

Bundesanstalt für Materialforschung und -prüfung (BAM)

## Certified Reference Material BAM-U130

Trace elements in wood

### Certified Values

Element	Mass fraction <sup>1) 3)</sup> in mg/kg	Uncertainty <sup>2)</sup> in mg/kg
As	4.0	0.4
Cd	2.52	0.30
Cr	39.3	2.7
Cu	30.0	2.7
Hg	0.66	0.06
Pb	41	5

<sup>1)</sup> Unweighted mean value of the means of accepted sets of data (consisting of 4 single results), each set being obtained by a different laboratory and/or a different method of measurement.

<sup>2)</sup> Estimated expanded uncertainty  $U$  with a coverage factor of  $k = 2$ , corresponding to a level of confidence of approx. 95 %, as defined in the Guide to the expression of uncertainty in measurement, (GUM, ISO/IEC Guide 98-3:2008).

<sup>3)</sup> All results are corrected to the dry mass content of the wood material determined after drying to constant mass at  $(103 \pm 2)$  °C.

This certificate is valid for a period of 24 months beginning with the dispatch of the reference material from BAM.

Date of dispatch:

Sample-No.:

### Additional material information

The moisture content of the bottled wood material at the time of certification was  $(7.10 \pm 0.22)$  %, corresponding to a drying temperature of  $(103 \pm 2)$  °C. The indicated uncertainty represents the standard deviation of the mean of 14 laboratory means. The given value of the moisture content should be regarded as being indicative.

## Sample Description

The certified reference material BAM-U130 is intended for the verification of a correct implementation of standardised analytical methods for waste wood characterisation such as digestion methods according to EN 13657 [1] for the determination of trace elements. Furthermore, it can be used for the validation of modified or new analytical procedures.

BAM-U130 originates from untreated German beech wood which was ground and thoroughly mixed and sieved. The particle fraction between 250 µm and 1000 µm was immersed in aqueous solutions of As, Cr, Cd, Cu, Hg, and Pb salts and thereafter slowly dried over several weeks to constant weight to yield fraction. Treated and untreated fractions were carefully mixed and homogenized.

BAM-U130 is provided in 125 ml amber glass bottles each containing approximately 36 grams. The screw caps with PTFE inserts are sealed with shrinking foil.

Until dispatch to the customer the bottled material is stored at BAM at  $(4 \pm 2)$  °C.

The initial stability study after storage of selected units at different temperatures did not reveal any statistically significant deterioration of the reference material. Starting with the date of sale, the validity of the certificate expires after 24 months. Post-certification measurements will be conducted in order to keep this information up to date.

The tests for homogeneity and stability are described in detail in a technical report (see overleaf).

## Instructions for Use

Before withdrawing a sub-sample, the bottle should be allowed to reach room temperature. Thereafter, the bottle should be closed tightly and stored at  $(4 \pm 2)$  °C. The stability of the reference material is not affected by short periods of handling at ambient temperature during transport and use.

The minimum sample size for one trace element determination is 0.5 g.

Analytical results have to be corrected to the dry mass content of the material. In this context it should be noted that under appropriate storage and handling conditions no significant moisture exchange between the bottled material and the ambient atmosphere may occur. Thus, at least at the beginning of the use of the material the required dry mass correction can be made based on the indicated moisture content at the time of certification (7.10 %). Nevertheless, after repeated use of the material its moisture content should be determined (at least in duplicate) either by Karl Fischer titration method or by heating in an oven at a temperature of  $(103 \pm 2)$  °C using separate sub-samples.

## Storage

The reference material must be stored in its original bottle at  $(4 \pm 2)$  °C.

## Participating Laboratories

AKS Aqua-Kommunal-Service GmbH, Frankfurt (Oder)

Analysen Service GmbH, Privates Institut für Umweltanalytik, Penzlin

ArcelorMittal Eisenhüttenstadt, Forschungs- und Qualitätszentrum GmbH,  
Eisenhüttenstadt

AWV- Dr. Busse GmbH, Plauen

Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin

BVU Bioverfahrenstechnik und Umweltanalytik GmbH, Markt Rettenbach

GBA Gesellschaft für Bioanalytik mbH, Pinneberg

GLU mbH, Gesellschaft für Lebensmittel und Umweltconsulting mbH, Hoppegarten

ICA - Institut für Chem. Analytik GmbH, Leipzig

Institut Dr. Lörcher, Ludwigsburg

nano GmbH, Weitnau

SGS Analytics Germany GmbH, Augsburg

SGS Institut Fresenius GmbH, Berlin

WESSLING GmbH Umweltanalytik Oppin, Landsberg OT Oppin

## Metrological Traceability

To ensure traceability of the certified mass fractions to the SI (Système International d'Unités) calibration was performed using standard solutions prepared from pure metals or stoichiometric compounds or with traceable commercial calibration solutions.

## Means of Accepted Data Sets

Line No.	Certified values Mass fraction in mg/kg						Value for information (in %)
	As	Cd	Cr	Cu	Hg	Pb	Moisture
1	3.252	2.105	---	25.58	0.567	33.46	5.50
2	3.634	2.344	35.13	25.82	0.594	35.67	5.94
3	3.707	2.345	37.37	27.02	0.604	35.74	6.00
4	3.721	2.350	37.63	27.05	0.617	36.46	6.29
5	3.840	2.360	37.94	27.50	0.620	37.55	6.87
6	3.866	2.395	38.00	28.22	0.630	37.69	7.08
7	3.897	2.407	38.29	28.42	0.631	38.08	7.21
8	3.952	2.445	38.50	29.98	0.634	38.38	7.29
9	3.982	2.446	39.39	30.16	0.635	40.07	7.32
10	3.993	2.479	39.58	30.52	0.674	41.46	7.38
11	4.000	2.515	39.90	31.06	0.683	42.17	7.40
12	4.025	2.527	40.13	31.09	0.683	42.49	7.66
13	4.079	2.601	40.15	31.91	0.708	42.86	8.12
14	4.398	2.611	40.34	32.17	0.720	43.69	8.17
15	4.448	2.765	40.60	32.95	0.722	44.90	8.29
16	4.469	2.800	41.10	33.08	0.736	45.32	
17	4.596	2.875	41.61	33.62	0.741	45.99	
18	4.932	2.926	41.77	33.80	0.742	47.39	
<i>M</i>	4.044	2.516	39.26	30.00	0.663	40.52	7.10
<i>s<sub>M</sub></i>	0.398	0.214	1.74	2.70	0.056	4.08	0.85

The laboratory mean values have been examined statistically to eliminate outlying values. Where a " --- " appears in the table it indicates that an outlying value has been omitted. A data set consists of 4 single values of one laboratory.

*M* : mean of laboratory means

*s<sub>M</sub>* : standard deviation of laboratory means

## Technical Report

A detailed technical report describing the analysis procedures and the treatment of the analytical data used to certify BAM-U130 is available on request or can be downloaded from BAM website ([www.bam.de](http://www.bam.de)).

## Reference

[1] EN 13657 (2002): Characterization of waste - Digestion for subsequent determination of aqua regia soluble portion of elements

**Accepted as BAM-CRM on**

**Bundesanstalt für Materialforschung und -prüfung (BAM)**



Dr. S. Richter  
Committee for Certification

Dr. S. Recknagel  
Project Coordinator

This Reference Material is offered by:

Bundesanstalt für Materialforschung und -prüfung (BAM)  
Richard-Willstätter-Str. 11, 12489 Berlin

Phone: +49 30 8104 2061  
Fax: +49 30 8104 72061

Email: [sales.crm@bam.de](mailto:sales.crm@bam.de)  
Internet: [www.webshop.bam.de](http://www.webshop.bam.de)