

Certificate

Produced in double accredited laboratory fulfilling
ISO/IEC 17025 and
ISO Guide 34

This certificate is designed in accordance with ISO Guide 31^[1].

Object of certification: **Cyanide standard for IC**
 Product no.: **90157**
 Lot no. **BCBQ9079V**
 Composition: **K₂Zn(CN)₄ (pure material) in high-purity water (18.2 MΩ·cm, 0.22 μm filtered)**
 Intended use: **Calibration of ion chromatography or any other analytical technique.**
 Storing and handling: **This reference material shall be stored between 5°C and 30°C. Before every use of the material the bottle must be shaken well and its temperature has to be 20°C. If storage of a partially used bottle is necessary, the cap should be tightly sealed and the bottle should be stored at reduced temperature (e.g. refrigerator) to minimize transpiration rate.**
 Expiry date: **NOV 2018**
 Certificate issue date: **28 JAN 2016**
 Bottle opening date: -----

The certified values and uncertainties are according to ISO Guide 35^[2] and Eurachem/CITAC Guide^[3]

Constituent	Certified value at 20°C and expanded uncertainty [$U = k u_c; k = 2$]	
Cyanide	1'014 mg kg⁻¹ ± 5 mg kg⁻¹	1'013 mg L⁻¹ ± 6 mg L⁻¹
Traceability ^[4]	NIST SRM 919a, Sodium Chloride	

Measurand	Certified value and expanded uncertainty [$U = k u_c; k = 2$]
Density at 20°C	0.9996 g mL⁻¹ ± 0.0005 g mL⁻¹

CRM operations: <i>S. Matt</i>	  
Certification body: <i>Klaus D. Schmidt</i> K.-D. Schmidt, Ph.D.	
	ISO Guide 34 ISO/IEC 17025 ISO 9001

1. CERTIFICATION

Production and certification of this CRM are performed under double-accreditation in accordance with ISO/IEC 17025 [5] and also ISO Guide 34 [6]. Storage stability, leaching and homogeneity tests are also considered for certification.

1.1 TITRATION MEASUREMENT

The certified value of the content (mg/kg) is determined using argentometric titration. The mean value is based on seven individual measurements. All measurements are traced gravimetrically to an internationally accepted reference material e.g. from NIST (USA) or BAM (Germany).

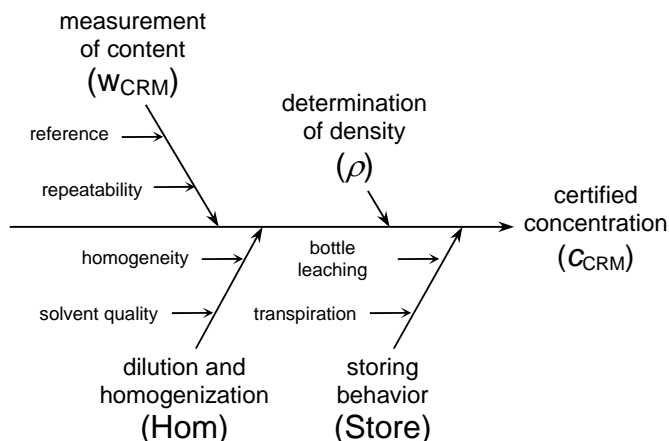
1.2 UNCERTAINTY EVALUATION

All uncertainties are calculated according to Eurachem/CITAC Guide [3] and reported as combined expanded uncertainties at the 95% confidence level. The main uncertainty contributions are illustrated by the following cause-effect diagram.

Typical relative contributions are:

$u(w_{CRM})$	0.1 - 0.3 %
$u(Store)$	< 0.2 %
$u(\rho)$	< 0.05 %
$u(Hom)$	< 0.03 %

The combined uncertainty u_c is calculated by combination of the squared contribution values.



1.3 DENSITY MEASUREMENT

The density measurement is carried out according to ISO 15212-1 [7] and using the digital density meter DMA 4500M from Anton Paar with an oscillating U-tube installed. The measurement uncertainty is calculated according to Eurachem/CITAC Guide and reported as combined expanded uncertainty at the 95% confidence level.

2. TRACE IMPURITIES IN BOTTLED SOLUTION

The following anions were measured as possible impurities (in mg L⁻¹, < X = below detection limit):

Bromide	Chloride	Fluoride	Iodide	Nitrite	Nitrate	Phosphate	Sulfate
< 0.0125	2.5	< 0.0125	< 0.0125	< 0.0125	< 0.0125	< 0.0125	0.031

References

- [1] ISO Guide 31:2000, "Reference materials - Contents of certificates and labels"
- [2] ISO Guide 35:2006, "Reference materials - General and statistical principles for certification"
- [3] Eurachem/CITAC Guide, 3rd Ed. (2012), "Quantifying uncertainty in analytical measurement"
- [4] Eurachem/CITAC Guide, 1st Ed. (2003) "Traceability in chemical measurement"
- [5] ISO/IEC 17025, 2nd Ed. (2005), "General requirements for the competence of testing and calibration laboratories"
- [6] ISO Guide 34:2009, "General requirements for the competence of reference material producers"
- [7] DIN EN ISO 15212-1:1998, Oscillation-type density meters - Part 1: Laboratory instruments