§ 5. Development of a Simplified Method for Tritium Measurement in the Environmental Water Samples

Sakuma, Y., Yamanishi, H.,
Koganezawa, T., Iida, T. (Graduate School of Engineering, Nagoya Univ.),
Ogata, Y. (School of Health Sciences, Nagoya Univ.),
Tsuji, N. (Japan Air-conditioning Service Co. & Ltd.)
Kakiuchi, M. (Faculty of Science, Gakushuin Univ.),
Torikai, Y. (Hydrogen Isotope Research Center, Toyama Univ.),
Kawakami, T. (Water Quality Management Center, Toyama Univ.),
Satake, H. (Graduate School of Science, Toyama Univ.)

Introduction

Liquid scintillation counting is the most popular method to measure the tritium concentration in the low level water samples such as environmental water samples. However, it takes much time with a lot of doing to achieve the measurement. In the light of it, we have been improving the conventional method. As published before, the filtration method was proved to be available to be alternatively used for tritium measurement [1][2]. It could reduce the pretreatment time of the water samples very much.

In the present environment water in Japan, the tritium concentration has become nearly 0.5Bq/kg-H_2O which is within the detective limit by the low background liquid scintillation counter. As for the samples lower than the detective limit, they will be treated by electrolysis enrichment with liquid scintillation analyzer. Recently an electrolysis tritium enriching method using a solid polymer electrolyte has been developed [3][4]. The apparatus can easily enrich the water samples.

Discussion

Based on the research results before, we have discussed how to optimize the procedure. The discussed liquid scintillation counters were a low-background type analyzer made by A Co. & Ltd. which uses large vials and a same type of P company's analyzer which uses smaller vials. The improved enriching apparatus would have 100A of electrolytic current. As was shown in table 1, using P company's analyzer and two new enriching apparatuses, we will able to measure two samples a day, by the detection limit of 0.052Bq/L. One of the reasons is the P analyzer uses small vials of 20mL.

Conclusion

(1) We would be able to improve the measurement of tritium in environmental water samples, using new enriching apparatuses..

(2) .Using this procedure, the measurement would become more accurate reducing time.

References

[1]Y.SAKUMA etal. Proc. 10th IRPA, P-4a-248, (Hiroshima, Japan, May 15-19, 2000).

[2]Y. SAKUMA et al., J. Radioanalytical and Nuclear Chemistry, 255 (2) (2003) 325-327.

[3]M.SAITO et al., Radioisotopes, 45 (5) (1996) 258-292.

[4]M.SAITO et al., Radioisotopes, 45 (8) (1996) 483-490.

Table 1 Comparison of Measuring Methods.

Liquid Scintillation Counter	A*	P**	A*	P**
Number of Enrichment Apparatus	1		2	
Vial Volume [mL]	130	20	1320	20
Sample Water Volume [mL]	65	10	65	10
Initial Water Sample Volume [mL] (Vi)	770	550	990	720
Sample Volume after Enrichment [mL] (Vf)	70	20	70	20
Enrichment Rate (Z)	6.8	14.2	8.33	17.6
Time for Enrichment [hours] (E)	21	16	27	21
Time for Measurement [hours] (T)	21	15	14	10
Detection Limit of the Counter [cpm] (M)	0.301	0.102	0.370	0.126
Detection Limit using Enrichment [Bq/L]	0.052	0.052	0.052	0.052

* Aloka Co.& Ltd. LB5.

** Perkin Elmer Co.& Ltd. 1220 Quantulus.