Designation: D 6866 – 04

Standard Test Methods for Determining the Biobased Content of Natural Range Materials Using Radiocarbon and Isotope Ratio Mass Spectrometry Analysis[1]

This standard is issued under the fixed designation D 6866; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 These test methods do not address environmental impact, product performance and functionality, determination of geographical origin, or assignment of required amounts of biobased carbon necessary for compliance with federal laws.

1.2 These test methods are applicable to any product containing carbon-based components that can be combusted in the presence of oxygen to produce carbon dioxide (CO_2) gas.

1.3 These test methods make no attempt to teach the basic principles of the instrumentation used although minimum requirements for instrument selection are referenced in the References section. However, the preparation of samples for the above methods is described. No details of instrument operation are included here. These are best obtained from the manufacturer of the specific instrument in use.

1.4 Currently, there are no ISO test methods that are equivalent to the test methods outlined in this standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:* [2]

D 883 Terminology Relating to Plastics

3. Terminology

3.1 The definitions of terms used in this test method are referenced in order that the practitioner may require further information regarding the practice of the art of isotope analysis and to facilitate performance of the method.

3.2 Terminology D 883 should be referenced for terminology relating to plastics. Although an attempt to list terms in a logical manner (alphabetically) will be made as some terms require definition of other terms to make sense.

3.3 *Definitions:*

3.3.1 *dpm*—disintegrations per minute. This is the quantity of radioactivity. The measure dpm is derived from cpm or counts per minute (dpm = cpm − bkgd / counting efficiency). There are 2.2 by 10^6 dpm / uCi **(11,13)**.[3]

3.3.2 *dps*—disintegrations per second (rather than minute as above) **(11,13)**.

3.3.3 *scintillation*—the sum of all photons produced by a radioactive decay event. Counters used to measure this as described in this method are Liquid Scintillation Counters (LSC) Bq **(11,13)**.

3.3.4 *specific activity (SA)*—refers to the quantity of radioactivity per mass unit of product, that is, dpmh % **(11,13)**.

3.3.5 *automated efficiency control (AEC)*—a method used by scintillation counters to compensate for the effect of quenching on the sample spectrum **(11)**.

3.3.6 *AMS facility*—a facility performing Accelerator Mass Spectrometry.

3.3.7 *accelerator mass spectrometry (AMS)*—an ultrasensitive technique for measuring naturally occurring radio nuclides, in which sample atoms are ionized, accelerated to high energies, separated on basis of momentum, charge, and mass, and individually counted in Faraday collectors. This high energy separation is extremely effective in filtering out isobaric interferences, such that AMS may be used to measure accurately the ^{14}C abundance to a level of 1 in 10^{15}. At these levels, uncertainties are based on counting statistics through the Poisson distribution **(7,8)**.

3.3.8 *background radiation*—the radiation in the natural environment; including cosmic radiation and radionuclides present in the local environment, for example, materials of construction, metals, glass, concrete **(1,3,6,7,11-15)**.

3.3.9 *coincidence circuit*—a portion of the electronic analysis system of a Liquid Scintillation Counter which acts to reject pulses which are not received from the two Photomultiplier Tubes (that count the photons) within a given period of time

[1] These test methods are under the jurisdiction of ASTM Committee D20 on Plastics and are the direct responsibility of Subcommittee D20.96 on Environmentally Degradable Plastics and Biobased Products.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The boldface numbers in parentheses refer to the list of references at the end of this standard.

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