National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 3191

Aqueous Electrolytic Conductivity

Lot No. 042402

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 3191 consists of one bottle containing approximately 500-milliliter of solution. The solution was prepared by dissolving reagent grade potassium chloride (KCl) in deionized water in equilibrium with atmospheric carbon dioxide.

SRM 3191 was prepared gravimetrically using deionized water that was filtered through a 0.22 μm filter. The initial electrolytic conductivity of this water was less than 0.2 μS/cm. The solution was dispensed into borosilicate glass (Pyrex®)[1] bottles with the caps wrapped in Parafilm M®[1]. 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.

The certified value given below is based on equilibrium conditions, and the solution should **NOT** be degassed before use.

Electrolytic Conductivity at 25.000 °C: 99.35 μS/cm ± 0.63 μS/cm

The uncertainty in the certified value, U = 0.63 μS/cm, is calculated as

$$U = 2.0u_c$$

where u_c is the *combined standard uncertainty* calculated according to the ISO and NIST Guides [3]. The value of u_c is intended to represent, at the level of one standard deviation, the combined effect of uncertainty components associated with the instability of the SRM, the cell calibration, and carbon dioxide dissolution. The value of u_c has been multiplied by 2.0, which is the coverage factor corresponding to approximately 95 % confidence based on greater than 100 overall effective degrees of freedom.

Expiration of Certification: The certification of **SRM 3191 Lot No. 042402** is valid, within the measurement uncertainty specified, until **17 February 2005**, 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 R.H. Shreiner of the NIST Analytical Chemistry Division.

Willie E. May, Chief
Analytical Chemistry Division

Gaithersburg, MD 20899
Certificate Issue Date: 20 April 2004

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

[1]Certain commercial equipment, instrumentation, or materials are identified in this certificate to specify adequately the experimental procedure. Such identification does not imply recommendation or endorsement by the NIST, 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.

The support aspects involved with the issuance of this SRM were coordinated through the NIST Standard Reference Materials Program by C.S. Davis of the Measurement Services Division.

Maintenance of Certification: NIST will monitor representative solutions from this SRM lot over the period of its certification. If substantive changes occur that affect the certification before the expiration of certification, NIST will notify the purchaser. Registration (see attached sheet) will facilitate notification.

Conductivity is strongly influenced by temperature, and for this solution, the temperature coefficient at 25 °C is approximately 2 % per °C [4]. The certified value and its uncertainty were determined with the temperature maintained at 25.000°C (the observed variation in temperature was ± 0.003 °C).

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 solution and possible acidic contamination.

REFERENCES

[1] Jameel, R.H.; Wu, Y.C.; Pratt, K.W.; *Primary Standards and Standard Reference Materials for Electrolytic Conductivity*; NIST Special Publication 260-142; U.S. Government Printing Office: Washington, DC (2000).

[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] *Guide to the Expression of Uncertainty in Measurement*; ISBN 92-67-10188-9, lst ed.; ISO; 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/.

[4] Robinson, R.A.; Stokes, R.H.; *Electrolyte Solutions*, 2nd ed., Butterworths: London (1959).

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 http://www.nist.gov/srm.