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

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Standard Reference Material® 919b
Sodium Chloride
CERTIFICATE OF ANALYSIS

Purpose: This Standard Reference Material (SRM) is intended for the production of saline solutions of accurately known concentration and the calibration of instrumentation and standardization of procedures used in the determination of sodium and chloride ions.

Description: A unit of SRM 919b consists of a single glass bottle containing 30 g of the material.

Certified Values: Table 1 lists the certified values for this SRM, expressed as mass fractions, w, of sodium chloride (NaCl), chloride (Cl^-), and sodium (Na^+). 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].

Table 1. Certified Values[(a)] for SRM 919b Sodium Chloride

w_{NaCl}	99.835 %	±	0.020 %
w_{Cl^-}	60.564 %	±	0.014 %
w_{Na^+}	39.2747 %	±	0.0075 %

(a) Each result is expressed as the certified value ± the expanded uncertainty, U, calculated as $U = ku_c$, where u_c is the combined standard uncertainty calculated according to the ISO/JCGM and NIST Guides [2]. The value of u_c is intended to represent, at the level of one standard deviation, the combined effects of inherent sources of uncertainty of the assay techniques and applicable corrections for interfering trace elements. The value of the coverage factor, k, is 2, which corresponds to a level of confidence of approximately 95 %. The certified values for the mass fractions of Na, Cl, and NaCl are metrologically traceable to the SI units for mass, current, and time in the coulometric assay; to the International System of Units (SI) unit for mass in the gravimetric assay; and to the derived SI unit kilogram per kilogram for mass fraction (expressed as a percent) for the corrections for trace elements.

Non-Certified Values: Non-certified values are provided in Appendix A.

Period of Validity: The certified values delivered by **SRM 919b** are valid within the measurement uncertainty specified until **01 March 2027**. The certified values are nullified if the material is stored or used improperly, damaged, contaminated, or otherwise modified.

Maintenance of Certified Values: 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 at the time of purchase. 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 free of charge through the NIST SRM website.

Carlos A. Gonzalez, Chief
Chemical Sciences Division

Steven J. Choquette, Director
Office of Reference Materials

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Safety: SRM 919b IS INTENDED FOR RESEARCH USE; NOT FOR HUMAN CONSUMPTION.

Storage: This SRM should be stored in its original bottle at room temperature. It must be tightly re-capped after use and protected from moisture and light. At room temperature, sodium chloride is hygroscopic above 60 % relative humidity. It is recommended that weighing and other manipulations not be made when the relative humidity exceeds 60 %.

Homogeneity: This SRM is homogeneous within the uncertainty limits for the nominal sample mass, 170 mg, used for the coulometric assays. Samples less than 170 mg are not recommended in order to avoid possible heterogeneity with smaller sample sizes.

Possible Interfering Species: It is the responsibility of the user to evaluate which species may interfere with the application of this SRM and to apply any necessary corrections that affect the given application. The following information and the values in Table A1 may be useful in this evaluation.

Corrections for trace elements were obtained from the spark-source mass spectrometric determinations and the appropriate gravimetric factors. A portion of the Na^+ is assumed to be present in SRM 919b as sodium sulfate (Na_2SO_4), sodium bromide (NaBr), sodium iodide (NaI), disodium hydrogen phosphate (Na_2HPO_4), and sodium fluoride (NaF); and a portion of the Cl^- is assumed to be present as potassium chloride (KCl), lithium chloride (LiCl), calcium chloride ($CaCl_2$), nickel chloride ($NiCl_2$), aluminum chloride ($AlCl_3$), magnesium chloride ($MgCl_2$), barium chloride ($BaCl_2$), rubidium chloride (RbCl), and cesium chloride (CsCl). Silicon is assumed to be present as silicon dioxide (SiO_2). Hence, the sum of the certified values for w_{Na^+} and w_{Cl^-} does not equal the certified value for w_{NaCl}.

The certified value for w_{NaCl} was obtained from an equally weighted combination of the results of the gravimetric determination of NaCl, with appropriate corrections for trace elements; and the results of the coulometric determination of NaCl, with appropriate corrections for trace elements.

The certified value for w_{Cl^-} was obtained from an equally weighted combination of the results of the coulometric determination of Cl^-, with corrections for interfering bromide and iodide; and the results of the indirect determination of Cl^- obtained from the gravimetric determination of Na^+, with appropriate corrections for trace elements.

The certified value for w_{Na^+} was obtained from an equally weighted combination of the results of the gravimetric determination of Na^+, with appropriate corrections for trace elements; and the results of the indirect determination of Na^+ obtained from the coulometric determination of Cl^-, with appropriate corrections for trace elements.

Coulometric measurements of SRM 919b ignited for 3 h at 600 °C and measurements of change in mass on ignition each indicate the presence of (0.16 ± 0.02) % inert volatile material, presumably occluded water, which is volatilized on ignition. This value is a non-certified value [1], which is a best estimate of the true value, where all known or suspected sources of bias have not been fully investigated by NIST.

Drying Instructions: Dry for 3 h at 110 °C. After the SRM has been dried, store it in a desiccator over anhydrous magnesium perchlorate and gently crush any lumps present before using.

NOTICE TO USERS

NIST strives to maintain the SRM inventory supply, but NIST cannot guarantee the continued or continuous supply of any specific SRM. Accordingly, NIST encourages the use of this SRM as a primary benchmark for the quality and accuracy of the user's in-house reference materials and working standards. As such, the SRM should be used to validate the more routinely used reference materials in a laboratory. Comparisons between the SRM and in-house reference materials or working measurement standards should take place at intervals appropriate to the conservation of the SRM and the stability of relevant in-house materials. For further guidance on how this approach can be implemented, contact NIST by email at srms@nist.gov.

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; U.S. Government Printing Office: Washington, DC (2021); available at https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.260-136-2021.pdf (accessed Jan 2024).

[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 https://www.bipm.org/en/committees/jc/jcgm/publications (accessed Jan 2024); 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 2024).

[3] *ACS Reagent Chemicals*, 9th ed.: American Chemical Society: Washington, DC (1999).

[4] Pratt, K.W.; *Automated, High-Precision Coulometric Titrimetry Part I. Engineering and Implementation*; Anal. Chim. Acta, Vol. 289, pp. 125–134 (1994).

[5] Moody, J.R.; Vetter, T.W.; *Development of the Ion Exchange-Gravimetric Method for Sodium in Serum as a Definitive Method*; J. Res. Natl. Inst. Stand. Technol., Vol. 101, pp. 155–164 (1996).

Certificate Revision History: 08 January 2024 (Change of period of validity; editorial changes); 15 February 2022 (Change of expiration date; updated format; editorial changes); 09 February 2016 (Editorial changes); 22 March 2007 (Original certificate date).

Certain commercial equipment, instruments, or materials may be identified in this Certificate of Analysis 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 materials or equipment identified are necessarily the best available for the purpose.

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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APPENDIX A

Source of Material: The NaCl used for this SRM was obtained from a commercial supplier. The material was examined for compliance with the specification for reagent grade NaCl as specified by the American Chemical Society [3]. The material was found to meet or exceed the minimum requirements in every respect.

Assay Techniques: The coulometric assay value was obtained by automated titration [4] with coulometrically generated Ag^+ using potentiometric detection of the endpoint. The gravimetric assay value was obtained by conversion of the Na present to Na_2SO_4, including corrections for trace impurities in the SRM (procedure based on reference 5).

Non-Certified Values: Table A1 lists non-certified values for selected impurities in SRM 919b. No other elements were detected at a mass fraction greater than 1 µg/g. Non-certified values are values that may be of interest and use to the SRM user, but insufficient information is available to provide an uncertainty associated with the value [1]. Non-certified values are suitable for use in method development, method harmonization, and process control but do not provide metrological traceability to the International System of Units (SI) or other higher-order reference system.

Table A1. Non-certified Values for SRM 919b

Element	Mass Fraction (µg/g)
Bromine (Br)	15
Sulfur (S)	10
Potassium (K)	7
Silicon (Si)	5
Calcium (Ca)	1
Phosphorus (P)	0.5
Aluminum (Al)	0.4
Iodine (I)	<25
Fluorine (F)	<5
Nickel (Ni)	<2
Lithium (Li)	<1
Magnesium (Mg)	<1
Rubidium (Rb)	<1
Barium (Ba)	<1
Cesium (Cs)	<0.5

Maintenance of Non-Certified Values: NIST will monitor this material to the end of its period of validity. If substantive technical changes occur that affect the non-certified values during this period, NIST will update this Appendix. Before making use of any of the values delivered by this material, users should obtain the most recent version of this documentation, available free of charge through the https://www.nist.gov/srm website.

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APPENDIX B

Coordination of the technical measurements leading to the certification of SRM 919b was provided by K.W. Pratt and T.W. Vetter of the NIST Chemical Sciences Division.

Coulometric and gravimetric analyses were performed at NIST by K.W. Pratt and T.W. Vetter, respectively. Trace element analyses by spark-source mass spectrometry were performed by a commercial laboratory.

Statistical consultation was provided by W.F. Guthrie of the NIST Statistical Engineering Division.

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

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