National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material 3132

Spectrometric Standard Solution

Manganese

Batch Code 490305

This Standard Reference Material (SRM) is intended for use in atomic absorption spectrometry, optical emission (plasma) spectrometry, spectrophotometry, or any other analytical technique that requires aqueous standard solutions for calibrating instruments. SRM 3132 is a single element solution prepared gravimetrically to contain 10 mg/mL of manganese with a nitric acid concentration (V/V) of 10 percent. The certified value (V) is based on the weight of pure metal dissolved and diluted to known volume. The value has been adjusted upward by 0.1% relative, based on estimated transpiration losses of solvent through the container walls of 0.2% relative per year. The density of the solution at 22 °C is 1.064 g/mL.

Metal	Concentration (mg/mL)	Source Purity, %	Acid Conc. (V/V) Approximate
Mn	10.00 ± 0.03	Mn metal (99.98%)*	HNO_3, 10%

*This high-purity material was analyzed by inductively coupled plasma mass spectrometry and found to contain less than 100 μg/g total metallic impurities. Analyses by inert gas fusion for O_2 and N_2 and by vacuum extraction for H_2 were also performed; the material was found to contain 0.216 weight percent total dissolved gases.

The uncertainty in the certified value is calculated as

$$\mathbf{U} = (2\mathbf{u}_c + 0.001\mathbf{V}) \text{ mg/mL}$$

where $\mathbf{u}_c$ is the "combined uncertainty" calculated according to the ISO Guide [1,2]. The value $\mathbf{u}_c$ is intended to represent, at the level of one standard deviation, the combined effect of uncertainty components associated with volumetric and gravimetric factors, as well as the purity of the Mn metal. The additional quantity, 0.001V, is an allowance for transpiration of the solution through the container walls, which is estimated to be ± 0.1% of the certified value during the one-year period of validity of the certification.

The combined uncertainty consists of Type B components due to uncertainty in the balance reading and uncertainty in the material handling and dilution. Each component is derived from its corresponding uniform probability distribution by division by $\sqrt{3}$.

SRM 3132 was prepared by T.A. Butler of the NIST Inorganic Analytical Research Division; atomic absorption and emission spectrometry analyses were made by T.A. Butler and G.C. Turk. Gas analyses were performed at Luvak, Inc., Boyleston, MA.

The technical and support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by J.S. Kane.

Gaithersburg, MD 20899
June 1, 1994

Thomas E. Gills, Chief
Standard Reference Materials Program

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Procedures for Use

Stability: This certification is valid for one year from the shipping date, provided the SRM solution is kept tightly capped and stored under normal laboratory conditions. NIST will monitor the stability of representative solutions from this SRM lot, and if any changes occur that invalidate this certification, NIST will notify purchasers.

Preparation of Working Standard Solutions: All solutions should be brought to 22 ± 1 °C and all glass or plastic surfaces coming into contact with the standard must have been previously cleaned. A working standard solution can be prepared from the SRM solution by serial dilution. Dilutions should be made with certified volumetric class A flasks and 5 or 10 mL class A pipets. All volumetric transfers of solutions should be performed using a proven analytical technique. Each dilution should be acidified with an appropriate high-purity acid and diluted to calibrated volume using high-purity water. The stability of the working standard solution will depend on the final acid concentration; therefore, care should be exercised to ensure that the final acid concentration of the dilution closely approximates that of the SRM. To achieve the highest accuracy, the analyst should prepare daily working solutions from 100 μg/mL dilutions of the original SRM solution.

REFERENCES

[1] *"Guide to the Expression of Uncertainty in Measurement"*, ISBN 92-67-10188-9, 1st Ed. ISO, Switzerland, 1993.

[2] Taylor, B.N. and Kuyatt, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results" NIST Technical Note 1297, National Institute of Standards and Technology, Technology Administration, U.S. Department of Commerce, 1993.