

National Institute of Advanced Industrial Science and Technology

National Metrology Institute of Japan



Reference Material Certificate

NMIJ CRM 7203-a

No. +++

Tap Water for Heavy Metals
(Elevated Level)

This certified reference material (CRM) is produced in accordance with the NMIJ's management system and is in compliance with ISO 17034 and ISO/IEC 17025. This CRM is intended for use in the calibration of instruments, and for validation of analytical methods and instruments during the quantification of trace elements in tap water, drinking water, and other freshwater samples.

Certified Values

The certified values of this CRM are given in the table below. The uncertainty of the certified value is the expanded uncertainty obtained by multiplying the combined standard uncertainty by a coverage factor (k) of 2, and it is the half-width of an interval estimated to have a level of confidence of approximately 95 %.

Element	Certified value, Mass fraction ($\mu\text{g}/\text{kg}$)	Expanded uncertainty Mass fraction ($\mu\text{g}/\text{kg}$)	Analytical methods
Al	67	3	2), 3), 4), 6)
As	5.3	0.3	2), 3), 6)
B	43	4	1), 2)
Cd	0.345	0.020	1), 2), 3)
Cr	5.03	0.12	1), 2)
Cu	9.2	0.3	1), 2), 4)
Fe	7.7	0.3	1), 2), 4)
Mn	5.0	0.3	2), 3), 4)
Mo	1.02	0.09	1), 2)
Ni	0.70	0.07	1), 2)
Pb	0.77	0.04	1), 2)
Rb	3.65	0.11	1), 2)
Sb	0.146	0.009	1), 2)
Se	5.0	0.2	1), 2)
Sr	107	3	1), 2)
Zn	12.0	0.6	1), 2), 5)

Element	Certified value, Mass fraction (mg/kg)	Expanded uncertainty Mass fraction (mg/kg)	Analytical methods
Ca	18.1	0.6	1), 2), 4), 5)
K	5.35	0.16	1), 2), 4), 5)
Mg	7.9	0.3	1), 2), 4), 5)
Na	33.1	1.1	2), 4), 5)

Analytical Methods

- 1) Isotope dilution (ID) inductively coupled plasma mass spectrometry (ICP-MS).
- 2) ICP-MS.
- 3) High resolution (HR) ICP-MS.

- 4) Inductively coupled plasma optical emission spectrometry (ICP-OES).
- 5) Microwave plasma optical emission spectrometry (MP-OES).
- 6) Graphite furnace atomic absorption spectrometry (GF-AAS).

Analysis

The certified values of this CRM are the weighted means of the results from two or more analytical methods conducted at NMIJ. The quantitative analyses of the elements were made using the aforementioned analytical methods, 1) to 6), and combinations of these based on: (1) a single primary method (ID-ICP-MS) with one or more reference methods or (2) three or more reference methods.

The expanded uncertainty in each certified value is equal to $U = k u_c$, where u_c is the combined standard uncertainty derived from: (a) the analytical results, (b) the method-to-method variance, (c) the concentration of the standard solution, (d) the long-term stability, and (e) the sample homogeneity.

Metrological Traceability

Each certified value was determined by multiple methods with standard solutions guaranteed by JCSS (Japanese Calibration Service System), and is traceable to the International System of Units (SI). All the working standards and sample solutions were prepared by a gravimetric method, using a balance calibrated by JCSS.

Mutual Recognition Arrangement under Metre Convention

The certified values of this CRM are recognized for international equivalence based on the Mutual Recognition Arrangement under the Metre Convention (CIPM MRA). The calibration measurement capabilities (CMC) of NMIJ related to this CRM are registered in the Key Comparison Database (KCDB) (see <https://www.bipm.org/kcdb/>) of the International Bureau of Weights and Measures (BIPM).

Expiration of Certification

This certificate is valid for one year from the date of shipment, provided that this CRM is stored in accordance with the instructions given in this certificate.

Description of the Material

This CRM is in the form of a clear liquid prepared from tap water in a polyethylene bottle. The bottle is sealed in a plastic package. The net amount of water solution in each bottle is *ca.* 100 mL, with 1 % nitric acid and 0.3 % hydrochloric acid.

Instructions for Storage

This CRM should be kept at 5 °C to 25 °C and shielded from light.

Instructions for Use

Care should be taken to prevent any contamination from equipment, vessels, or the working environment because the concentrations of the trace elements are extremely low. To avoid contaminating this CRM, pipet tips should not be dipped into the CRM bottle. This CRM should be opened in a clean space such as a clean booth and used up as soon as possible after opening to prevent contamination.

Precautions for Handling

Wear a mask, gloves, and other protective equipment when handling this CRM. Entrust disposal of this reference material to a professional waste disposal company licensed by local or national authority. Refer to the safety data sheet (SDS) on this CRM before use.

Preparation

Tap water was filtered with cartridge filters (pore size 0.45 µm and 0.20 µm, in turn). Nitric acid (1 %) and hydrochloric acid (0.3 %) were added to ensure the stability of the trace elements and to prevent their adsorption to the bottle. The concentrations

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of As, Cd, Cr, Hg, Mn, and Se in the initial material were extremely low and solutions of these elements were added to achieve the target concentrations (ca. 0.4 µg/kg for Cd and Hg, ca. 5 µg/kg for As, Cr, Mn, and Se).

Technical Information

The concentration of Hg in the CRM was 0.39 µg/kg determined by ICP-MS and ID-ICP-MS, when the certification was complete.

NMIJ Analysts

The technical manager for this CRM is INAGAKI K., the production manager is ZHU Y., and the analysts are ZHU Y., NARUKAWA T., INAGAKI K., MIYASHITA S., KUROIWA T., KUDO I., and KOGUCHI M.

Information

If substantive technical changes occur that affect the certification before the expiration of this certificate, NMIJ will notify the registered customers. Customer registration on the NMIJ Website (given below) will facilitate notification. Technical reports regarding this CRM can be obtained from the contact details given below.

Reproduction of Certificate

In reproducing this certificate, it should be clearly indicated that the document is a copy.

Note

The certified values of the trace elements were additionally verified in a co-analysis program “Trace Elements in Tap Water” performed by the “ACRM (Asian Collaboration on Reference Materials)” that is constructed with NMIJ (Japan), KRISS (Korea), and NIM (China).

April 1, 2020

ISHIMURA Kazuhiko
President

National Institute of Advanced Industrial Science and Technology

If you have any questions about this CRM, please contact:
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