National Institute of Standards and Technology
U.S. Department of Commerce

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Standard Reference Material® 917d
D-Glucose (Dextrose)
CERTIFICATE OF ANALYSIS

Purpose: This Standard Reference Material (SRM) is intended primarily for use in calibrating measuring systems employed for the analysis of glucose in clinical samples.

Description: This SRM comprises crystalline D-glucose of known chemical purity. A unit of SRM 917d consists of one bottle containing approximately 50 g of D-glucose.

Certified Value: A NIST certified value is a value for which NIST has the highest confidence in its accuracy in that all known or suspected sources of bias have been investigated or taken into account [1]. The measurand is the mass fraction of D-glucose in the material [2].

The certified value of chemical purity was determined using a quantitative ^{1}H-nuclear magnetic resonance spectroscopy (q^{1}H-NMR) measurement procedure [3,4]. This value, provided in percent form, is metrologically traceable to the International System of Units (SI) unit of mass, expressed as mass fraction in grams of glucose per gram of material [5].

Table 1. Certified Value for Chemical Purity of SRM 917d

Constituent	Purity as Mass Fraction[(a)] (%)
D-Glucose	99.6 ± 0.3

[(a)] The number after the ± symbol is the numerical value of uncertainty that defines an interval of values attributable to the measurand with a level of confidence of approximately 95 percent [6]. The uncertainty estimate is based on the shortest 95 % coverage interval calculated for the measurand using a Monte Carlo Method [7]. For guidance on using and propagating this uncertainty, see reference 8.

Period of Validity: The certified value delivered by **SRM 917d** is valid within the measurement uncertainty specified until **31 December 2032.** The certified value is nullified if the material is stored or used improperly, damaged, contaminated, or otherwise modified.

Maintenance of Certified Value: NIST will monitor this SRM over the period of its validity. If substantive technical changes occur that affect the certification, NIST will issue an amended certificate through the NIST SRM website (https://www.nist.gov/srm) and notify registered users. SRM users can register online from a link available on the NIST SRM website or fill out the user registration form that is supplied with the SRM. Registration will facilitate notification. Before making use of any of the values delivered by this material, users should verify they have the most recent version of this documentation, available through the NIST SRM website (https://www.nist.gov/srm).

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Safety: SRM 917d IS INTENDED FOR RESEARCH USE; NOT FOR HUMAN CONSUMPTION.

Storage: The SRM should be stored in its original container, tightly closed, at temperatures ≤25 °C. The SRM should always be protected from moisture, light, and heat. A previously opened bottle can be reused until the material reaches its expiration date, provided that the unit has been handled and stored as specified in this certificate. The surface of the SRM 917d material absorbs a significant amount of moisture when exposed to a relative humidity of approximately 75 %. The vial must be kept tightly closed at all times except during active transfer of sample material. In environments where relative humidity levels can exceed 75 %, the closed bottle should be stored in a desiccator or environmental conditions whereby the relative humidity does not exceed 50 %. Refrigeration of a unit within a desiccator is recommended for prolonged periods of storage; however, the bottle and contents should be allowed to warm to room temperature prior to opening.

Use: SRM 917d, stored as described above, should be used without preliminary drying. The minimum sample size is 10 mg.

To prepare a standard solution having nominal glucose mass concentration of 10 mg/mL for use in analyzing clinical samples, transfer 1.004 g of SRM 917d into a 100 mL volumetric flask, fill the flask to approximately 100 mL with an approximately 2 mg/mL benzoic acid (preservative, ACS Reagent grade) solution, and swirl to dissolve. Adjust volume to 100 mL with the 2 mg/mL benzoic acid solution.

Source: The SRM source material was obtained from a commercial supplier.

Analysis: Analyses for chemical identity, purity, and assessment of homogeneity were performed by NIST using seventeen units of SRM 917d D-Glucose (Dextrose), sampled at regular intervals across the entire production lot. A q^{1}H-NMR measurement procedure using an internal standard was implemented to determine the mass fraction of D-glucose in the material. The uncertainty in the certified purity value is based on the shortest 95 % coverage interval of the q^{1}H-NMR measurement result, calculated using a Bayesian statistical procedure [9]. No trend in mass fraction of glucose was observed across the bottling order of the production lot and there is no significant heterogeneity with respect to the uncertainty associated with the certified value and for samples of 10 mg or more.

Additional Information: The mass fraction of moisture in the SRM is less than 0.06 %. The mass fraction of non-volatile inorganic impurity content, measured as ash residual, was determined to be less than 0.02 %.

Details of the production of this SRM are described in NIST Special Publication 260-232, reference 10.

REFERENCES

[1] Beauchamp, C.R.; Camara, J.E.; Carney, J.; Choquette, S.J.; Cole, K.D.; DeRose, P.C.; Duewer, D.L.; Epstein, M.S.; Kline, M.C.; Lippa, K.A.; Lucon, E.; Molloy, J.; Nelson, M.A.; Phinney, K.W.; Polakoski, M.; Possolo, A.; Sander, L.C.; Schiel, J.E.; Sharpless, K.E.; Toman, B.; Winchester, M.R.; Windover, D.; *Metrological Tools for the Reference Materials and Reference Instruments of the NIST Material Measurement Laboratory*; NIST Special Publication (NIST SP) 260-136, 2021 edition; National Institute of Standards and Technology, Gaithersburg, MD (2021); available at https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.260-136-2021.pdf (accessed Jan 2023).

[2] Thompson, A.; Taylor, B.N.; *Guide for the Use of the International System of Units (SI)*; NIST Special Publication (NIST SP) 811; U.S. Government Printing Office: Washington, DC (2008); available at https://www.nist.gov/pml/special-publication-811 (accessed Jan 2023).

[3] Milton, M.J.T.; Quinn T.J.; *Primary Methods for the Measurement of Amount of Substance*; Metrologia, Vol. 38, pp. 289−296 (2001).

[4] Jancke, H.; *NMR Spectroscopy as a Primary Analytical Method of Measurement*; Nachr. Chem. Tech. Lab., Vol. 46(7-8), pp. 720−722 (1998).

[5] Nelson, M.A.; Waters, J.F.; Toman, B.; Lang, B.E.; Rück, A.; Breitruck, K.; Obkircher, M.; Windust, A.; Lippa, K.A.; *A New Realization of SI for Organic Chemical Measurement: NIST PS1 Primary Standard for Quantitative NMR (Benzoic Acid)*; Anal. Chem., Vol. 90, pp. 10510-10517 (2018).

[6] JCGM 100:2008; *Evaluation of Measurement Data — Guide to the Expression of Uncertainty in Measurement* (GUM 1995 with Minor Corrections); Joint Committee for Guides in Metrology (2008); available at https://www.bipm.org/en/committees/jc/jcgm/publications (accessed Jan 2023); see also Taylor, B.N.; Kuyatt, C.E.; *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*; NIST Technical Note 1297; U.S. Government Printing Office: Washington, DC (1994); available at https://www.nist.gov/pml/nist-technical-note-1297 (accessed Jan 2023).

[7] JCGM 101:2008; *Supplement 1 – Propagation of distributions using a Monte Carlo method (2008)*; Joint Committee for Guides in Metrology (2008); available at https://www.bipm.org/en/committees/jc/jcgm/publications (accessed Jan 2023).
[8] Possolo, A.M.; *Evaluating, Expressing, and Propagating Measurement Uncertainty for NIST Reference Materials*; NIST Special Publication (NIST SP) 260-202; U.S. Government Printing Office: Washington, DC (2020); available at https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.260-202.pdf (accessed Jan 2023).
[9] Toman, B., Nelson, M.A.; Lippa, K.A.; *Chemical Purity Using Quantitative ^{1}H-Nuclear Magnetic Resonance: A Hierarchical Bayesian Approach for Traceable Calibrations*; Metrologia, Vol. 53, pp. 1193−1203 (2016).
[10] Nelson, M.A.; Lang, B.E.; Mulloor, J.; Certification of Standard Reference Material 917d: D-Glucose (Dextrose); NIST Special Publication (NIST SP) 260-232 (2022); available at https://nvpubs.nist.gov/SpecialPublications/NIST.SP.260-232.pdf (accessed Jan 2023).

If you use this SRM in published work, please reference:

Nelson MA, Lang BE, Mulloor J, Toman B (2022) Certification of Standard Reference Material® 917d: D-Glucose (Dextrose). (National Institute of Standards and Technology, Gaithersburg, MD), NIST Special Publication (SP) 260-232. https://doi.org/10.6028/NIST.SP.260-232

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Users of this SRM should ensure that the Certificate of Analysis in their possession is current. This can be accomplished by contacting the Office of Reference Materials 100 Bureau Drive, Stop 2300, Gaithersburg, MD 20899-2300; telephone (301) 975-2200; e-mail srminfo@nist.gov; or the Internet at https://www.nist.gov/srm.

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