



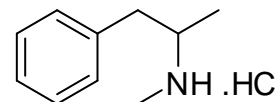
CERTIFIED REFERENCE MATERIAL CERTIFICATE OF ANALYSIS

NMIA D816h: (\pm)-Methamphetamine hydrochloride

Report ID: D816h.2024.01 (Bottled 230720)

Chemical Formula: C₁₀H₁₅N.HCl

Molecular Weight: 185.7 g/mol (HCl), 149.2 g/mol (base)



Certified value

Batch No.	CAS No.	Purity (mass fraction)
19-D-01	300-42-5 (HCl) 537-46-2 (base)	99.8 ± 0.3%

The uncertainty has been calculated according to ISO Guide 35 and is stated at the 95% confidence limit ($k = 2$).

IUPAC name: *N*-Methyl-1-phenyl-2-propanamine hydrochloride (1:1).

Expiration of certification: The property values are valid till 22 April 2029, five years from the date of recertification provided the **unopened** material is handled and stored in accordance with the recommendations below. The material as issued in the unopened container and stored as recommended below should be suitable for use beyond this date, subject to confirmation of batch stability from the issuing body. The expiry date/shelf life does not apply to sample bottles that have been opened. In such cases it is recommended that the end-user conduct their own in-house stability trials.

Description: White powder prepared by synthesis, and certified for identity and purity by NMIA. Packaged in amber glass bottles with a septum and crimped aluminium cap or screw top cap.

Intended use: This certified reference material is suitable for use as a primary calibrator.

Instructions for use: Equilibrate the bottled material to room temperature before opening.

Recommended storage: When not in use this material should be stored at or below 25 °C in a closed container in a dry, dark area.

Metrological traceability: The certified purity value is traceable to the SI unit for mass (kg) through Australian national standards via balance calibration. In the mass balance approach all impurities are quantified as a mass fraction and subtracted from 100%. Quantitative NMR provides an independent direct measure of the mass fraction of the analyte of interest, calibrated with an internal standard certified for purity (mass fraction).

Stability: This material has demonstrated stability over a minimum period of five years. The measurement uncertainty at the 95% confidence interval includes a stability component which has been estimated from annual stability trials.

The long-term stability of the compound in solution has not been examined.

Homogeneity assessment: The homogeneity of the material was assessed using purity assay by GC-FID on seven randomly selected 1-2 mg sub samples of the material. The material was judged to be sufficiently homogeneous at this level of sampling as the variation in analysis results between samples was not significantly different at a 95% confidence level from that observed on repeat analysis of the same sample.

Safety: Treat as a hazardous substance. Use appropriate work practices when handling to avoid skin or eye contact, ingestion or inhalation of dust. Refer to the provided safety data sheet.

S. R. Davies

Dr Stephen R. Davies,
Team Leader,
Chemical Reference Materials, NMI.
24 April 2024

This report supersedes any issued prior to 24 April 2024.

NATA Accreditation No. 198 / Corporate Site No. 14214.

Legal notice: Terms and Conditions associated with the provision of this reference material can be found on the NMIA website.

Characterisation Report:

The identity was confirmed by a range of spectroscopic techniques, NMR, IR and MS. The certified purity value was obtained by mass balance from a combination of traditional analytical techniques, including GC-FID, thermogravimetric analysis, Karl Fischer analysis and ¹H NMR spectroscopy. The purity value is calculated as per Equation 1.

$$\text{Purity} = (100\% - I_{\text{ORG}}) \times (100\% - I_{\text{VOL}} - I_{\text{NVR}}) \quad \text{Equation 1}$$

I_{ORG} = Organic impurities of related structure, I_{VOL} = volatile impurities, I_{NVR} = non-volatile residue.

Supporting evidence is provided by quantitative nuclear magnetic resonance (qNMR) and qualitative elemental microanalysis. The purity value by qNMR was obtained using the three proton doublet at 1.29 ppm measured against a certified internal standard of maleic acid.

GC-FID: Instrument: Varian CP-3800/Agilent 8890
 Column: VF-1ms/HP-1, 30 m × 0.32 mm I.D. × 0.25 μm
 Program: 60 °C (1 min), 10 °C/min to 100 °C, 30 °C/min to 300 °C (3 min)
 Injector: 250 °C
 Detector Temp: 320 °C
 Carrier: Helium
 Split ratio: 20/1

Relative mass fraction of the main component as the free base:

Initial analysis: Mean = 100.0%, s = 0.003% (7 sub samples in duplicate, June 2019)
 Re-analysis: Mean = 99.8%, s = 0.03% (5 sub samples in duplicate, September 2021)
 Re-analysis: Mean = 99.9%, s = 0.003% (5 sub samples in duplicate, April 2024)

Karl Fischer analysis: Moisture content 0.1% mass fraction (June 2019)
 Moisture content < 0.1% mass fraction (August 2021 & April 2024)

Thermogravimetric analysis: Volatiles content < 0.1% and non-volatile residue < 0.2% mass fraction (June 2019)

qNMR: Instrument: Bruker Avance-III-500
 Field strength: 500 MHz
 Solvent: D₂O (4.79 ppm)
 Internal standard: Maleic acid (98.8% mass fraction)
 Initial analysis: Mean (1.28 ppm) = 100.2%, s = 0.1% (8 sub samples, July 2019)

Spectroscopic and other characterisation data

GC-MS:	Instrument:	HP6890/5973
	Column:	DB-5, 30 m x 0.25 mm I.D. x 0.25 µm
	Program:	60 °C (1 min), 10 °C/min to 300 °C (3 min)
	Injector:	250 °C
	Split ratio:	20/1
	Transfer line temp:	280 °C
	Carrier:	Helium, 1.0 mL/min
	The retention time of the free base is reported with the major peaks in the mass spectra. The latter are reported as mass/charge ratios and (in brackets) as a percentage relative to the base peak.	
	Free base (8.4 min):	148 (M ⁺ -1, 1), 134 (2), 117 (3), 91 (12), 77 (2), 65 (5), 58 (100) <i>m/z</i>
TLC:	Conditions:	Kieselgel 60F ₂₅₄ . Methanol/ammonia (100:0.5) Single spot observed, R _f = 0.4.
IR:	Instrument:	Bruker Alpha Platinum ATR
	Range:	4000-400 cm ⁻¹ , neat
	Peaks:	2966, 2943, 2831, 2799, 2783, 2727, 2460, 1604, 1488, 1454, 1436, 1386, 1355, 1191, 1081, 1060, 1046, 748, 700, 463 cm ⁻¹
¹ H NMR:	Instrument:	Bruker Avance III-500
	Field strength:	500 MHz
	Solvent:	D ₂ O (4.79 ppm)
	Spectral data:	δ 1.29 (3H, d, <i>J</i> = 6.6 Hz), 2.72 (3H, s), 2.92 (1H, dd, <i>J</i> = 8.1, 13.9 Hz), 3.09 (1H, dd, <i>J</i> = 6.3, 13.9 Hz), 3.56 (1H, m), 7.34 (2H, m), 7.38 (1H, m), 7.44 (2H, m) ppm Isopropanol estimated at 0.01% mass fraction was observed in the ¹ H NMR
¹³ C NMR:	Instrument:	Bruker Avance III-500
	Field strength:	126 MHz
	Solvent:	D ₂ O
	Spectral data:	δ 14.8, 29.9, 38.8, 56.4, 127.5, 129.0, 129.5, 135.7 ppm
Melting point:	135-137 °C	
Microanalysis:	Found:	C = 65.2%; H = 8.6%; N = 7.4% (June, 2019)
	Calculated:	C = 64.7%; H = 8.7%; N = 7.5% (Calculated for C ₁₀ H ₁₅ N.HCl)