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Secular distribution of radioactive strontium concentration in the atmosphere after after the accident of FD-NPP

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1.Introduction

On March 12, 2011, a large amount of radioactive nuclides have been released into the environment by the nuclear accident at the Fukushima Daiichi Nuclear Power Station. Measurement about radioactive nuclides will give us much information about the accident circumstance. Furthermore, radioactivities in the air dust are critical for estimation of internal exposure. There are many measurements results of I-131, Cs-134, Cs-137 in environment samples. However, in other nuclides, such as the pure beta emitter nuclide Sr-90 has not been measured sufficiently. Sr-90 is considered one of the harmful radioactive nuclides. Therefore, measurement of Sr-90 in the air dust is important for calculating exposure. We developed a new simple and quick strontium isolation technique using solid-phase extraction for determination Sr-90 in the air dust by liquid scintillation counter (LSC).

2. Method

In this study, we used 3M EmporeTM Strontium Rad Disk to extract strontium ion from air dust samples. This filter can collect Sr2+ ion efficiently. However, it is known that this filer also catches Pb2+. Natural radioactive nuclide Pb-210 seriously will be interferences in Sr identification in beta ray counting. In this study, cation exchange with EDTA adopted for Sr isolation. We made test experiments with radioactive Sr tracer and obtained that the chemical yield was about 90 %. The time for chemical operation was about 3-4 hours. To determine Sr-90, Cherenkov radiation of Y-90 has been measured by LSC, 1220 QUANTULUSTM Ultra Low Level Liquid Scintillation Spectrometer. With Sr-90 standard solution, we obtained that the Y-90 Cherenkov light detection efficiency was 68.7% and the Sr-90 detection limit was 0.004 Bq. With sequential measurement, the growth curve of Y-90 was described to determinate activity of Sr-90.

3.Results

We measured Sr-90 in the air dust samples of Fukushima, Hitachi, Kawasaki and Osaka. We chose some air dust samples that have high Cs-137 activity for Sr-90 measurement. Strontium isolation with solid phase extraction was performed. In Hitachi, the Sr-90 activity concentration in air is decreased with time and the ratio of Sr-90/Cs-137 is about 10-3. It is possible that after April, Sr-90 has been the same behavior of Cs-137. We observed a long time variation of Sr-90 air concentration in Hitachi and Fukushima and found that the Sr-90/Cs-137 activity ratio increased over time. We are going to discuss about behaviors of the Sr-90 and Cs-137 in the atmosphere.