

National Institute of Advanced Industrial Science and Technology

National Metrology Institute of Japan



Reference Material Certificate

NMIJ CRM 7204-a

No. +++

Trace Elements in Seawater
(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 the validation of analytical methods and instruments used for the quantification of trace elements in seawater and other water samples with high contents of salts conducted especially for conservation of the aquatic environment.

Certified Values

The certified values of trace elements in this CRM are given in the table below. The uncertainty of each 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 of confidence estimated to have a level of confidence of approximately 95 %.

	Certified value Mass fraction ($\mu\text{g}/\text{kg}$)	Expanded uncertainty Mass fraction ($\mu\text{g}/\text{kg}$)	Analytical Method
Cr	9.4	0.5	1), 5)
Mn	9.3	0.4	1), 2), 3), 4)
Fe	9.7	0.6	1), 5), 6)
Ni	9.8	0.8	1), 5), 6)
Cu	9.6	0.7	1), 6)
Zn	12.6	1.7	1), 6)
As	10.9	0.9	1), 3), 4)
Se	9.7	0.9	1), 5)
Cd	3.1	0.2	1), 5), 6)
Pb	9.4	0.5	1), 5), 6)

Analytical methods

- 1) Inductively coupled plasma mass spectrometry (ICP-MS).
- 2) Solid phase extraction (SPE-) / ICP-MS.
- 3) Coprecipitation / ICP-MS
- 4) Graphite furnace atomic absorption spectrometry (GF-AAS)
- 5) Coprecipitation / Isotope dilution (ID-) ICP-MS.
- 6) SPE/ID-ICP-MS.

Analysis

These certified values of this CRM were the weighted means of the results of two or more quantitative analytical methods conducted by NMIJ. The quantitative analyses of elements were conducted by combining the aforementioned analytical methods of 1) to 6) in two ways: (1) one or more primary methods (ID-ICP-MS) with a single reference method and (2) three or more reference methods. For each analytical method, the calibration standards and samples were gravimetrically prepared by using a balance calibrated in the Japanese Calibration Service System (JCSS). The calibration standards were made from the JCSS standard solutions.

The expanded uncertainty of each certified value, U , is equal to ku_c , where u_c is the combined standard uncertainty derived from: (a) the analytical methods, (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

The certified values of this CRM are metrologically traceable to the International System of Units (SI) via the JCSS.

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 colorless and clear seawater at room temperature, containing 0.1 mol/dm^3 nitric acid. The net amount of seawater in each polyethylene bottle is about 500 cm^3 .

Instructions for Storage

This CRM should be stored at temperature of $5 \text{ }^\circ\text{C}$ to $35 \text{ }^\circ\text{C}$ and protected from light.

Instructions for Use

Care should be taken to prevent any contamination from equipment, vessels, or working environment because the concentrations of the trace elements are extremely low. This CRM should be opened in clean space such as a clean booth and used up as soon as possible once the bottle is opened to prevent contamination. Prior to use, the bottle should be shaken thoroughly to ensure homogeneity.

Precautions for Handling

This CRM contains As, poisonous substance designated in Poisonous and Deleterious Substances Control Act, and therefore should be handled with care. A protective mask, gloves, and other personal protective equipment should be used during handling. Disposal of this reference material 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

Coastal seawater was collected near the shore of Pacific Ocean. The collected seawater of 200 dm^3 was filtered in two stages: 1) a filter with a pore size of $0.45 \text{ }\mu\text{m}$ and then 2) a filter with a pore size of $0.20 \text{ }\mu\text{m}$, and stored in a polypropylene tank. A multielement standard solution was added to elevate the concentrations of trace elements of interest, and concentrated nitric acid was added to raise nitric acid concentration to 0.1 mol/dm^3 .

Technical Information

The concentrations of Na, Mg, K, and Ca in the CRM determined by ICP-MS were ca. $10\,200 \text{ mg/kg}$, 1220 mg/kg , 340 mg/kg , and 380 mg/kg , respectively. The density of this CRM at $15 \text{ }^\circ\text{C}$, $20 \text{ }^\circ\text{C}$, and $25 \text{ }^\circ\text{C}$ were 1.028 g/cm^3 , 1.026 g/cm^3 , and 1.025 g/cm^3 , respectively. The technical information provided in this section represents the values measured when the certified values were determined.

NMIJ Analysts

The technical manager is NONOSE N., the production manager is ZHU Y., and the analysts are ZHU Y., NARUKAWA T., ARIGA T., MIYASHITA S., 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

Some of the candidate reference materials for this CRM were provided to “Trace Elements in Seawater”, a joint analysis program performed by the “ACRM (Asian Collaboration on Reference Materials)” that was established by NMIJ (Japan), KRISS (Korea), and NIM (China).

February 24, 2021

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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