

Comparison of AMS and LSC Analysis for Environmental Samples

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1. INTRODUCTION

Carbon-14 is one of the radio-nuclides which are produced by nuclear power plants. The main part of the carbon-14 released during normal operation is produced through neutron induced reactions in the cooling water and is released as airborne effluents such as carbon monoxide and hydrocarbon through the ventilation system of the plant to the surrounding environment. Because this nuclide has long half-life and biological importance, it is of interest to measure the releases and their incorporation into living material in the environment of the power plants [1]. The collected samples were measured by using the liquid scintillation counter (LSC) for the environment effects assessment depending on carbon-14 release. The environmental samples around the nuclear power plant were analyzed using the accelerator mass spectrometry (AMS) [2] and compared with LSC analytical results.

2. METHODS OF MEASUREMENT

1) Sample Preparation

The environmental samples collected near by the plant are vegetables-radish, pine leaves, rice and Korean cabbage- and eggs and so on. The samples for analyzing are divided into classification per each sample which is contributed to distance from plant to 0.7 km and 25 km. The key point of sample collection is considering the terrestrial direction about the direction of wind and the velocity of the wind excepting the direction of the sea. The sampling points were selected with two points on a boundary of plant for air sample and five points for terrestrial vegetations those are apart from a few km at plant. Air samples are collected monthly on a boundary

the plant. The air samplers have been continuously operated with low-volume air samplers contained in a fiberglass housing mounted to utility poles approximately one meter from the ground. Terrestrial vegetation samples were taken at various locations around the plant, which are also collected monthly. The sampling periods are progressed above six months.

2) Analysis

The accelerator mass spectrometry and liquid scintillation counter were used for measurement and analysis of low-level carbon-14 in environmental samples from near by the nuclear plant. The AMS measurements were performed at the tandem accelerator in the Inter-University Center for Natural Science Research Facility (ICNSRF) [4]. The analysis of the LSC instrument was used with PerkinElmer wallac Quantulus 1220.

3. RESULTS

The AMS and LSC analysis results of environmental samples are shown in Table 1. The samples analyzed for the carbon-14 activity using two instruments are radish, pine leaves, rice, Korean cabbage, milk and egg, which were collected from the region within 25 km plant during recent two years. The carbon-14 average concentration of air was 0.271 Bq/gC. From this result, an amount of the carbon-14 released from plant to environment is small to ignore comparing with the other world nuclear power plant. In environmental sample analysis, the pine leaves and radish generally showed higher than milk and Korean cabbage. The results of LSC analysis are showing higher concentration than AMS analysis. The relative deviation between LSC and AMS appeared about 11~12% as shown

in Fig 1. Also, the analysis value to two methods showed in agreement within range of about 90 %. Therefore, the AMS and LSC method are available to environment sample analysis such as these samples.

4. CONCLUSIONS

Although the carbon-14 through the stacks of NPP was released, the effect to environment is inferred not to occur because the carbon-14 around plant is almost background level. In spite of appearing to background level, the AMS and LSC methods are useful to analysis for low level environmental sample. Hereafter, present research will monitor the carbon-14 release from PWR's plant stacks in Korea until 2008 and evaluate to environmental effect.

REFERENCE

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Table 1. The comparison of the AMS and LSC analytical results for the environmental samples.

Sample	AMS analyt. Result (Bq/gC)[4]	LSC analyt. Result (Bq/gC)	Ratio (%)
Radish	0.264±0.008	0.302±0.008	87.4
Pine Leaves	0.262±0.020	0.294±0.008	89.1
Rice	0.259±0.020	0.286±0.008	90.6
Korean cabbage	0.243±0.006	0.267±0.007	91.0
Milk	0.235±0.030	0.267±0.008	88.0
Egg	0.260±0.010	0.291±0.008	89.4

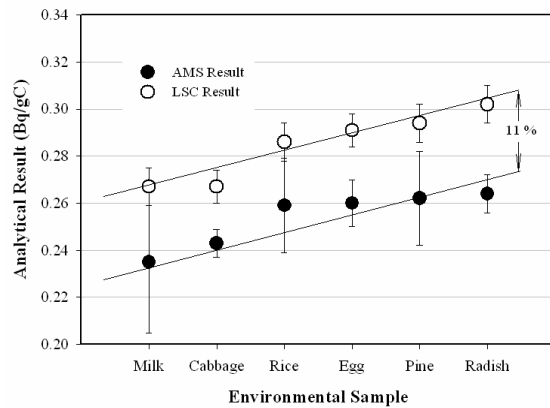


Fig. 1. Deviation of sample analysis using AMS and LSC.