METHODS OF I-129 ANALYSIS FOR ENVIRONMENTAL MONITORING

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Among the radioiodine isotopes discharged from nuclear facilities I-129 has the longest half-life of 1.7×10^7 years and is accumurated in the environment for a long time period, therefore, it is one of the most important nuclides in the environmental monitoring arround a nuclear fuel reprocessing plant.

Low level contamination of enviornmental samples with I-129 may cause considerably high thyroid dose to the population. For instance, only a tenth pico-curies of I-129 per liter of fresh milk may give one millirem of thyroid dose. Accordingly, in considering the I-129 discharged to the atmosphere or the marine environment, it is important to establish a methodology for evaluating the environmental impacts caused by the long-term accumulation and to develop the measuring techniques of the environmental samples having very low radioactivity.

This paper presents the methods of the analysis of low-level I-129 in the environmental samples such as milk, vegetations, sea weeds and soils.

PROCEDURES

Leafy vegetables, sea weeds and soils are dried with a low-temperature oven and are ground to powders. Milk is pulverized by freeze drying method.

The iodine is separated from the dried or pulverized samples by ignition at high temperature (about 1000°C) in a quartz combution apparatus with a stream of oxygen. Figure 1 shows the apparatus for ignition used in the experiments. Furnace 1 moves from the edge of the combustion tube to a sample slowly and the sample is heated gradually, finally ignited at 1000°C. The off-gas from the sample is burned completely while passing through Furnace 2. The iodine carried with the off-gases is trapped on a small bed of activated-charcoal. The iodine is then recovered from the charcoal to a dryice cooled quartz tube by heating in vacuum. The cooled end of the quartz tube is sealed off to make a irradiation ampule.

The quartz ampule is irradiated in a reactor for several ten minutes at thermal neutron flux of $10^{13} n/cm^2 \cdot sec$.

After the irradiation the iodine is purified through the solvent extraction method using carbon tetrachloride. Iodine is finally precipitated as AgI and counted with a Ge(Li) detector. Each activities of I-126, I-128 and I-130 are calculated from the gamma-ray spectra. The chemical yield of this method are calculated by counting I-125 which has been added to the sample prior to the ignition as an yield tracer.

RESULTS

Several samples were analized on I-129 by the method mentioned above and no I-129 concentration higher than detection limits were found. The results of analysis for typical food samples collected near the fuel reprocessing plant of Tokai Works are given in Table 1. The detection limit of I-129 by this method is about 10^{-2} pCi for a 10 g dry sample. Stable iodine I-127 is simultaneously determined and atom ratio of $^{129}I/^{127}I$ are calculated in order to evaluate thyroid dose by the specific activity method and long term environmental impacts by I-129 discharged from nuclear facilities.

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Table 1 Results of Analysis

Sample	I-127 * (μg/g)	I-129 (10^{-3}pCi/g)	$^{129}I/^{127}I$ Atom Ratio (10^{-7})
Seaweed	210 ± 11	< 5.1	< 1.5
Cabbage	4.2 ± 1.3	< 0.9	< 15
Rice	34 ± 1.2	< 2.1	< 3.6

* Determined by counting on I-126

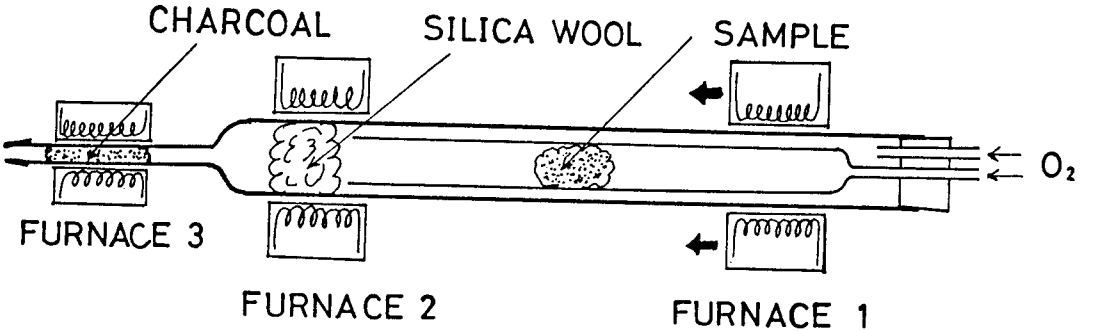

Figure 1 Diagram of Sample Combustion Apparatus