

Certificate of the Reference Material

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Name of the Material : Elements in Waste Water

Material Code : UME CRM 1204

Issue Date : 15.08.2016

Revision Date : 19.01.2026 (Revision history can be found on the last page)

Validity Period of the Certificate : 5 year from the sales date

Certified Values :

| Element | Certified Value $\mu\text{g/kg}$ ^[4] | Uncertainty $\mu\text{g/kg}$ ^[4,5] | Element | Certified Value $\mu\text{g/kg}$ ^[4] | Uncertainty $\mu\text{g/kg}$ ^[4,5] |
|-------------------|--|--|-------------------|--|--|
| As ^[1] | 63.2 | 3.1 | Fe ^[2] | 1943 | 68 |
| B ^[3] | 1390 | 130 | Hg ^[2] | 49.9 | 2.6 |
| Cd ^[2] | 105 | 4 | Mn ^[1] | 372 | 14 |
| Co ^[1] | 419 | 12 | Ni ^[1] | 173 | 6 |
| Cr ^[2] | 243 | 8 | V ^[1] | 197 | 6 |
| Cu ^[2] | 334 | 10 | Zn ^[3] | 403 | 19 |

- [1] Certified value has been assigned based on the results produced by using independent HR-ICP-MS and GF-AAS methods applied by a single laboratory.
- [2] Certified value has been assigned by using ID-ICP-MS method.
- [3] Certified value has been assigned based on the results produced by using independent HR-ICP-MS and ID-ICP-MS methods applied by a single laboratory.
- [4] The certified values and the uncertainties are traceable to the International System of Units (SI).
- [5] The expanded uncertainty of certified value includes characterization, homogeneity, stability components and is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$, which for a normal distribution corresponds to a coverage probability of approximately 95 %. The standard uncertainty of measurement has been determined in accordance with GUM "Guide to the Expression of Uncertainty in Measurement".

TÜBİTAK UME has been accredited by TÜRKAK as a reference material producer under the accreditation number AB-0001-RM in accordance with the TS EN ISO 17034:2018 standard.

Turkish Accreditation Agency (TÜRKAK) is a signatory to the European Cooperation for Accreditation (EA) Multilateral Agreement (MLA) and the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement (MRA) for the recognition of reference material certificates.

Sales Date



Assoc. Prof. Mustafa ÇETİNTAŞ
Director

The following pages are an integral part of the certificate. The use of current certificate is customers' responsibility.

Most recent certificate can be downloaded from www.ume.tubitak.gov.tr.

Informative Values

| Element | Value and Uncertainty, µg/kg ^[3] |
|-------------------|---|
| Al ^[1] | 349 |
| Mo ^[2] | 95 |
| P ^[2] | 698 |
| Tl ^[2] | 157 |

[1] Value has been assigned by using HR-ICP-MS and GF-AAS methods via three independent measurements from three units.

[2] Value has been assigned by using HR-ICP-MS method via three independent measurements from three units.

[3] The expanded uncertainty of the informative value has contribution from characterisation, homogeneity, stability and is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$, which for a normal distribution corresponds to a coverage probability of approximately 95 %. The standard uncertainty of measurement has been determined in accordance with GUM "Guide to the Expression of Uncertainty in Measurement".

| Parameter | Value ^[1] |
|-----------------|--------------------------|
| Density (20 °C) | 1.0006 g/cm ³ |
| pH (20 °C) | 1.8 |

[1] Values have been calculated based on the results of three independent measurements from three units applied by a single laboratory.

Description

The material is in HDPE bottle containing about 100 mL waste water acidified with HNO₃. Additional information about the material and certification is presented in the certification report.

Intended Use

This material is intended to be used for method validation of the determination of element mass fractions in waste water and quality control purposes.

Instructions for Use

The bottle must be shaken for a minute before opening for assurance of homogeneity. All precautions must be taken in order to prevent contamination and evaporation.

Minimum sample intake is 0.5 mL for Al, As, Cu, Hg, Ni, P and Zn, and is 0.1 mL for B, Cd, Co, Cr, Fe, Mn, Mo, Tl and V. The material can be safely dispatched at ambient temperature where the temperature does not exceed 60 °C and the transportation period of 4 weeks.

Storage Conditions

The material should be stored at (4 ± 2) °C in dark conditions.

TÜBİTAK UME cannot be held responsible for changes that might happen to the material at customer's premises due to noncompliance to the instructions for use, and the storage conditions given in the certificate.

Safety Information

Usual laboratory precautions apply. It is strongly recommended that the material must be handled and disposed according to the safety guidelines where applicable. Please refer to the Safety Data Sheet before any use of the material.

Participants

Information about the laboratory participated in the characterisation study is given in the following table.

| Laboratory | Address |
|-------------|--|
| TÜBİTAK UME | TÜBİTAK Gebze Yerleşkesi, Barış Mahallesi, Dr. Zeki Acar Caddesi No.1, 41470 Gebze - Kocaeli / Turkey |

Methods and/or Techniques Used for the Determination of the Certified Values

Methods and/or techniques used in the characterisation studies are given in the following table.

| Method/Technique | Elements |
|---|---------------------------|
| Graphite Furnace Atomic Absorption Spectrometry (GF-AAS) | As, Co, Mn, Ni, V |
| High Resolution Inductively Coupled Plasma Mass Spectrometry (HR-ICP-MS) | As, B, Co, Mn, Ni, V, Zn |
| Isotope Dilution Inductively Coupled Plasma Mass Spectrometry (ID-ICP-MS) | B, Cd, Cr, Cu, Fe, Hg, Zn |

Revision History

| Date | Remarks |
|------------|--|
| 15.08.2016 | First issue. |
| 13.09.2018 | Certificate is updated due to format change of the document. |
| 18.09.2019 | Information about shipping conditions is added. Certificate is updated due to changes in the format of certificate for reference materials. |
| 19.01.2026 | The informative values for lead and antimony are removed from the certificate due to instability observed in post-certification monitoring measurements. The certified values and uncertainties for boron and cadmium elements, and the uncertainty values for As, Cu, Fe, Mn, Ni, and Zn elements are updated. The informative value for phosphorus is updated. Certificate is updated due to corporate identity (logo) change of TÜBİTAK UME. |