Date of Shipment: Xxxxx xx, 20xx

7202d00-240530-240530

National Institute of Advanced Industrial Science and Technology

National Metrology Institute of Japan



Reference Material Certificate

NMIJ CRM 7202-d No. +++

AIST

Trace Elements in River Water (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 a quality control of analyses, and a validation of analytical methods and instruments used for the quantification of elements in river water and samples with sililar matrices.

Certified Values

The certified values for this CRM are given in the tables 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,	Expanded uncertainty,	Analytical method
	Mass fraction (µg/kg)	Mass fraction (µg/kg)	(see below)
В	46	2	1, 3
AI	23.1	1.1	3, 4, 6
Cr	5.03	0.18	1, 3
Mn	4.97	0.19	3, 4, 6
Fe	27.1	0.6	1, 3
Ni	1.00	0.05	1, 3
Cu	10.1	0.3	1, 3
Zn	10.4	0.4	1, 3
As	1.13	0.07	3, 4, 6
Se	1.16	0.08	2, 3, 4
Rb	0.85	0.03	2, 3
Sr	26.3	0.7	1, 3
Мо	0.117	0.007	1, 2, 3
Cd	1.04	0.04	1, 3
Sb	0.0105	0.0016	1, 2, 3
Ва	4.66	0.15	1, 3
Pb	1.03	0.03	1, 3

Element	Certified value,	Expanded uncertainty,	Analytical method
	Mass fraction (mg/kg)	Mass fraction (mg/kg)	(see below)
Na	3.04	0.08	3, 4, 5
Mg	1.31	0.03	3, 4, 5
К	0.69	0.04	3, 4, 5
Ca	4.15	0.14	3, 4, 5

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Analytical methods:

1) Isotope dilution/inductively coupled plasma mass spectrometry (ID-ICP-MS)

2) Isotope dilution/ ICP-tandem MS (ID-ICP-MS/MS)

3) ICP-MS

4) ICP-MS/MS

5) ICP optical emission spectrometry

6) Graphite furnace atomic absorption spectrometry

Analysis

The certified values of this CRM were calculated as weighted means of the results obtained from two or more aforementioned methods of 1) to 6) conducted by NMIJ. The combinations of the methods are: (1) a single primary method (isotope dilution mass spectrometry) with other reference method or (2) three reference methods.

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

Metrological Traceability

The certified values were determined by isotope dilution mass spectrometry or other reference methods with elemental standard solutions guaranteed by Japan Calibration Service System (JCSS), which are traceable to the International System of Units (SI). Calibration standards and samples were prepared by a gravimetric method, using a balance calibrated by JCSS. Therefore, the certified values are traceable to SI.

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 remains unopened and is stored in accordance with the instructions given in this certificate.

Description of the Material

This CRM was prepared from natural river water and contains 0.3 mol/L nitric acid. This CRM is colorless and clear liquid at an ordinary temperature. The net volume of this CRM in each is about 100 mL kept in a high-density polyethylene bottle.

Instructions for Storage

This CRM should be stored at a temperature about 5 °C and shielded from light.

Instructions for Use

- (1) A unit of the certified values of this CRM is mass fraction (µg/kg, mg/kg). The unit can be converted to mass concentration (µg/L, mg/L) by multiplying a density of this CRM at a temperature when used. The density of this CRM at 20 °C and 25 °C is shown as the technical information in this certificate.
- (2) Prior to use, the bottle should be kept standing at an ordinary temperature until a temperature of the CRM reaches to an equilibrium, then the bottle should be gently shaken. Care should be taken to prevent any contamination from laboratory wares and working environment, because the mass fractions of the trace elements in this CRM are extremely low. Handling of this CRM should be performed in the clean room or the clean bench. This CRM should be used promptly once the bottle is opened.

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Precautions for Handling

This CRM contains 0.3 mol/L nitric acid, and therefore should be handled with care. A mask, gloves, and other personal protective equipment should be used during handling. Since As is added, this CRM is subjected to be a poisonous substance and should be handled in accordance with Poisonous and Deleterious Substances Control Act. Disposal of this CRM should be entrusted to a professional waste disposal company licensed by prefectural governor. Refer to the safety data sheet (SDS) on this CRM before use.

Preparation

This CRM was prepared from natural river water. The natural river water was stand still in cool and dark place for two weeks and then filtered with a membrane filter with a pore size of 0.45 µm. Appropriate amount of nitric acid was added to the natural river water and mixed as the nitric acid concentration became approximately 0.3 mol/L. The mixture was filtered with a membrane filter with a pore size of 0.45 µm. Elemental solutions (B, Al, Cr(III), Mn, Fe, Ni, Cu, Zn, As, Se, Cd and Pb) were added to the filtered mixture and mixed for ten hours. The mixture was finally filtered with a membrane filter with a pore size of 0.2 µm and the filtered mixture was directly bottled in high-density polyethylene bottles of 100 mL volume. The above processes were carried out by Kanto Chemical Co., Inc. (Tokyo, Japan).

Technical Information

The density of this CRM in March 2024 was 1.009 g/cm³ at 20 °C and 1.008 g/cm³ at 25 °C, determined by a resonant frequency oscillator.

NMIJ Analysts

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

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.

May 30, 2024

ISHIMURA Kazuhiko President National Institute of Advanced Industrial Science and Technology

If you have any questions about this CRM, please contact: National Institute of Advanced Industrial Science and Technology, National Metrology Institute of Japan, Center for Quality Management of Metrology, Reference Materials Office, 1-1-1 Umezono, Tsukuba, Ibaraki 305-8563, Japan Phone: +81-29-861-4059, https://unit.aist.go.jp/nmij/english/refmate/