Date of Shipment: Xxxxx xx, 20xx

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National Institute of Advanced Industrial Science and Technology

National Metrology Institute of Japan

Reference Material Certificate

NMIJ CRM 7202-c

No. +++

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 analyses of trace elements in river water, drinking water and other freshwater samples.

Certified Values

The certified values for elements in this CRM are given in the table below. The uncertainty of the certified value is the expanded uncertainty obtained by multiplying the combined standard uncertainties 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 (µg/kg)	Expanded uncertainty, Mass fraction (µg/kg)	Analytical method (see below*)
B	44.0	1.6	1, 2, 4
Al	21.8	0.4	2, 4, 6
Cr	5.16	0.10	1, 2, 4
Mn	5.04	0.13	2, 4, 6
Fe	27.1	0.4	1, 2, 4
Ni	1.06	0.02	1, 2, 4
Cu	10.1	0.2	1, 2, 4
Zn	10.6	0.2	1, 2, 4
As	1.17	0.04	2, 4, 6
Se	1.03	0.05	1, 2, 4,
Rb	0.653	0.010	1, 2, 4
Sr	33.5	0.5	1, 2, 4
Mo	0.183	0.003	1, 2, 3, 4
Cd	1.01	0.02	1, 2, 4
Sb	0.0095	0.0007	1, 2, 3, 4
Ba	5.74	0.07	1, 2, 4
Pb	1.018	0.019	1, 2, 4

Element	Certified value, Mass fraction (mg/kg)	Expanded uncertainty, Mass fraction (mg/kg)	Analytical method (see below*)
Na	3.68	0.08	2, 5, 7
Mg	1.26	0.05	2, 5, 7
K	0.836	0.033	2, 5, 7
Ca	4.59	0.10	2, 5, 7

*Analytical methods:
1) Isotope dilution/inductively coupled plasma mass spectrometry (ID-ICP-MS)
2) ICP-MS
3) High-resolution ICP-MS
4) ICP-tandem MS
5) ICP optical emission spectrometry (ICP-OES)
6) Graphite furnace atomic absorption spectrometry (GFAAS)
7) Microwave plasma atomic emission spectrometry (MP-AES)

Analysis

These certified values of this CRM were calculated as weighted means of results obtained from two or more aforementioned methods of 1) to 6) at NMIJ. Combinations of the methods are: (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 (U) is equal to $U = ku_c$, where u_c is a combined standard uncertainty derived from: (a) analytical results, (b) method-to-method variance, (c) sample homogeneity, and (d) concentration of a standard solution.

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 Unit (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 is in the form of a clear liquid, prepared from natural river water and contains 0.3 mol/L nitric acid. This CRM of ca. 100 mL in net volume is kept in a high-density polyethylene bottle.

Instructions for Storage

This CRM should be kept at a temperature about 5 °C and shielded from light. The bottle must be sealed as tightly as possible for storage after opening. However, the stability of this CRM after opening has not been confirmed.

Instructions for Use

(1) A unit of the certified values is mass fraction (μg/kg, mg/kg). The unit can be converted to volume concentration (μg/L, mg/L) by multiplying a density of this CRM at room temperature when used. The density of this CRM at 25 °C is shown as a technical information in this certificate.

(2) Before opening, a bottle should be kept standing at room temperature until a temperature of the CRM reaches to an equilibrium, then the bottle should be gently shaken with a hand. The CRM is readily used up after opening the bottle. Care should be taken to prevent any contamination from pipettes, vessels, and working environment, because the mass fractions of the trace elements in the CRM are extremely low. Pipet tips should not be dipped into the CRM bottle to avoid contaminating the CRM.

Precautions for Handling

Wear a mask, gloves, and other protective equipment during handling. Entrust disposal of this CRM 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 NMIJ CRM 7201-a River Water (Natural Level). Appropriate amounts of elemental solutions (B, Al, Cr(III), Mn, Fe, Ni, Cu, Zn, As, Se Cd and Pb) and nitric acid (ca. 0.3 mol/L in the material) were added and mixed for one night, then bottled in high density polyethylene bottles of 100 mL volume. The processes of addition of elemental solutions and nitric acids, and bottling was carried out by Kanto Chemical Co., Inc. (Tokyo, Japan).

NMIJ CRM 7201-a was prepared from natural river water. The river water was sampled by using an inert pump and filtered with filter medias (pore size 1 μm and 0.45 μm). After adding nitric acid and mixed for one night, the mixture was bottled in high density polyethylene bottles of 250 mL.

Technical Information

(1) Density

The density of this CRM at 25 °C in Jan. 2019 was 1.0071 g/cm^3, determined by a resonant frequency oscillation method.

(2) Mass fraction of P and U

Mass fractions of P and U in Jan. 2019 were 7.3 μg/kg, and 0.0078 μg/kg, respectively.

The information values were determined with a JCSS standard solution for P and a standard solution (CertiPrep, Spex, XSTC-469, traceable to NIST) for U by using ICP-MS.

NMIJ Analysts

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

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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