



Enabling Quicker Analysis of Strontium-90

Development of a new technique by Fukushima University, the JAEA and other partners

A joint team comprised of Fukushima University, the Japan Atomic Energy Agency (JAEA), the Japan Agency for Marine-Earth Science and Technology (JAMSTEC), and PerkinElmer Japan has developed a technique enabling analysis of the radioactive isotope strontium-90 in just a few hours, whereas it previously took two weeks or more.

Among the different types of radiation, gamma rays have particularly strong penetration of matter, and can be measured easily. As a result, it is comparatively easy to measure cesium-134 and 137 because they emit gamma rays. Strontium-90, however, is a radionuclide which emits only weakly-penetrating beta rays, and analyzing this isotope has previously been a complex task taking from two weeks to one month, due to steps such as processing to separate the strontium-90 from the measured sample and refine it.

In addition, the inductively coupled plasma mass spectrometers (ICP-MS) used in areas such as environmental analysis have the problem of being unable to distinguish strontium-90 from zirconium-90 and yttrium-90, which have the same atomic mass number.

Therefore, the joint team added an on-line concentration/separation function and a reaction function at two points where measured elements pass through the inside of the ICP-MS. In this way, they developed a system in which only strontium is collected, in a step-by-step fashion. With this system, measurement can be done in about 15 minutes. Before measurement with an ICP-MS, it is necessary to perform steps such as operation to break down the solid sample, but even including all of these work steps, analysis of eight specimens was completed in three hours.

This method does not require the use of standard solutions of radioactive strontium, which must be managed as unsealed radioactive materials, and thus even ordinary environmental analysis laboratories can carry out measurement in an emergency. Analysis is fully automatic, so the person conducting measurement is never exposed in the course of chemical processing after supplying the sample solution. The detection limit when introducing 10mL of sample is approximately 5 Bq/kg in terms of soil concentration (weight concentration conversion: $0.9 \text{ pico}(10^{-12})\text{g/kg}$). The solution concentration is about 3 Bq/L (0.5 pg/L), and analysis sensitivity is inferior to the previous method. However, the new method has the advantage of enabling quick response in emergencies where many samples must be processed.

It is expected that use of this new technique will contribute in areas such as ascertaining the strontium-90 contamination situation of sea-bottom soil offshore from Fukushima Prefecture.