

JOINT RESEARCH CENTRE
Institute for Reference Materials and Measurements

CERTIFICATE OF ANALYSIS

ERM[®] - EC591

POLYPROPYLENE		
	Mass Fraction	
	Certified value ² [g/kg]	Uncertainty ³ [g/kg]
Br	2.08	0.07
2,4,4'-TriBDE (BDE-28) ¹	0.0025	0.0004
2,2',4,4'-TetraBDE (BDE-47) ¹	0.245	0.023
2,2',4,4',5-PentaBDE (BDE-99) ¹	0.32	0.04
2,2',4,4',6-PentaBDE (BDE-100) ¹	0.066	0.007
2,2',4,4',5,5'-HexaBDE (BDE-153) ¹	0.044	0.006
2,2',4,4',5,6'-HexaBDE (BDE-154) ¹	0.026	0.004
2,2',3,4,4',5,6'-HeptaBDE (BDE-183) ¹	0.087	0.008
2,2',3,3',4,4',6,6'-OctaBDE + 2,2',3,4,4',5,6,6'-OctaBDE (BDE-197+204) ¹	0.052	0.009
DecaBDE (BDE-209) ¹	0.78	0.09
DecaBB (BB-209) ¹	0.74	0.08

1) Brominated diphenylethers (BDE) or brominated biphenyls (BB) as obtained by quantification by GC-MS. The numbering is according to the system by Ballschmiter *et al.* (J. high resolut. chrom. 15:260-270).

2) Certified values are values that fulfil the highest standards of accuracy. The given values represent the unweighted mean values of the means of accepted sets of data, each set being obtained in a different laboratory and/or with a different method of determination. The certified values and their uncertainties are traceable to the International System of Units (SI).

3) The certified uncertainty is the expanded uncertainty estimated in accordance with the Guide to the Expression of Uncertainty in Measurement (GUM) with a coverage factor $k = 2$, corresponding to a level of confidence of about 95 %.

This certificate is valid for one year after purchase.

Sales date:

The minimum amount of sample to be used is 30 mg for Br and the polybrominated flame retardants and 200 mg for Sb.

Accepted as an ERM[®], Geel, December 2008

Latest revision: April 2016

Signed:



Prof. Dr. Hendrik Emons
European Commission
Joint Research Centre
Institute for Reference Materials and Measurements
Retieseweg 111
B-2440 Geel, Belgium

Indicative Values		
	Mass Fraction	
	Indicative value ² [g/kg]	Uncertainty ³ [g/kg]
Sb ¹	0.713	0.022
<p>1) As obtained by k₀NAA.</p> <p>2) Indicative values are values where either the uncertainty is deemed too large or where too few independent datasets are available to allow certification and are therefore less reliable than certified values. Great caution should be used when using these values. The given value is the unweighted mean value of the means of accepted sets of data, each set being obtained in a different laboratory and/or with a different method of determination. The indicative value and its uncertainty are traceable to the International System of units (SI).</p> <p>3) The indicative uncertainty is the expanded uncertainty estimated in accordance with the Guide to the Expression of Uncertainty in Measurement (GUM) with a coverage factor k = 2, corresponding to a level of confidence of about 95 %.</p>		

Additional Material Information	
	Mass Fraction
	Mass fraction ¹ [mg/kg]
2,2',4-TriBDE (BDE-17) ¹	0.9
2,2',4,5'-TetraBDE (BDE-49) ¹	5.5
2,3',4,4'-TetraBDE (BDE-66) ¹	4.6
2,4,4',5-TetraBDE (BDE-74) ¹	2.4
2,4,4',6-TetraBDE (BDE-75) ¹	0.4
2,2',3,4,4'-PentaBDE (BDE-85) ¹	19.1
2,2',3',4,5-Penta BDE + 2,3',4,4',5-PentaBDE (BDE-97+118) ¹	1.3
2,2',4,5,5'-PeBDE (BDE-101) ¹	2.1
2,3',4,4',6-PentaBDE (BDE-119) ¹	
2,2',3,4,4',5'-HexaBDE (BDE-138) ¹	5.5
2,2',3,4,4',6-HexaBDE (BDE-139) ¹	5.1
2,2',4,4',6,6'-HexaBDE (BDE-155) ¹	1.4
2,2',3,3',4,5,6'-HeptaBDE + 2,3,3',4,4',5,6-HeptaBDE (BDE-173+190) ¹	4.3
2,2',3,4,4',5,5'-HeptaBDE (BDE-180) ¹	5.4
2,2',3,4,4',5,6-HeptaBDE (BDE-181) ¹	0.8
2,2',3,4,4',5,6'-HeptaBDE (BDE-182) ¹	2.3
2,2',3,3',4,4',5,6,6'-NonaBDE (BDE-207) ¹	43.8
2,2',3,3',4,4',5,5',6,6'-NonaBDE (BDE-208) ¹	6.6
<p>1) These values refer to values that were obtained in the course of the study. They are the unweighted mean values of 1-5 sets of results, all obtained using GC-MS. The numbering is according to the system by Ballschmiter <i>et al.</i> (J. high resolut. chrom. 15:260-270). The values are stated without an uncertainty and give merely information about other material properties that may be of interest for the user</p>	

NOTE

European Reference Material ERM[®]-EC591 was produced and certified under the responsibility of the IRMM according to the principles laid down in the technical guidelines of the European Reference Materials[®] co-operation agreement between BAM-IRMM-LGC. Information on these guidelines is available on the internet (<http://www.erm-crm.org>).

DESCRIPTION OF THE SAMPLE

The sample consists of 20 g polypropylene granulate that has been spiked with technical mixtures of Penta-BDE, Octa-BDE, Deca-BDE and Deca-BB as well as Sb_2O_3 . In addition, Ca-stearate, Irgafos 1638, Irganox 1010 have been added.

ANALYTICAL METHOD USED FOR CERTIFICATION

Br: k_0 NAA, INAA, combustion-IC, combustion-ICP-MS

Sb: k_0 NAA

Polybrominated flame retardants: Various extraction techniques followed by quantification by GC-MS. Different ionisation techniques (EI, ECNI) and mass spectrometer types (quadrupole, sectorfield) were used.

PARTICIPANTS

Adixen, Annency (FR)

BAM Bundesanstalt für Materialforschung und -prüfung, Berlin (DE)

DSM Resolve, Geleen (NL)

Eidgenössische Materialforschungs und -prüfungsanstalt (EMPA), Dübendorf (CH)

Energieonderzoek Centrum Nederland (ECN), Petten (NL)

European Commission, Joint Research Centre, Institute for Reference Materials and Measurements (IRMM), Geel (BE)

Fraunhofer-Institut für Verfahrenstechnik und Verpackung, Freising (DE)

Tests under 17025 accreditation DAP-PL-3909

Integrated Service Technology, Taipei (TW)

Tests under 17025 accreditation TAF1396

Intertek Test Hizmetleri A.Ş., Istanbul (TR)

Tests under 17025 accreditation UKAS 2111

Intertek Testing Services Taiwan, Taipei (TW)

Tests under 17025 accreditation TAF 055

National Institute for Standards and Technology, Analytical Chemistry Division, Gaithersburg (US)

Prüfinstitut Chemische Analytik GmbH (PiCA), Berlin (DE)

SGS Hong Kong Ltd, Hong Kong (CN)

Solvias, Basel (CH)

Studiecentrum voor Kernenergie (SCK), Mol (BE)

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TÜV Rheinland Hong Kong, Hong Kong (CN)

TÜV Rheinland Shenzhen, Shenzhen (CN)

TÜV Rheinland Taiwan, Taipei (TW)

Umweltbundesamt, II 2.5 Labor für Wasseranalytik, Berlin (DE)

Umweltbundesamt, Umweltanalytik & Chemikalien, Wien (AT)

VDE Prüf- und Zertifizierungsinstitut, Offenbach (DE)

Vlaamse Instelling voor Technologisch Onderzoek (VITO), Mol (BE)

Wageningen IMARES Institute for Marine Resources & Ecosystem Studies, IJmuiden (NL)

SAFETY INFORMATION

The usual laboratory safety precautions apply.

INSTRUCTIONS FOR USE AND INTENDED USE

The material is intended to be used for method validation and for demonstration of laboratory proficiency.

It is recommended to grind the materials to particle diameters < 0.5 mm if extraction methods are used, although the influence of particle size on extraction efficiency strongly depends on the extraction technique and extraction solvent.

Cryogrinding is recommended, as the polymer tends to become plastic when ground without cooling.

Comparing an analytical result with the certified value

A result is unbiased if the combined uncertainty of measurement and certified value covers the difference between the certified value and the measurement result. (see also ERM Application Note 1; www.erm-crm.org).

Use in quality control charts

The materials can be used for quality control charts. Different CRM-units will give the same result as heterogeneity was included in the uncertainties of the certified values.

Use as a calibrant

It is not recommended to use these matrix materials as calibrants, unless the method in question requires calibration with matrix materials. If used nevertheless, the uncertainty of the certified value shall be taken into account in the final estimation of measurement uncertainty.

STORAGE

The material shall be stored at -20 ± 5 °C in the dark.

However, the European Commission cannot be held responsible for changes that happen during storage of the material at the customer's premises, especially of opened samples.

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NOTE

A detailed technical report is available on www.erm-crm.org. A paper copy can be obtained from IRMM on request.