Performance Test of SGS to Measure the γ-Activity from 200L Drum

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Radioactive waste assay system was designed, manufactured to exclude worker's exposure and to measure the individual nuclide's activity inhomogeneous and non-homogeneous waste drum, accurately. After measuring the activity of a representative γ-emitters(Co-60, Cs-137), automatically, this assay system can be calculated total activity by utilizing scaling factor.

Our SGS(Segmented Gamma Scanning System) devide a waste drum into 8 segments vertically, and also one segment into 8 sectors to minimize the error, and the activities from the homogeneous and non-homogeneous waste drum can be determined by using matrix correction methods such as transmission ratio, differential peak absorption and mean waste density correction, individually or by combination.

An optimum operating conditions of our system was induced by evaluating the affecting factors(drum's rotation speed, measuring time, source position and methods attenuation correction) for the measurement of activity.

Drum must be rotated to measure the activity emitting from all surface of drum so that we have evaluated how much the drum rotation speed affect the measuring result good. 5 rpms (8, 9, 10, 11, 12 rpm) as a rotation speed, are selected. And it is desirable to take the measurement time long, but it takes long time to analyze one waste drum. On the basis of the average 30 minuites to measure one drum, the relation between the measure time and their measured value was investigated.

We evaluated the results obtained according to change the positions of standard source in various model drum and also evaluated Non Uniformity Correction (NUC) Method (with the average density, the transmission method and the differential peak absorption method) to correct the density of drum.

Finally the results of the performance test were shown in Table 1~ 3, Fig. 1. As shown in results, the measurement error in our system was about 10 % in a very low-level standard gamma source(Co-60 ; 93 μCi and Cs-137 ; 86 μCi) and was less than 30% in a very low-level standard gamma source(Co-60; 8.7 mCi and Cs-137 ; 9.3 mCi) located in the center of model drum (density ; 1.1 g/cc).

The minimum detectable limit was 1.0 mR/hr. in the surface dose rate of radwaste drum.

Table 1. Analysis Results According to the Change of Drum Rotation Speed

Drum Type	Rotaion, Rpm	Co-60, μCi	Cs-137, μCi	
Wood (d=0.68)	8	81 ± 21	88 ± 36	- Meas. time : 50 sec/segment - Std. Source : Co-60, 93μCi, Cs-137, 86μCi - Source Position : 3, 5
	9	99 ± 22	94 ± 30	
	10	86 ± 21	85 ± 13	
	11	111 ± 24	121 ± 39	
	12	96 ± 20	96 ± 32	

Table 2. Analysis Results According to the Change of Measuring Time

Drum Type	Meas. Time(sec)	Co-60, μCi	Cs-137, μCi	
Wood (d=0.68)	50	3.9 ± 1.1	2.7 ± 1.1	Co-60, 10.5 μCi Cs-137, 10.3 μCi
	100	4.0 ± 0.9	3.5 ± 1.4	
	150	4.5 ± 1.0	4.1 ± 1.5	
	200	4.6 ± 1.0	4.4 ± 1.6	
	300	10.0 ± 1.7	10.6 ± 3.8	
Paraffin (d=1.1)	100	11,300 ± 5,600	19,200 ± 17,800	Co-60, 8.7 mCi Cs-137, 9.3 mCi
	200	11,300 ± 7,500	19,200 ± 23,900	

Table 3. Analysis Results Applied With and Without Non Uniformity Correction

Source Position	Co-60		Cs-137		
	With	Without	With	Without	
3, 5	0.99	1.25	1.11	1.52	- 100 s/segment - Co-60, 93 μCi Cs-137, 86 μCi
5, 5	1.02	1.68	1.01	1.95	
6, 5	1.05	1.73	1.20	2.32	
7, 5	0.92	1.85	1.00	2.48	
8, 5	1.23	1.87	1.29	2.56	
9, 5	0.88	1.88	1.02	2.76	

o Drum Type : wooden(d=0.68), the value means the measured value/the standard value.

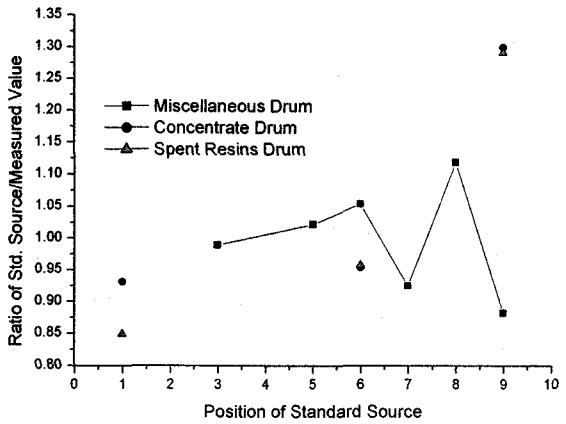

Fig. 1. Analysis Results according to the Change of the Position of Standard Source