



TÜBİTAK ULUSAL METROLOJİ ENSTİTÜSÜ

TÜBİTAK
UME

Certificate of the Reference Material



Page 1 / 4

Name of the Material : Elements in Soil

Material Code : UME EnvCRM 03

Issue Date : 22.03.2019

Revision Date : 29.12.2025 (Revision history can be found on the last page)

Validity Period of the Certificate : 12 months from the sales date

Certified Values :

Element	Mass Fraction (mg/kg)		Element	Mass Fraction (mg/kg)	
	Certified Value ^[1]	Uncertainty ^[1,2]		Certified Value ^[1]	Uncertainty ^[1,2]
As ^[3]	79.9	5.9	Mn ^[5]	674	70
Cd ^[4]	1.29	0.08	Ni ^[5]	51.7	7.1
Co ^[5]	42.0	4.5	Pb ^[7]	64.1	2.1
Cr ^[6]	115.6	16.9	Sb ^[3]	1.81	0.19
Cu ^[5]	63.5	8.2	V ^[5]	76.2	10.1
Fe ^[6]	26748	1761	Zn ^[5]	150.6	26.7
Hg ^[6]	0.315	0.047			

[1] The certified values and the uncertainties are traceable to the International System of Units (SI). Certified value is corrected for dry mass. Moisture content is determined at $(103 \pm 2)^\circ\text{C}$ until constant weight.

[2] The expanded uncertainty of the 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".

[3] Calculated from the arithmetic mean of the dataset obtained by single reference k_0 -INAA method.

[4] Calculated from the arithmetic mean of the two reference ID ICP-MS method.

[5] Calculated from the median of the accepted results submitted by laboratories using different methods.

[6] Calculated from the arithmetic mean of the reference ID ICP-MS and k_0 -INAA methods.

[7] Calculated from the arithmetic mean of the reference ID TIMS and ID ICP-MS methods.

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

Parameter ^[1]	Mass Fraction ^[2] (g/100g)	
	Assigned Value	Standard Deviation
Moisture Content	4.15	0.18

[1] Moisture content is determined at $(103 \pm 2)^\circ\text{C}$ until constant weight.

[2] Calculated from means of 4 laboratory results.

Extractable Element Content According to ISO 11466 and/or ISO 12914 Methods

Element	Mass Fraction (mg/kg)		Element	Mass Fraction (mg/kg)	
	Assigned Value ^[1]	Standard Deviation		Assigned Value ^[1]	Standard Deviation
As ^[2]	70.3	2.1	Mn ^[6]	520	7
Cd ^[3]	1.29	0.10	Ni ^[4]	48.9	8.8
Co ^[4]	41.7	3.2	Pb ^[5]	63.1	11.6
Cr ^[4]	56.4	17.6	Sb ^[8]	1.38	0.28
Cu ^[5]	67.3	7.9	V ^[2]	69.5	2.3
Fe ^[6]	19189	227	Zn ^[5]	128.5	11.7
Hg ^[7]	0.310	0.009			

[1] Assigned value is corrected for dry mass. Moisture content is determined at $(103 \pm 2)^\circ\text{C}$ until constant weight.

[2] Calculated from the ICP-MS and ICP-OES means obtained by ISO 12914 method.

[3] Calculated from the ICP-MS and ASV by ISO 12914 method and ICP-MS means by ISO 11466 method.

[4] Calculated from ICP-MS and ICP-OES by ISO 12914 method and ICP-MS means by ISO 11466 method.

[5] Calculated from ICP-MS, ICP-OES, ASV by ISO 12914 method and ICP-MS means by ISO 11466 method.

[6] Calculated from ICP-MS means by ISO 11466 method.

[7] Calculated from ICP-MS means obtained by ISO 12914 method.

[8] Calculated from ISO 12914 method and ICP-MS means by ISO 11466 method.

Additional Elemental Information Determined by Single k_0 -INAA method

Element	Mass Fraction (mg/kg)		Element	Mass Fraction (mg/kg)	
	Assigned Value ^[1]	Uncertainty ^[2]		Assigned Value ^[1]	Uncertainty ^[1,2]
Al ^[3]	58864	4166	Mg ^[3]	39008	2840
Ba	289	20	Na	10130	712
Br	7.89	0.56	Rb	65.9	4.6
Ca	88024	5304	Sr	461	38
Cs	7.14	0.50	Ta	0.807	0.056
Hf	3.97	0.28	Ti ^[3]	3854	340
K	15774	1114	Zr	176	14

[1] Calculated from the mean of the dataset obtained by single reference k_0 -INAA method (long and short irradiation). Results are dry mass corrected. Moisture content is determined at $(103 \pm 2)^\circ\text{C}$ until constant weight.

[2] The expanded uncertainty of assigned value includes characterization component 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".

[3] Results were obtained by k_0 -INAA via short irradiation.

Description

The material is filled in amber glass bottles containing about 25 g of soil each. The bottles and their content were sterilized by γ -irradiation at a minimum dose of 25 kGy. Additional information is presented in the certification report.

Intended Use

This material is intended to be used for method validation of the determination of As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Sb, V and Zn mass fractions in soils and quality control purposes.

Instructions for Use

Before opening and taking a sample, the bottle should be shaken to re-homogenize the content.

Minimum sample intake is 0.2 g for certified elements and 1 g for moisture content determination. After use, the bottle should be immediately and tightly recapped. Moisture content should be determined on separate samples at (102 ± 3) °C until constant weight.

Storage Conditions

The material should be stored at (18 ± 4) °C in dark and clean environment. This material can be safely dispatched under conditions where the temperatures do not exceed 60 °C for up to 4 weeks, i.e. at ambient temperature without applying any cooling elements.

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

Safety Information

The usual laboratory safety measures apply as in the case of similar powders.

It is strongly recommended that the material must be handled and disposed according to the safety guidelines where applicable.

It is recommended to avoid inhalation of powder material and work under appropriate ventilation conditions. Please refer to the Safety datasheet (SDS) before any use of the material.

Participants

Information about the laboratories participated in the characterization study are given in the table below.

Laboratory	Address
BAM	Bundesanstalt für Materialforschung und -prüfung, Berlin, GERMANY
DMDM	Directorate of Measures and Precious Metals, Belgrade, SERBIA
IMBIH	Institute of Metrology of Bosnia and Herzegovina, Sarajevo, BOSNIA and HERZEGOVINA
IJS	Jožef Stefan Institute, Ljubljana, SLOVENIA
NTUA	National Technical University of Athens, Athens, GREECE
TÜBİTAK UME	National Metrology Institute, Gebze - Kocaeli, TURKEY
UW	University of Warsaw, Warsaw, POLAND

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

Techniques used in the characterisation studies:

Method/Technique	Parameter
Atomic Absorption Spectroscopy (AAS)	Fe
Cold Vapor AAS (CV-AAS)	Hg
Inductively Coupled Plasma Mass Spectrometry (ICP-MS)	As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Sb, V, Zn
Isotope Dilution Inductively Coupled Plasma Mass Spectrometry (ID ICP-MS)	Cd, Cr, Fe, Hg, Ni, Pb, Zn
Isotope Dilution Thermal Ionization Mass Spectrometry (ID TIMS)	Cu, Pb
Microwave Plasma Atomic Emission Spectrometry (MP-AES)	Co, Cr, Cu, Fe, Mn, Ni, Pb, V, Zn
k_0 -Instrumental Neutron Activation Analysis (k_0 -INAA)	As, Co, Cr, Fe, Hg, Mn, Sb, V, Zn

Commutability

UME EnvCRM 03 was produced by blending the original processed soil with 8 elements spiked soil (additional information is given in the certification report). The analytical behaviour is assumed to be similar for an anthropogenic contaminated soil. It should be noted that the extractability of the 8 spiked elements (Cd, Co, Cu, Hg, Ni, Pb, Sb, Zn) from this CRM can be different to the extractability from an unspiked soil tested by the user's laboratory due to the possibility that these elements might exist in different chemical forms.

Revision History

Date	Remarks
22.03.2019	First issue.
11.10.2021	Certificate is updated due to changes in the format of certificate for reference materials.
29.12.2025	Certificate is updated due to corporate identity (logo) change of TÜBİTAK UME.