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A STANDARD SAMPLE OF ^{14}C-SPECIFIC β ACTIVITY

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A standard sample (SS) of ^{14}C-specific β activity has been created based on benzene containing radioactive carbon diluted with "dead" benzene.

The SS activity determination has been made at several laboratories from the preparation activity measurements as compared to the activity of benzenes synthesized on the oxalic acid base (NBS standard, SRM-4990) and oak and pine tree rings of 1845–1855. Specific activity values of the sample age corrected back to 1950 are summarized in Table 1.

Non-parametric statistical methods have been applied to data processing (Table 1). We used a sampling median as a SS-certified characteristic, as well as sequential statistics with numbers 3 and 14 for the non-symmetrical distribution of measurement results as the limits of the confidence interval corresponding to the 0.95 probability. The determined value of SS-specific β activity is 1129 Bk/kg (imp/s · kg) with an error not exceeding 15 Bk/kg corresponding to a five-fold carbon activity (4.996) referring to 1950. The present ^{14}C-specific activity is assumed to be 226 Bk/kg (13.56 decay/g · min) (Karlen *et al*, 1964).

During SS certification, a number of methodologic problems have been solved. The identification of variations of radiocarbon concentrations with time in different trees and geographic areas is made by annual high-precision measurements (Bitvinskas, Metzkhvarishvili & Stupneva, 1984) of the ^{14}C concentration in rings of Scotch pine, Siberian larch, Norwegian and Eastern spruce, English oak, and black poplar. The measured ^{14}C concentration in pine and oak rings coincides within the limits of counting errors (Table 2).

Isotopic fractionation is demonstrated by the δ^{13}C values which are $-24.1‰$ for benzene synthesized from oak rings, $-25.0‰$ from pine rings, $-22.6‰$ from NBS standard.

Homogeneity of SS in the process of its storage was checked by measuring the activity of samples from the total SS volume of 1983–1986. Data in Table 3 referred to in terms of count rates excluding background, confirm the SS material uniformity during storage.

REFERENCES

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TABLE 1
The results of standard sample specific activity measurements

Lab	Ref sample	Weight (g)	Specific activity (Bk/kg)	Remarks
1	Oak and pine rings	2.0	1069	
2	Pine rings	5.7	1103	
3	NBS standard	8.8	1114	
4	Pine rings	6.2	1119	
4	Pine rings	7.7	1125	Synthesis of 1984
5	Pine rings	4.4	1126	Synthesis of 1986
6	Pine rings	9.4	1129	
7	Pine rings	8.8	1129	
7	Oak rings	8.8	1131	
6	NBS standard	19.4	1131	Isotopic fractionation
6	NBS standard	13.2	1131	
2	Oak rings	5.7	1138	
1	Oak and pine rings	8.8	1143	
2	Oak rings	6.2	1159	
4	Oak rings	7.7	1167	

TABLE 2
The results of 1845–1855 pine and oak ring measurements

Lab	Sample count rate, imp/min		Relative deviation (%)
	Pine rings	Oak rings	
AURISGG	20.817	20.779	0.2
Leningrad State Univ	146.623	146.038	0.4

TABLE 3
The results of SS measurements in various years

Lab	Sample count rate, imp/min				Relative deviation (%)
	1983	1984	1985	1986	
AURISGG		116.700		116.723	0.017
Leningrad State Univ	710.164		710.128		0.014

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