European Commission

ERM European Reference Materials

JOINT RESEARCH CENTRE
Institute for Reference Materials and Measurements

CERTIFICATE OF ANALYSIS

ERM®- AE641

Cl in water			
		Certified value (1)	Uncertainty (2)
amount content	mol (^{35}Cl) · g^{-1} (solution)	1.895 9 ·10^{-5}	0.001 5 ·10^{-5}
amount ratio	$n(^{37}Cl)/n(^{35}Cl)$	0.319 77	0.000 83

1) The values reported in this certificate result from measurements performed at IRMM and the Slovak Institute of Metrology and are traceable to the SI via the values of the isotopic reference material NIST-SRM 975.

2) Estimated expanded uncertainty U with a coverage factor k=2, corresponding to a level of confidence of about 95 %, as defined in the Guide to the Expression of Uncertainty in Measurement (GUM), ISO, 1995.

This certificate is valid for three years after purchase.

Sales date:

The material can be regarded as a homogenous solution.

Accepted as CRM, Geel, February 2002

Signed:

Dr. Philip Taylor
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Accepted as an ERM®, Geel, November 2003
Latest revision: November 2013

Signed:

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NOTE

European Reference Material **ERM®-AE641** was originally certified as **IRMM-641**. It 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). A detailed technical report on the certification procedure can be found in IRMM Internal Report GE/R/IM/02/00, available from IRMM on explicit request.

DESCRIPTION OF THE SAMPLE

The spike isotopic reference material ERM®-AE641 is supplied with a certified amount content of ^{35}Cl and a certified isotopic compositon. The samples are supplied in flame-sealed quartz ampoules containing about 100 µmol chlorine in 4 mL of water.

From the certified values, the following amount and mass contents, the isotopic composition of Cl and the molar mass of Cl are derived:

		Certified value	Uncertainty (1)
amount content	mol (Cl) · g^{-1} (solution)	2.502 2 · 10^{-5}	0.001 1 · 10^{-5}
mass content	g ^{35}Cl · g^{-1} (solution)	6.629 8 · 10^{-4}	0.005 1 · 10^{-4}
	g (Cl) · g^{-1} (solution)	8.871 0 · 10^{-4}	0.003 9 · 10^{-4}
isotope amount fractions of Cl (·100)	$n(^{35}Cl)/n(Cl)$ $n(^{37}Cl)/n(Cl)$	75.770 24.230	0.048 0.048
isotope mass fractions of Cl (·100)	$m(^{35}Cl)/m(Cl)$ $m(^{37}Cl)/m(Cl)$	74.736 25.264	0.049 0.049
molar mass of Cl		35.452 73 g·mol^{-1}	0.000 95

[1] Estimated expanded uncertainty U with a coverage factor k=2, corresponding to a level of confidence of about 95 %, as defined in the Guide to the Expression of Uncertainty in Measurement (GUM), ISO, 1995

Atomic masses used for calculation of the derived values:*

* G. Audi and A.H. Wapstra, The 1993 atomic mass evaluation, *Nucl Phys* A565 (1993) 1-65.

Isotope	g · mol^{-1}	U (k=2)
^{35}Cl	34.968 852 71	0.000 000 08
^{37}Cl	36.965 902 60	0.000 000 10

ANALYTICAL METHOD USED FOR CERTIFICATION

ERM®-AE641 was prepared by dissolution of NaCl from NIST-SRM 975 Isotopic Standard for Chlorine, in distilled and subboiled water. The chlorine amount content was certified using high precision argentometric coulometric titration.

PARTICIPANTS

Not applicable

SAFETY INFORMATION

Not applicable

INSTRUCTIONS FOR USE

Using this spike isotopic reference material, the ^{37}Cl content in an unknown sample can be determined by Isotope Dilution, through a measurement of the isotope amount ratio $R(B) = n(^{35}Cl)/n(^{37}Cl)$ in a blend. It should be calculated with the aid of the following equation, which enables an easy quantification of the uncertainty sources in the procedure:

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

where:

$R(X)$	=	amount ratio $n(^{35}Cl)/n(^{37}Cl)$ in the sample material X
$R(Y)$	=	amount ratio $n(^{35}Cl)/n(^{37}Cl)$ in the spike material Y
$\sum R_i(X)$	=	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 spike solution used in the measurement
$c(Cl,X)$	=	amount content of Cl · kg^{-1} sample material
$c(Cl,Y)$	=	amount content of Cl · kg^{-1} spike solution

STORAGE

Room temperature

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