



National Institute of Standards and Technology

Certificate of Analysis

Standard Reference Material[®] 2900

Ethanol-Water Solution (nominal 95.6 % by mass)

This Standard Reference Material (SRM) is a solution of ethanol (ethyl alcohol - Chemical Abstracts Service [CAS] Registry Number 64-17-5) in water at a nominal concentration of 95.6 % by mass. This SRM is intended primarily for use in the calibration of instruments and techniques used for the determination of ethanol in water-based media. SRM 2900 consists of five 10-milliliter ampoules (nominal concentration of 95.6 % by mass), each containing approximately 10 mL of solution.

Certified Concentration of Ethanol: 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]. The certified concentration value given below is based on results obtained from the gravimetric preparation of the solution and from the analytical results determined using gas chromatography.

Ethanol Certified Concentration Value: 95.6 % \pm 1.9 % (mass fraction)

The results are expressed as the certified value \pm the expanded uncertainty. Certified values are weighted means of concentrations determined by gravimetric preparation and chromatographic measurements [2]. The uncertainty listed with each value is an expanded uncertainty about the mean, with coverage factor 2 (approximately 95 % confidence), calculated by combining a between-source variance incorporating inter-method bias with a pooled within-source variance following the ISO and NIST Guides for expressing the uncertainty in measurements [3]. The uncertainty includes both correction for estimated purity and allowance for differences among the concentration determined by gravimetric preparation and chromatographic measurements.

Expiration of Certification: The certification of SRM 2900 is valid until **31 December 2015**, within the measurement uncertainties specified, provided the SRM is handled and stored in accordance with the instructions given in this certificate (see "Notice and Warnings to Users"). However, the certification is nullified if the SRM is damaged, contaminated, or modified. NIST reserves the right to withdraw, amend, or extend this certification at anytime.

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) will facilitate notification.

The coordination of the technical measurements leading to the certification of this SRM was under the direction of M.M. Schantz and L.C. Sander of the NIST Analytical Chemistry Division.

Partial funding support for the preparation and certification of this SRM was provided by the National Institute of Justice (NIJ) and managed through the NIST Office of Law Enforcement Standards (OLES).

Preparation and analytical measurements of the SRM were performed by M.M. Schantz of the NIST Analytical Chemistry Division and M.P. Cronise, J.T. Fort, and C.N. Fales of the NIST Measurement Sciences Division.

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Consultation on the statistical design of the experimental work and evaluation of the data were provided by S.D. Leigh of the NIST Statistical Engineering Division.

The support aspects involved in the issuance of this SRM were coordinated through the Measurement Sciences Division.

NOTICE AND WARNING TO USERS

Handling: The solution contains ethanol in water at the stated concentrations. Use proper disposal methods.

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

INSTRUCTIONS FOR USE

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

PREPARATION AND ANALYSIS

The solution was prepared at NIST by weighing and mixing known masses of ethanol and organic-free water. The solution was mixed overnight (a minimum of 16 h). The total mass of the solution was measured, and the concentration was calculated from this gravimetric procedure. The gravimetric concentration was adjusted for the purity estimation of the ethanol, which was determined using flame ionization capillary gas chromatography with two stationary phases of different polarities, differential scanning calorimetry, 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.

Aliquots from nine ampoules selected using a stratified random sampling scheme were analyzed in duplicate by using capillary gas chromatography with flame ionization detection on a relatively polar DB-wax column, 15 m × 0.45 mm id, 0.85 µm 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.

REFERENCES

- [1] May, W.; Parris, R.; Beck, 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.cstl.nist.gov/nist839/special_pubs/SP260136.pdf.
- [2] Ruhkin, A.L.; Vangel, M.G.; *Estimation of a Common Mean and Weighted Means Statistics*; J. Am. Stat. Assoc., Vol. 93, pp. 303–308 (1998).
- [3] ISO; *Guide to the Expression of Uncertainty in Measurement*; ISBN 92-67-10188-9, 1st ed.; International Organization for Standardization: Geneva, Switzerland (1993); 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://physics.nist.gov/Pubs/>.

Users of this SRM should ensure that the certificate in their possession is current. This can be accomplished by contacting the SRM Program at: telephone (301) 975-6776; fax (301) 926-4751; e-mail srminfo@nist.gov; or via the Internet at <http://www.nist.gov/srm>.