



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

Object of certification: **HYDRANAL™ CRM Water Standard 10.0**
 Product no.: **34425**
 Lot no.: **SZBG1800V**

Composition: This certified reference material (CRM) is a solution of water in a mixture of 1-butanol, xylene and propylene carbonate, which is certified for its water content. One unit consists of ten 10 mL glass ampoules, each containing a volume of approximately 8 mL.

Intended use: We recommend the use of this CRM for titer determination, validation of methods and calibration of instruments for the measurement of water (Karl Fischer titrators).

Storage and handling: This CRM is sealed under argon and should be stored at room-temperature (approx. 20°C ± 5°C). Before use of the material the ampoule must be shaken well and its temperature should be room-temperature. After opening the ampoule samples should be transferred into a dry glass syringe (first rinse the syringe with a small portion of CRM) and used immediately. We do not recommend using partially used ampoules after opening.

Minimum sample weight: There is no recommended minimum sample amount. The CRM is liquid at room-temperature and therefore homogeneous under these conditions. A potential inhomogeneity between different ampoules within one production lot is covered by the expanded measurement uncertainty.

QC release date: Oct. 19, 2016 Expiry date: Jun. 13, 2019

The certified value is determined under **double-accreditation** in accordance with **ISO/IEC 17025** [2] and also **ISO Guide 34** [3]. Extensive homogeneity and stability tests are considered for certification.

Certified value and uncertainty according to ISO Guide 35 [4] and Eurachem/CITAC Guide [5]		
Constituent	Certified water content (mass fraction)	Expanded uncertainty (mass fraction), $U = k \cdot u_c$ ($k = 2$)
Water	10.04 mg/g	0.18 mg/g

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CERTIFICATION REPORT

1. Production

Honeywell Specialty Chemicals Seelze GmbH (Germany) produced this certified reference material **HYDRANAL™ CRM Water Standard 10.0**, product no. 34425, lot no. SZBG1800V as water standard.

A mixture of 1-butanol, xylene and propylene carbonate was spiked with water (Ph Eur quality) and stirred for several hours at room temperature until the whole production batch was homogenous. A total number of 11'600 glass ampoules were filled by dispensing aliquots of approximately 8 mL of batch material into argon filled ampoules and flame sealed.

2. Assignment of property value

The determination of the water content (w_{CRM}) for the whole production batch was performed on twelve systematically chosen ampoules, selected throughout the filling process, applying the volumetric Karl Fischer titration using the two component system Hydranal Titrant 5 (product no. 34801) and Hydranal Solvent (product no. 34800). All measurements were traced gravimetrically to high-purity water (TraceSELECT® Ultra, ACS reagent, for ultratrace analysis; product no. 14211) and carried out on Jul. 05, 2016 in a temperature range of $22^{\circ}\text{C} \pm 4^{\circ}\text{C}$. Calibration with high-purity materials of well-established purity is an accepted concept for the realization of traceability to SI unit^[6]. Additionally the certified value is verified against SRM 2890 (Water Saturated 1-Octanol) from National Institute of Standards & Technology (NIST) which has to be confirmed within its stated uncertainty.

3. Homogeneity study

The assessment of homogeneity for the whole production batch was investigated simultaneously with the assignment of a property value as described in part 2. No trend or statistically significant variation in the water content was detected within the filling process. Results from analysis of variance (ANOVA) are considered for the uncertainty contribution (u_{hom}) due to inhomogeneity of the CRM.

4. Stability study

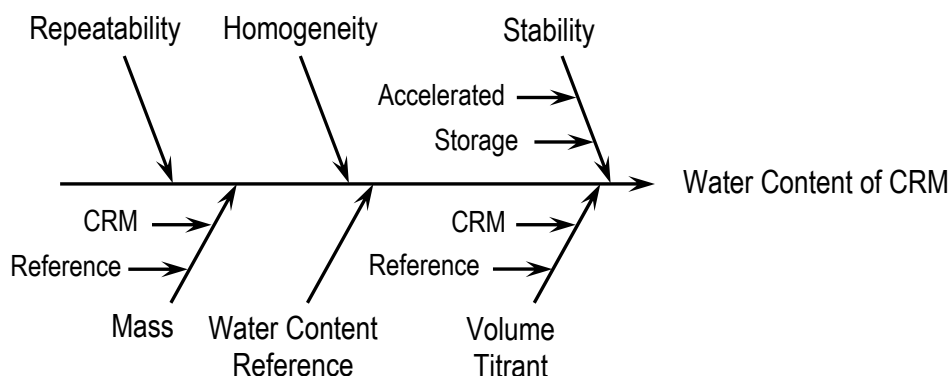
Accelerated stability tests at 50°C are performed after 1, 3 and 9 months. These tests consider worst-case conditions that may appear during transportation and these data are also used for the estimation of shelf-life. Long-term stability tests at the recommended storage temperature are performed covering the entire shelf-life of the CRM. For all stability measurements volumetric Karl Fischer titrations are applied.

5. Uncertainty estimation

All uncertainties are calculated according to Eurachem/CITAC Guide and reported as combined expanded uncertainty. The expanded uncertainty is calculated to a confidence level of 95% by multiplying with a confidence level factor of $k = 2$. The combined uncertainty of the certified reference material (u_{CRM}) is calculated by combination of the squared contribution values for the uncertainties of the water content (u_{char}), homogeneity (u_{hom}) and stability (u_{stab}).

$$u_{CRM} = \sqrt{u_{char}^2 + u_{hom}^2 + u_{stab}^2}$$

The uncertainty contributions are illustrated by the following cause-effect diagram.



References

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