

Certified Reference Material

CERTIFICATE

IAEA-470

MASS FRACTIONS OF TRACE ELEMENTS AND METHYL MERCURY IN OYSTER SAMPLE

Certified mass fraction values

(based on dry mass)

Analyte	Certified Value ^(a) [mg kg ⁻¹]	Expanded uncertainty ^(b) [mg kg ⁻¹]
Ag	1.29	0.10
As	11.9	0.9
Ca	2.43×10^3	0.28×10^3
Cd	3.14	0.24
CH ₃ Hg ^(c)	5.22×10^{-3}	0.87×10^{-3}
Co	0.201	0.025
Cr	0.97	0.11
Cu	146	13
Fe	131	12
Hg	21.1×10^{-3}	2.1×10^{-3}
Mg	3.08×10^3	0.39×10^3
Mn	66.7	5.3
Na	19.7×10^3	2.3×10^3
Pb	0.361	0.053
Rb	5.14	0.59
Se	3.06	0.33
Sr	20.6	1.6
V	0.90	0.13
Zn	727	48

(a) Certified values are calculated from the accepted data sets, each set being obtained by a different laboratory and/or a different method of determination following ISO 33405 [1].

(b) The uncertainty is expressed as an expanded uncertainty with a coverage factor $k = 2$, corresponding to a 95% level of confidence, estimated in accordance with the JCGM 100:2008 [2] and ISO 33405 [1].

(c) As (Hg)

Information mass fraction values

(based on dry mass)

Analyte	Information Value ^(a) [mg kg ⁻¹]	Expanded uncertainty ^(b) [mg kg ⁻¹]
Ni	0.85	0.29

(a) Information values are calculated from the reported data sets, each set being obtained by a different laboratory and/or a different method of determination following ISO 33405 [1].

(b) The uncertainty is expressed as an expanded uncertainty with a coverage factor $k = 2$, corresponding to a 95% level of confidence estimated in accordance with the JCGM 100:2008 [2] and ISO 33405 [1].

Origin and preparation of the material

A sample of ten kg of dried oysters was delivered by the Korean Ocean Research and Development Institute (KORDI). The homogenization of the material was performed by dividing the total mass of oyster material to 12 lots, each of them with the weight of 0.9 kg. The material of each lot was transferred into clean plastic bottles and mixed using a shaker (Turbula, Switzerland) for 24 hours at 20°C and humidity of 50%. Aliquots of about 12 g were packed into pre-cleaned polyethylene bottles with secured screw caps immediately after stopping the mixing operation. The process was repeated 12 times and bottles were labelled with lot and bottle numbers.

Homogeneity of the material

For the between and within-unit homogeneity, 12 units were selected from the whole batch using random stratified sampling and 3 subsamples from each unit were analysed for (Ag, As, Cd, CH₃Hg, Co Cr, Cu, Fe, Hg, Mn, Ni, Pb, Sr, and Zn) mass fraction. The measurements were performed under repeatability conditions and in a randomized way in order to separate a potential analytical drift from a trend in the filling sequence and minimize variations.

The results were evaluated to determine the contribution of the heterogeneity between and within bottles to the final uncertainty budget and the minimum sample amount.

Characterization study

The assigned values were established based on results obtained by IAEA Marine Environmental Studies Laboratory (MESL) and by 15 invited laboratories, with demonstrated measurements capabilities in former IAEA interlaboratory comparisons and/or characterization campaigns.

Before use for calculation of assigned values the reported measurement results were evaluated based on technical validity.

Stability

The short-term stability of the material was evaluated in line with ISO 33405 for (As, Cr, Cu, Hg, Mn and Zn) mass fraction. Results demonstrate that the material is stable under expected transport conditions, and no contribution of short-term stability was added the uncertainty budget of the assigned values.

The long-term stability was evaluated for (Ag, As, Cd, CH₃Hg, Co, Cu, Hg, Mn, Ni, Pb, Sr, Zn) mass fraction using the isochronous approach over 9 months (24 months for MeHg) storage time at conditions described in the handling and storage section, using storage at $(-20 \pm 5)^{\circ}\text{C}$ as reference condition. Results demonstrate stability of all studied analytes. An estimate of uncertainty due to long-term instability over the validity period of this certificate (as indicated below) was estimated in line with ISO 33405 [1].

Long-term stability monitoring showed no significant changes to the assigned values of this material during 12 years of storage.

Assignment of values

Assigned values were calculated as the mean of the accepted data sets, each being obtained by a different laboratory and/or a different method of determination, following ISO 33405 [1].

The IAEA Reference Materials Certification Committee accepted these assigned values as certified, or information values as presented in this certificate.

The criteria for certification and details on value assignment can be found in the certification report [3]. The report may be downloaded from:

<https://analytical-reference-materials.iaea.org/trace-elements>

Statement on metrological traceability, commutability and uncertainty of assigned values

The property values assigned to the IAEA-470 Certified Reference Material were calculated as mass fractions of specified analytes, expressed in the derived SI unit mg kg^{-1} .

Evidence of metrological traceability to the SI units was provided for all results considered for the calculation of the assigned values. The related references of metrological traceability are presented in the certification report of IAEA-470 [3].

The uncertainty associated with the assigned value(s) is expressed as an expanded uncertainty using a coverage factor $k = 2$ estimated in accordance with JCGM 100:2008 [2] and ISO 33405 [1].

The agreement between results obtained with different analytical methods selected for the IAEA-470 characterization study confirms the absence of any significant method bias and demonstrates commutability of the material for all certified trace elements. More information on commutability of certified values may be found in reference [3].

Intended use

This certified reference material is intended to be used for quality assurance and quality control purposes and is suitable for method development and validation of analytical procedures. IAEA-470 is not to be used for calibration.

Instructions for use

The IAEA-470 certified reference material is supplied in 12 g units. The material homogeneity is guaranteed if a minimum test portion of 0.2 g is used for Ag, As, Cd, CH_3Hg , Co, Cr, Cu, Fe, Hg, Mg, Mn, Na, Pb, Rb, Se, V and Zn and 0.05g for total Hg.

To overcome segregation effects due to storage or transportation, the material should be mixed before opening the bottle. All necessary precautions should be taken when opening the bottle to prevent any spread of the fine powder in the laboratory.

The IAEA does not guarantee the stability of the material for repeated sampling from the same Certified Reference Material unit, nor the stability of the material after opening and transfer to new containers.

Dry mass determination

All certified and information values are expressed on a dry mass basis. Therefore, the analytical results need to be corrected for the moisture content of the sample at the time of

analysis. It is recommended to dry a separate sample portion of at least 1 gram at 85°C until constant weight (typically 24 hours).

Handling and storage

The original unopened container should be stored securely at ambient temperature in a dark and dry place. It is recommended to avoid direct exposure to sunlight or to a source of heat. The material should be handled by experienced persons and is for laboratory purposes only. Any remaining material in the opened polypropylene container should be stored in the same conditions, however the stability of the material cannot be guaranteed after initial use.

Issue and expiry date

The issue date of this Certified Reference Material is **May 2017**. The revision number (if any) and issue date of this certificate are provided in the footer of this document. Based on experience with similar materials, the validity of this certificate expires in **July 2031**. The IAEA is monitoring the long-term stability of the material and customers will be informed in case of any observed change.

Legal disclaimer

The IAEA shall under no circumstances be liable for any loss, damage, liability or expense incurred or suffered that is claimed to have resulted from the use of information contained in this Reference Material Certificate.

Citation of this certificate

It is suggested to cite this certificate according to the following example, as appropriate to the citation format used: INTERNATIONAL ATOMIC ENERGY AGENCY, Certificate, Certified Reference Material IAEA-470, IAEA, Vienna. (The latest version published applies, see “Note” below).

Note

Assigned values as stated in this certificate may be updated if more information becomes available. Users of this material should ensure that the certificate in their possession is current. The current version is available on the IAEA’s Reference Products website:

<https://analytical-reference-materials.iaea.org/trace-elements>

Further information

For further information regarding this material, please contact the producer:

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References

- [1] INTERNATIONAL ORGANIZATION FOR STANDARDIZATION, Reference materials — Approaches for characterization and assessment of homogeneity and stability, ISO 33405:2024, ISO, Geneva (2024).

- [2] JOINT COMMITTEE FOR GUIDES IN METROLOGY (JCGM), Evaluation of Measurement data - Guide to the Expression of Uncertainty in Measurement, JCGM 100:2008 (GUM 1995 with minor corrections), (2008).
- [3] INTERNATIONAL ATOMIC ENERGY AGENCY, Certification of Trace Elements and Methyl Mercury Mass fractions in IAEA 470 Oyster Sample, IAEA Analytical Quality in Nuclear Applications Series No. 47 (IAEA/AQ/47), IAEA, Vienna (2016).

Revision information

- Original reference sheet issue date: 2017-05-20
- Rev.00.01 (2020-04-28): update of web link to the online catalogue in section 'Note'
- Rev.01 (2021-06-15): change of expiry date confirmed by long term stability test
- Rev.02 (2026-06-07): change of expiry date confirmed by long term stability test

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The project officer is responsible for the content of this certificate.

The Chair of the RM Certification Committee approves this certificate and authorizes its release on behalf of the Committee.