JOINT RESEARCH CENTRE
Directorate F – Health, Consumers and Reference Materials

CERTIFICATE OF ANALYSIS

ERM®- AE671

METHYLMERCURY IN 2 % ETHANOL/WATER			
		Certified value [1]	Uncertainty [2]
Amount content	mol $(CH_3(^{202}Hg)Cl) \cdot g^{-1}$ (solution)	$15.1 \cdot 10^{-9}$	$0.7 \cdot 10^{-9}$
Amount ratios of Hg isotopes in form of CH_3HgCl	$n(^{196}Hg)/n(^{202}Hg)$	0.000 018	0.000 013
	$n(^{198}Hg)/n(^{202}Hg)$	0.000 62	0.000 05
	$n(^{199}Hg)/n(^{202}Hg)$	0.001 60	0.000 10
	$n(^{200}Hg)/n(^{202}Hg)$	0.005 50	0.000 22
	$n(^{201}Hg)/n(^{202}Hg)$	0.013 4	0.000 6
	$n(^{204}Hg)/n(^{202}Hg)$	0.002 60	0.000 16

1) The amount content values reported in this certificate result from gravimetric dilution and measurements performed at IRMM, and are traceable to the SI via the kg and the values of the isotopic reference material IRMM-639, which are traceable to the SI via the values of the Tl isotope ratios of the isotopic reference material NIST SRM 997. The isotopic ratio values reported in this certificate result from gravimetric dilution and measurements performed at IRMM, and are traceable to the SI via the Hg isotope ratios of the isotopic reference material ERM-AE670, which are traceable to the SI via the values of the Hg isotope ratios of the isotopic reference material ERM-AE640.

2) The certified uncertainty is the expanded uncertainty with a coverage factor k = 2 corresponding to a level of confidence of about 95 % estimated in accordance with ISO/IEC Guide 98-3, Guide to the Expression of Uncertainty in Measurement (GUM:1995), ISO, 2008.

This certificate is valid for one year after purchase.

Sales date:

Minimum sample intake to be used is 10 mg.

Accepted as an ERM®, Geel, November 2016

Signed:

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CERTIFIED VALUES (*CONTINUED*)
The certified values were calculated from the Hg amount content and the amount ratios of Hg isotopes in form of CH_3HgCl using atomic masses according to G. Audi and A.H. Wapstra *(The 1993 atomic mass evaluation*, Nucl Phys A565 (1993) 1-65.)

		Certified value [1]	Uncertainty [2]
Amount content	mol (CH_3HgCl) · g^{-1} (solution)	$15.5 \cdot 10^{-9}$	$0.7 \cdot 10^{-9}$
Mass fractions	g (^{202}Hg as CH_3HgCl) · g^{-1} (solution)	$3.05 \cdot 10^{-6}$	$0.13 \cdot 10^{-6}$
	g (Hg as CH_3HgCl) · g^{-1} (solution)	$3.12 \cdot 10^{-6}$	$0.14 \cdot 10^{-6}$
Isotope amount fractions of Hg in the form of CH_3HgCl ·(100)	n(^{196}Hg)/n(Hg) n(^{198}Hg)/n(Hg) n(^{199}Hg)/n(Hg) n(^{200}Hg)/n(Hg) n(^{201}Hg)/n(Hg) n(^{202}Hg)/n(Hg) n(^{204}Hg)/n(Hg)	0.001 8 0.061 0.156 6 0.537 1.30 97.69 0.254	0.001 3 0.005 0.001 0 0.021 0.06 0.06 0.016
Isotope mass fractions of Hg in the form of CH_3HgCl ·(100)	m(^{196}Hg)/m(Hg) m(^{198}Hg)/m(Hg) m(^{199}Hg)/m(Hg) m(^{200}Hg)/m(Hg) m(^{201}Hg)/m(Hg) m(^{202}Hg)/m(Hg) m(^{204}Hg)/m(Hg)	0.001 7 0.060 0.154 3 0.532 1.30 97.70 0.257	0.001 2 0.005 0.001 0 0.021 0.06 0.06 0.016
Molar mass of Hg in the form of CH_3HgCl	g · mol^{-1}	201.944 7	0.000 8

1) The values reported in this certificate result from gravimetric dilution and measurements performed at IRMM, and are traceable to the SI via the kg and the values of the isotopic reference material ERM-AE639, which are traceable to the SI via the values of the Tl isotope ratios of the isotopic reference material NIST SRM 997.

2) The certified uncertainty is the expanded uncertainty with a coverage factor k = 2 corresponding to a level of confidence of about 95 % estimated in accordance with ISO/IEC Guide 98-3, Guide to the Expression of Uncertainty in Measurement (GUM:1995), ISO, 2008.

NOTE

European Reference Material ERM®-AE671 was produced and certified under the responsibility of the Institute for Reference Materials and Measurements of the European Commission's Joint Research Centre 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 MATERIAL

ERM-AE671 consists of pure, ^{202}Hg enriched methylmercury in 2 % ethanol/water solution. It is supplied in flame-sealed quartz ampoules, containing 5 g solution.

ANALYTICAL METHODS USED FOR CERTIFICATION

The CH_3Hg amount content of ERM-AE671 was established by multiplication of the certified CH_3Hg value of ERM-AE670 with the gravimetric dilution factor.

The correctness of the dilution was verified by measurement if the inorganic Hg content and the total Hg content. The inorganic Hg^{2+} content was measured by ion-exchange-ICP-SFMS. The gravimetric dilution was additionally verified by measurement of the total Hg content in ERM-AE671 by ID-ICP-MCMS with ERM-AE639 used as a spike material.

PARTICIPANTS

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

SAFETY INFORMATION

The usual laboratory safety precautions apply.

INSTRUCTIONS FOR USE AND INTENDED USE

The main purpose of the material is to be used as spike isotopic reference material for determination of CH_3Hg content in an unknown samples by species-specific isotope dilution through a measurement of the mercury isotope amount ratio R(B) = n(^{200}Hg)/n(^{202}Hg) of CH_3Hg, in a blend.

Before use, the material must be allowed to reach ambient temperature. The ampoule should be cleaned with a dust-free wipe wetted with purified water before opening. The material is ready for use after ampoule opening.

The CH_3Hg content in unknown samples should be calculated with the aid of the following equation, which enables an easy quantification of the uncertainty sources in the procedure:

$$c(Hg,X) = \frac{R(Y) - R(B)}{R(B) - R(X)} \cdot \frac{\sum R_i(X)}{\sum R_i(Y)} \cdot \frac{m(Y)}{m(X)} \cdot c(Hg,Y)$$

$R(X)$	=	amount ratio n(^{200}Hg)/n(^{202}Hg) in the unknown sample material X
$R(Y)$	=	amount ratio n(^{200}Hg)/n(^{202}Hg) in the spike material Y
$R(B)$	=	amount ratio n(^{200}Hg)/n(^{202}Hg) in the blend B
$\sum R_i(X)$	=	sum of all amount ratios in the unknown sample material X
$\sum R_i(Y)$	=	sum of all amount ratios in the spike material Y
$m(X)$	=	mass of unknown sample used in the measurement
$m(Y)$	=	mass of the sample spike solution used in the measurement
$c(Hg,X)$	=	amount content of the Hg $\cdot$ g^{-1} sample material
$c(Hg,Y)$	=	amount content of the Hg $\cdot$ g^{-1} spike solution

STORAGE

The materials shall be stored at – 20 °C ± 5 °C in the dark. Care shall be taken to avoid change of the Hg isotopic composition once the units are open, as the material is prone to Hg contamination. The user is reminded to transfer the material into a clean closable and Hg contamination free container immediately after taking a sample or opening the ampoule.

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.

LEGAL NOTICE

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NOTE

A detailed technical report is available on https://crm.irmm.jrc.ec.europa.eu. A paper copy can be obtained from the Joint Research Centre Directorate F – Health, Consumers and Reference Materials on request.

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