National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 3198

Aqueous Electrolytic Conductivity

Lot No. 070604

This Standard Reference Material (SRM) is intended primarily for use in electrolytic conductivity measurement as a calibration standard or control sample. As a calibration standard, it can be used to determine the conductivity cell constant. One unit of SRM 3198 consists of one glass bottle containing approximately 500 mL of a dilute potassium chloride (KCl) solution in a mixture of 30 % (mass fraction) 1-propanol, 70 % (mass fraction) water in equilibrium with atmospheric carbon dioxide.

SRM 3198 was prepared gravimetrically using deionized water of initial electrolytic conductivity less than 0.06 μS/cm. The solution was dispensed into borosilicate glass (Pyrex 33)[1] bottles. The certified electrolytic conductivity and its uncertainty given below were established through determinations with a conductivity cell immersed in a constant-temperature oil bath and using a Jones bridge with a null detector. The conductivity bridge and electronics are described in references 1 and 2.

Certified Value and Uncertainty: The certified value given below is based on equilibrium conditions, and the solution should **NOT** be degassed before use. 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 [3].

Electrolytic Conductivity at 25.000 °C: 5.31 μS/cm ± 0.45 μS/cm

The certified value is expressed as the value ± its expanded uncertainty, U. The expanded uncertainty is calculated as $U = ku_c$, where k is the coverage factor and u_c is the combined standard uncertainty calculated according to the ISO *Guide to the Expression of Uncertainty in Measurement* [4] and NIST Technical Note 1297 [5]. The value of u_c represents the combined uncertainty in the certified value, at the level of one standard deviation, arising from the dissolution of carbon dioxide, stability of the SRM, cell calibration, measurement of resistance, and temperature control in the certification measurements. The value of k controls the approximate level of confidence associated with U.. For this SRM, $k = 1.96$, which corresponds to a level of confidence of approximately 95 %. The value of k is obtained from the Student's t distribution with effective degrees of freedom > 1000.

Expiration of Certification: The certification of **SRM 3198 Lot No. 070604** is valid, within the measurement uncertainty specified, until **03 September 2010**, provided the SRM is handled in accordance with instructions given in this certificate (see "Instructions for Use"). This certification is nullified if the SRM is damaged, contaminated, or otherwise modified.

This SRM was prepared and analyzed by K.W. Pratt of the NIST Analytical Chemistry Division.

Stephen A. Wise, Chief
Analytical Chemistry Division

Gaithersburg, MD 20899
Certificate Issue Date: 25 August 2009
See Certificate Revision History on Last Page

Robert L. Watters, Jr., Chief
Measurement Services Division

[1]Certain commercial equipment, instruments, or materials are identified in this certificate in order to specify adequately 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.

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 Measurement Services Division.

Maintenance of Certification: NIST will monitor this SRM lot 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.

INSTRUCTIONS FOR USE

The SRM bottle should be open for the minimum time required to dispense the solution. Each time the bottle is opened, a portion of the solution will evaporate, which will change the conductivity. After use, the bottle should be tightly recapped and stored under normal laboratory conditions away from acid fumes, nitrogen oxides, and sulfur dioxide. These precautions will reduce the evaporation rate of the solute and possible acidic contamination.

Conductivity is strongly influenced by temperature. For this solution, the temperature coefficient at 25 °C, α, is approximately 2.9 % per °C [6]. The certified value and its uncertainty were determined at a temperature of 25.000 °C ± 0.005 °C. The corresponding equation for correcting to other temperatures is

$$\kappa = \kappa_{25°C}\left[1 + \alpha\left(t - 25\,°C\right)\right]$$

where $\kappa_{25\ °C}$ is the certified value, α is 2.9 % (= 0.029), t is the temperature of measurement, and κ is the corrected value at t. This correction is valid in the range of t = 25.0 °C ± 0.5 °C. It should not be applied to values of t outside this range.

REFERENCES

[1] Shreiner, R.H.; Pratt, K.W.; *Primary Standards and Standard Reference Materials for Electrolytic Conductivity*; NIST Special Publication 260-142, 2004 Ed., U.S. Government Office: Washington, DC (2004); available at http://ts.nist.gov/MeasurementServices/ReferenceMaterials/upload/260-142-2ndVersion.pdf.

[2] Wu, Y.C.; Pratt, K.W.; Koch, W.F.; *Determination of the Absolute Specific Conductance of Primary Standard KCl Solutions*; J. Solution Chem., Vol. 18, p. 515 (1989).

[3] 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://ts.nist.gov/MeasurementServices/ReferenceMaterials/upload/SP260-136.PDF.

[4] *Guide to the Expression of Uncertainty in Measurement*; ISBN 92-67-10188-9, lst ed., ISO, Geneva, Switzerland (1993).

[5] 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/.

[6] Wu, Y. C.; Berezansky, P. A.; *Low Electrolytic Conductivity Standards*; J. Res. Natl. Inst. Stand. Technol. Vol. 100, p. 521 (1995).

Certificate Revision History: 25 August 2009 (This revision reflects at extension of the certification period); 27 January 2009 (Original certificate date).

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) 975-2200; fax (301) 926-4751; e-mail srminfo@nist.gov; or via the Internet at http://www.nist.gov/srm.