National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 913b

Uric Acid

This Standard Reference Material (SRM) is certified as a chemical of known purity. It is intended primarily for use in the calibration and standardization of procedures for uric acid determinations employed in clinical analysis and for routine critical evaluation of the daily working standards used in these procedures. A unit of SRM 913b consists of one bottle containing 10 g of crystalline uric acid.

Certified Value and Uncertainty: The certified value is based upon the results from several analytical techniques designed to measure impurities and on scientific judgement of these results. The certified chemical purity presented in Table 1 was determined by measuring the mass fractions of impurities, including water and residue from ashing, summing the impurities and subtracting this sum from 100 %. 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 accounted for by NIST [1].

Table 1. Certified Chemical Purity and Uncertainty for Uric Acid (Mass Fraction)

99.8 % ± 0.2 %

The results are expressed as the certified value ± the expanded uncertainty. The uncertainty in the certified value is equal to $U = ku_c$, where, u_c, is the combined standard uncertainty calculated according to the ISO/JCGM Guide [2] and, $k = 2$, is the coverage factor. The expanded uncertainty is intended to represent a 95 % confidence interval and reflects the combined effects of measurement imprecision, variability in concentrations between bottles and any systematic differences between techniques when more than one method has been used [2]. The measurand is the total concentration of uric acid and the certified value is metrologically traceable to the SI unit of mass, expressed as percent.

Reference Values: Reference values are noncertified values that are the best estimates of the true values; however, the values do not meet NIST criteria for certification. Such values are provided with associated uncertainties that may reflect only measurement precision, may not include all sources of uncertainty, or may reflect a lack of sufficient statistical agreement among multiple analytical methods [1]. Reference values for mass loss upon drying, residue after ashing, and molar extinction coefficients are provided in Table 2.

Expiration of Certification: The certification of **SRM 913b** is valid, within the measurement uncertainty specified, until **01 January 2024**, provided the SRM is handled and stored in accordance with instructions given in this certificate (see "Instructions for Storage and Use"). This certification is nullified if the SRM is damaged, contaminated, or otherwise modified.

Maintenance of SRM Certification: NIST will monitor this SRM over the period of its certification. If substantive technical changes occur that affect the certification before the expiration of this certificate, NIST will notify the purchaser. Registration (see attached sheet or register online) will facilitate notification.

Coordination of the technical activities leading to the certification of this SRM were performed by J.E. Camara of the NIST Chemical Sciences Division.

Acquisition of the material was performed by K.W. Phinney of the NIST Biomolecular Measurement Division. Certification measurements at NIST were performed by L.T. Sniegoski, M.J. Welch, and J.S. Pritchett of the NIST Chemical Sciences Division.

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Statistical analysis of the data was provided by N-F. Zhang of the NIST Statistical Engineering Division.

Support aspects involved in the issuance of this SRM were coordinated through the NIST Office of Reference Materials.

INSTRUCTIONS FOR STORAGE AND USE

Storage: SRM 913b should be stored in its original bottle at temperatures between 20 °C and 25 °C. It must be tightly re-capped after use and protected from excessive moisture and light.

Use: SRM 913b is not hygroscopic under ordinary storage conditions (as described above) and can be used without preliminary drying. The minimum sample size required is 10 mg.

SOURCE AND ANALYSIS[(1)]

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

Analytical Approach: All analyses for the certified and reference values were performed at NIST. Because uric acid does not melt, differential scanning calorimetry could not be used as an overall measure of the purity. Instead, potential impurities were evaluated using a variety of techniques that included: liquid chromatography-mass spectrometry (LC-MS), gas chromatography-mass spectrometry (GC-MS), mass loss upon drying, ashing at 800 °C, and ultraviolet (UV) spectroscopy. The results for the drying and ashing analyses are shown in Table 2. Other low level impurities may be present but were not detected by the techniques used here. The certified purity is determined by subtracting from 100 %, the sum of the mass loss upon drying and the residue after ashing.

Homogeneity Analysis: The homogeneity assessment was made at the time the certification analyses were performed. A stratified sampling plan was devised to test for homogeneity across the lot of bottles. There was no apparent trend in the data when plotted against the sequence in which the bottles were prepared.

Molar extinction coefficients were measured for solutions of SRM 913b in a glycine-NaOH aqueous buffer (pH 9.6) and 0.0017 mol/L ammonia (pH 10.1) at 234 nm and 292 nm. The results for the molar extinction coefficients are also shown in Table 2.

Table 2. Reference Values for Selected Properties of SRM 913b[(a)]

Components of Impurity	Mass Fraction[(b)] (%)	
Mass loss upon drying	0.13 ± 0.02	
Residue after ashing	0.06 ± 0.01	
UV Absorbance of Uric Acid	**Molar Extinction Coefficients[(c)] ($L \cdot mol^{-1} \cdot cm^{-1}$)**	
	234 nm	292 nm
In glycine-NaOH buffer, pH 9.6	9 820 ± 27	12 507 ± 43
In ammonia solution, pH 10.1	9 549 ± 70	12 515 ± 168

[(a)] The results are expressed as the reference value ± the expanded uncertainty. The uncertainty in the reference value is equal to $U = ku_c$, where, u_c, is the combined standard uncertainty calculated according to the ISO/JCGM Guide [2] and, $k = 2$, is the coverage factor. The expanded uncertainty is intended to represent a 95 % confidence interval.

[(b)] The measurand is the mass fraction of mass loss upon drying and residue after ashing as determined by the method indicated. The reference value is metrologically traceable to the SI unit of mass expressed as percent.

[(c)] The measurand is the molar extinction coefficient as determined by the method indicated. The reference value is metrologically traceable to the SI units volume, amount of substance, and length expressed as $L \cdot mol^{-1} \cdot cm^{-1}$.

[(1)]Certain commercial equipment, instruments or materials are identified in this certificate to adequately specify the experimental procedure. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the instruments, materials, or processes identified are necessarily the best available for the purpose.

REFERENCES

[1] May, W.; Parris, R.; Beck II, C.; Fassett, J.; Greenberg, R.; Guenther, F.; Kramer, G.; Wise, S.; Gills, T.; Colbert, J.; Gettings, R.; MacDonald, B.; *Definitions of Terms and Modes Used at NIST for Value-Assignment of Reference Materials for Chemical Measurements*; NIST Special Publication 260-136; U.S. Government Printing Office: Washington, DC (2000); available at: http://www.nist.gov/srm/publications.cfm (accessed June 2014).

[2] 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 (JCGM) (2008); available at http://www.bipm.org/utils/common/documents/jcgm/JCGM_100_2008_E.pdf (accessed June 2014); 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 http://www.nist.gov/pml/pubs/index.cfm (accessed June 2014).

Users of this SRM should ensure that the Certificate of Analysis in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 948-3730; e-mail srminfo@nist.gov; or via the Internet at http://www.nist.gov/srm.