Certificate of Analysis – Certified Reference Material

Certipur® Cadmium standard solution 1000 mg/l Cd

Product no.: 1.19777.0100
Lot no.: HC33253877
Description of CRM: Cadmium standard solution 1000 mg/l Cd
Expiry date: 2027/10/31
Storage: +15°C to +25°C tightly closed in the original container
Composition: $Cd(NO_3)_2$ in HNO_3 0.5 mol/l

Analyte	Certified value as mass fraction	Associated uncertainty, $U=k\cdot u$ ($k=2$) as mass fraction
Cd	**986 mg/kg**	**± 5 mg/kg**

Metrological traceability: Directly traceable to NIST SRM 3108, lot 130116

Measurement method: Inductively coupled plasma optical emission spectrometry ICP-OES

Intended use: This reference material is intended for use as a calibration standard in element analysis.

Instructions for handling and correct use: Shake well before use and never pipet directly from the original container. See Details for correct use on page 2.

Health and safety information: Please refer to the Safety Data Sheet for detailed information about the nature of any hazard and appropriate precautions to be taken.

Accreditation: Merck KGaA, Darmstadt, Germany is accredited by the German accreditation authority DAkkS as registered reference material producer D-RM-15185-01-00 in accordance with ISO 17034.

Certificate issue date: 2023/11/07

ilac-MRA

DAkkS Deutsche Akkreditierungsstelle D-RM-15185-01-00

ISO 17034

CRM released by Approving Officer or delegate of Quality Control

A. Yildirim

Dipl.-Ing. Ayfer Yildirim
Responsible Laboratory Manager

Merck KGaA, 64271 Darmstadt, Germany, Tel. +49(0)6151 72-2440
EMD Millipore Corporation, 400 Summit Drive, Burlington MA 01803, USA, Tel. +1-978-715-4321
MilliporeSigma Canada Ltd., 2149 Winston Park Dr, Oakville, Ontario, L6H 6J8, Canada
Phone: +1 800-565-1400

Details on correct use:

The user should be aware of the additional effect of transpiration losses of solvent through the container walls of the unopened bottle. The effect leads to an increase of the mass fraction in the range of 0.023 mg/kg per month. It is the responsibility of the user to account for this effect by correction of the certified value by

$$w(t) = 0.023 \cdot t + w(t_0)$$

$w(t)$ = element mass fraction after storage time in months

t = storage in months of the unopened bottle

$w(t_0)$ = element mass fraction at the time of certification

Certification process details:

Certipur® AAS single element standards are prepared gravimetrically from high purity raw materials in either high purity acids or high purity bases Suprapur® and diluted with filtered (0.22 µm) high purity water (18 MΩ). All balances are regularly calibrated with analytical weight sets traceable to primary weights by PTB (Physikalisch Technische Bundesanstalt). The density of each batch is measured in g/cm^3 at 20°C and is used to calculate the concentration in mg/l.

Characterisation of Certipur® AAS single element standards is carried out by the accredited quality control (QC) laboratory at Merck KGaA, Darmstadt, Germany according to DIN EN ISO / IEC 17025 by inductively coupled plasma optical emission spectroscopy (ICP – OES).

Homogeneity and stability studies are performed with the material according to the requirements of ISO 17034 and ISO Guide 35.

Associated uncertainty:

The associated uncertainty U_{CRM} reported with the certified values is calculated as combined expanded uncertainty $U_{CRM}=k \cdot u_{CRM}$ in accordance with GUM and EA-4/02, with $k=2$ as the coverage factor for a 95% coverage probability.

The combined uncertainty u_{CRM} is derived from combination of the squared uncertainty contributions:

$$u_{CRM} = \sqrt{u^2_{Characterisation} + u^2_{Homogeneity} + u^2_{Stability}}$$

$u_{characterisation}$:	is the uncertainty in accordance with DIN EN ISO/IEC 17025 which includes the contributions of the primary reference material and the measuring system. The characterisation measurements have been conducted by our DAkkS accredited calibration laboratory (D-K-15185-01).
$u_{homogeneity}$:	is the between-bottle variation in accordance with ISO 17034. The assessment of homogeneity is performed by analysis of a representative number of systematically chosen sample units.
$u_{stability}$:	is the uncertainty obtained from short-term and long-term stability in accordance with ISO 17034. The stability studies are the basis for the quantification of the expiry date of this elemental standard for the unopened bottle.

Informative values:

The density of the elemental standard solution is 1.0132 g/cm^3 at 20°C and is used to calculate the concentration 999 mg/l.

For more detailed information please read the certification report on our website.

Certificate of analysis revision history:

Certificate version	Date	Reason for version
01	2023/11/07	Initial version

The vibrant M, Supelco, Certipur, Suprapur and Sigma-Aldrich are trademarks of Merck KGaA, Darmstadt, Germany or its affiliates.
Detailed information on trademarks is available via publicly accessible resources.
© 2023 Merck KGaA, Darmstadt, Germany and/or its affiliates. All Rights Reserved.

The life science business of Merck KGaA, Darmstadt, Germany operates as MilliporeSigma in the U.S. and Canada.