products to use the concentration coefficient of each chemical form of iodine. This study aims to establish the concentration coefficient of radioiodine in I^- and IO_3^- for marine products (seaweed, shellfish and benthos). In FY 2011, the following experimental methods for getting the concentration coefficients were decided: 1) the incubation methods of seaweeds for experiments using an iodine radiotracer; 2) the cultivation method of phytoplankton which has a high concentration of iodine; and 3) the analytical method for determining the chemical form of stable iodine in marine products using X-ray absorption fine structure (XAFS) analysis.

Incubation methods of *Ulva pertusa* and *Sargassum siliquastrum* for a few days and weeks were established by using a culture flask and a marine flask, respectively. The iodine volatilized from the incubation vessel was captured with activated carbon filters with the collecting efficiency of >99%. The concentration coefficient of I^- or IO_3^- for *Ulva pertusa* and *Sargassum siliquastrum* was preliminary measured with stable iodine in different concentrations in incubation seawater. The seaweed samples were incubated for 3 d at 15°C in the media with added iodine to get concentrations of 0, 100, 500 and 1000 ng g^{-1} seawater. Iodine concentration in the seaweed samples increased in proportion to that in incubation media excluding that in *Ulva pertusa* incubated in the media with added IO_3^-. The iodine concentration of *Ulva pertusa* exposed to IO_3^- did not show any significant increase. The concentration coefficients of I^- for *Ulva pertusa* and *Sargassum siliquastrum* were found as 310 and 660, respectively, while that of IO_3^- for *Sargassum siliquastrum* was 330. Those results showed that the iodine concentration coefficients of seaweeds depend on not only the chemical form of iodine but also the seaweed species.

The incubation methods of *Skeletonema costatum* and *Nitzschia sp* with a high concentration of iodine were established. The concentration coefficient of iodine depended on chemical forms, and increased in the order of $IO_3^- < I^-$ < organic iodine (thyroxin).

The analysis method of the chemical form of stable iodine (I^-, IO_3^- and organic iodine) in the marine products was established using XAFS analysis. Most of the iodine in *Sargassum siliquastrum* incubated in seawater without added iodine was found to be organic iodine.

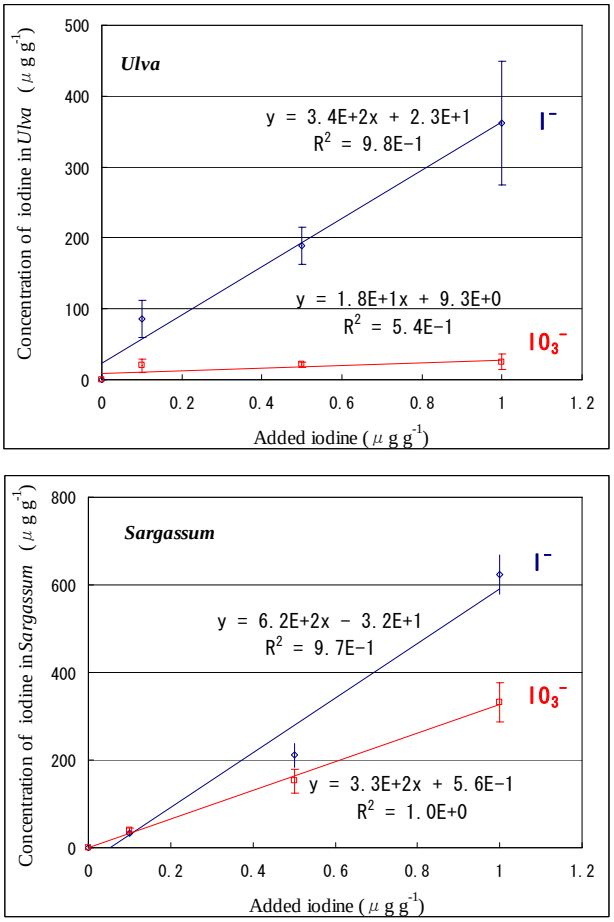

Fig. 1 Concentration of iodine to seaweed.