

Standard Reference Material[®] 2897a

Ethanol-Water Solution

(Nominal Mass Fraction 2 %)

CERTIFICATE OF ANALYSIS

Purpose: The certified value delivered by this Standard Reference Material (SRM) is intended primarily for use in the calibration of instruments and techniques used for the determination of ethanol.

Description: This SRM is a solution of ethanol (ethyl alcohol: Chemical Abstracts Service [CAS] Registry Number 64-17-5) in water at a nominal mass fraction of 2 %. A unit of SRM 2897a consists of five 10-milliliter ampoules, each containing approximately 10 mL of solution.

Certified Value: The certified mass fraction value given below is based on results obtained from the gravimetric preparation of the solution and from the analytical results determined using gas chromatography with flame ionization detection (GC-FID). Metrological traceability is the International System of Units (SI) derived unit for mass fraction, expressed as percent, through the mass balance purity assessment of neat material determined by GC-FID and Karl Fischer analysis. 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].

Ethanol Certified Mass Fraction Value: 2.001 % $\pm$ 0.045 %

The result is expressed as the certified value $\pm$ the expanded uncertainty. The certified value is an unweighted mean of mass fractions determined by gravimetric preparation and chromatographic measurements. The uncertainty provided is an expanded uncertainty about the mean to cover the measurand with approximately 95 % confidence. The expanded uncertainty is calculated as $U = ku_c$, where u_c incorporates the observed difference between the results from the methods and their respective uncertainties, as well as an uncertainty component related to purity determination, consistent with the ISO/JCGM Guide and with its Supplement 1, and $k = 2$ is a coverage factor corresponding to approximately 95 % confidence [2–4].

Additional Information: Additional information is provided in Appendix A.

Period of Validity: The certified value delivered by **SRM 2897a** is valid within the measurement uncertainty specified until **30 April 2035**. 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 the value 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>).

Carlos A. Gonzalez, Chief
Chemical Sciences Division
Certificate Revision History on Page 2

Steven J. Choquette, Director
Office of Reference Materials

Safety: Consult the Safety Data Sheet (SDS) for hazard information. The solution contains ethanol in water at the stated concentration. Use proper disposal methods.

Storage: Sealed ampoules, as received, should be stored in the dark at temperatures between 10 °C and 30 °C.

Use: Sample aliquots for analysis should be withdrawn **immediately** after opening the ampoules and should be processed without delay for the certified value to be valid within the stated uncertainty. Because of the volatility of ethanol, the certified value is **NOT** applicable to material stored in ampoules that have been opened for more than 2 min, even if they are resealed.

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 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 Apr 2025).
- [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 (2008); available at <https://www.bipm.org/en/committees/jc/jcgm/publications> (accessed Apr 2025); 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 Apr 2025).
- [3] JCGM 101:2008; *Evaluation of Measurement Data – Supplement 1 to the Guide to Expression of Uncertainty in Measurement; Propagation of Distributions Using a Monte Carlo Method*; Joint Committee for Guides in Metrology (2008); available at <https://www.bipm.org/en/committees/jc/jcgm/publications> (accessed Apr 2025).
- [4] Efron, B.; Tibshirani, R. J.; *An Introduction to the Bootstrap*; Chapman & Hall, London, UK (1993).

Certificate Revision History: 25 April 2025 (Change of period of validity; updated format; editorial changes); 24 August 2020 (Editorial changes); 30 May 2013 (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>.

* * * * * End of Certificate of Analysis * * * * *

APPENDIX A

Preparation and Analysis: The solution was prepared at NIST by weighing and mixing known masses of ethanol and organic-free water. The solution was capped and mixed overnight (a minimum of 16 h). The total mass of the solution was measured, and the mass fraction was calculated from this gravimetric procedure. The gravimetric mass fraction was adjusted for the purity estimation of the ethanol, which was determined using GC-FID and Karl Fischer analysis for water content. The bulk solution was chilled slightly, and 10 mL aliquots were dispensed into 10-milliliter glass ampoules, which were then flame sealed.

Duplicate aliquots from ten ampoules; selected using a stratified random sampling scheme; were analyzed by GC-FID on a relatively polar DB-wax column, 15 m $\times$ 0.45 mm id, 0.85 μ m film thickness (Agilent Technologies, Wilmington, DE, USA). The internal standard added to each sample for quantification purposes was 1-propanol. Calibration solutions consisting of weighed amounts of ethanol and the internal standard compound in organic-free water were chromatographically analyzed to determine analyte response factors.

***** End of Appendix A *****