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Ref. No.: CML-HRM-1007A/08
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Certificate of Analysis

CERTIFIED REFERENCE MATERIAL
HRM – 1007A

L-Proline

Batch Number
STY-0039-001

Description
A unit of the certified reference material (CRM) consists of 1 g of L-proline in a screw-capped amber vial. Quantitative nuclear magnetic resonance (qNMR) approach was adopted to determine the mass fraction (mg/g) of the reference material using a benzoic acid CRM (HRM-1002A) from the Health Sciences Authority (HSA) Singapore as internal standard.

The reference material was produced with reference to the requirements set out in ISO/IEC 17025:2017 [1], ISO 17034:2016 [2] and ISO 33405:2024 [3].

Certified Mass Fraction Value
A certified value is a value for which a laboratory has the highest confidence in its accuracy. The certified mass fraction value given below is based on the results obtained by the qNMR approach:

Certified Mass Fraction Value: 986.5 ± 7.1 mg/g

The final result is expressed as the certified value ± the expanded uncertainty.

The uncertainty listed with the certified value is an expanded uncertainty about the mean, with coverage factor 2 (approximately 95 % confidence). The certified value has an associated measurement uncertainty attributed to uncertainty contribution from the characterisation of the material (u_{char}), uncertainty in the homogeneity of the material (u_{bb}) and uncertainty in the stability of the material (u_{stab}). The u_{char} was evaluated by combining uncertainties from method precision, purity of the internal standard, molecular weight of L-proline, molecular weight of internal standard and weighing, in accordance with ISO/IEC Guide 98-3:2008 [4].

Homogeneity

Homogeneity testing on L-proline was performed on two sub-samples taken from eight bottles (a total of 16 samples) using qNMR. The sample size taken for homogeneity testing was approximately 50 mg. No significant differences in the between and within-bottle variances were found using one-way ANOVA at 95 % confidence level [3]. Thus, the material was regarded to be sufficiently homogeneous. The u_{bb} was evaluated from the uncertainty due to between-bottle inhomogeneity.

Stability

The short term stability of L-proline was studied. The material was stored at 50 ºC (maximum allowable transportation temperature) for up to 14 days. This was carried out as "isochronous measurements", i.e. all samples of the stability study were analysed under repeatability conditions. The results showed that L-proline was stable over the study period.

The long term stability of L-proline at storage temperature (2 - 8 ºC) was evaluated on six occasions over a period of up to about 10 years after preparation. The results showed that L-proline was stable over the study period. The u_{stab} was evaluated from the standard error of the slope.

Validity of Certified Mass Fraction Value

The certified mass fraction value is valid within the specified measurement uncertainty until **28 Sep 2027**, provided that the reference material is subjected to the same handling and storage conditions as stated in this *Certificate of Analysis* (COA). The validity of the certified mass fraction value has been confirmed using a 500 MHz NMR (Bruker Avance Ascend 500) at the Chemical Metrology Laboratory, HSA.

The CRM will be continuously monitored during the validity period to determine if any substantive change to the certified value has occurred. If necessary, its user will be advised if the property value of the CRM is found to have changed or an updated COA may be issued.

Analytical Methods

The determination of the purity of the L-proline CRM was previously carried out using a 500 MHz Bruker Ultra Shield NMR at the Department of Chemistry, National University of Singapore. Benzoic acid CRM (HRM-1002A) from HSA was used as the internal standard for the determination. The certified mass fraction was calculated from the mean of 16 results obtained from one determination each on the 16 sub-samples prepared from the CRM and the internal standard.

Metrological Traceability

The certified mass fraction is traceable to the International System of Units (SI) through the use of benzoic acid CRM (HRM-1002A) from HSA.

Intended Use

The CRM is intended for use as a calibrant or quality control (QC).

Instructions for Use

Prior to use, the bottle should be equilibrated to room temperature and rotated gently before sampling. After use, the bottle must be tightly re-capped and protected from moisture and light. The minimum sample size for each use should be 50 mg. If results differ from certified value in subsequent sampling, customers are advised to purchase a new CRM.

Storage

The CRM should be properly sealed and stored at a temperature of 2 ºC to 8 ºC in its original bottle. Exposure to moisture and light should be avoided.

Safety Precautions for Users

Treat the material as hazardous substance. Use appropriate work practices when handling to avoid skin or eye contact, ingestion or inhalation of dust.

Further Information

Please direct all enquiries regarding this CRM to the contact above.

References

[1] ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories.

[2] ISO 17034:2016 General requirements for the competence of reference material producers.

[3] ISO 33405:2024 Reference materials – Approaches for characterisation and assessment for homogeneity and stability.

[4] ISO/IEC Guide 98-3:2008 Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995).

Certificate Revision Record

Certificate Ref. No.	Date of issue	Reason for issuance
CML-HRM-1007A/01	28 Sep 2016	Issuance of first certificate
CML-HRM-1007A/02	24 Aug 2017	Extension of expiry date
CML-HRM-1007A/03	16 Jul 2018	Extension of expiry date
CML-HRM-1007A/04	15 Aug 2019	Extension of expiry date
CML-HRM-1007A/05	04 Aug 2020	Extension of expiry date
CML-HRM-1007A/06	30 Jul 2021	Extension of expiry date
CML-HRM-1007A/07	24 Aug 2022	Extension of expiry date
CML-HRM-1007A/08	17 Sep 2025	Update on measurement uncertainty

Note

HSA does not assume any liability with respect to any loss caused by improper use and/or storage of the reference material by the customer.

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