Australian Government
Department of Industry, Science and Resources

National Measurement Institute

NATA
WORLD RECOGNISED ACCREDITATION

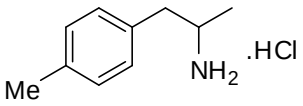
CERTIFIED REFERENCE MATERIAL CERTIFICATE OF ANALYSIS

NMIA D895b: (±)-4-Methylamphetamine hydrochloride

Report ID: D895b.2023.01

Chemical Formula: $C_{10}H_{15}N.HCl$

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



Certified value

Batch No.	CAS No.	Purity (mass fraction)
11-D-19	**41632-56-8 (HCl)** **64-11-9 (base)**	**99.5 ± 0.4%**

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

IUPAC name: 1-(4-Methylphenyl)-2-aminopropane hydrochloride

Expiration of certification: The property values are valid till 19 April 2028, i.e. five years from the date of re-certification 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: Off-white powder prepared by synthesis, 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 ºC 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%.

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 ten 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.

Caution: 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.
28 April 2023

This report supersedes any issued prior to 28 April 2023.

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

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 ^{1}H NMR spectroscopy. The purity value is calculated as per Equation 1.

Purity = (100 % - I_{ORG}) x (100 % - I_{VOL} – I_{NVR}) Equation 1

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

Supporting evidence is provided by qualitative elemental microanalysis.

GC-FID:	Instrument:	Varian CP-3800 or Agilent 6890, Agilent 8890
	Column:	VF-1MS or HP-1, 30 m × 0.32 mm I.D. × 0.25 µm
	Program:	80 °C (1 min), 5 °C/min to 170 °C, 20 °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 = 99.9%, s = 0.02% (10 sub samples in duplicate, October 2011)
	Re-analysis	Mean = 99.9%, s = 0.03% (5 sub samples in duplicate, October 2012)
	Re-analysis:	Mean = 99.9%, s = 0.03% (5 sub samples in duplicate, August 2015)
	Re-analysis:	Mean = 99.9%, s = 0.01% (5 sub samples in duplicate, August 2018)
	Re-analysis:	Mean = 99.9%, s = 0.01% (5 sub samples in duplicate, April 2023)
GC-FID:	Instrument:	Varian CP-3800
	Column:	HP-5, 30 m × 0.32 mm I.D. × 0.25 µm
	Program:	80 °C (1 min), 5 °C/min to 170 °C, 20 °C/min to 300 °C (3min)
	Injector:	250 °C
	Detector Temp:	320 °C
	Carrier:	Helium
	Split ratio:	20/1
	Relative mass fraction of main component as the free base:	
	Initial analysis:	Mean = 99.9%, s = 0.02% (10 sub samples in duplicate, October 2011)
Thermogravimetric analysis:		Non volatile residue < 0.2% mass fraction (October 2011). The volatile content (e.g. organic solvents and/or water) could not be determined because of the inherent volatility of the material.
Karl Fischer analysis:		Moisture content ≤0.2% mass fraction (October 2011, October 2012, August 2015 and June 2018, April 2023)

Spectroscopic and other characterisation data

GC-MS:	Instrument:	Agilent 6890/5973
	Column:	TG-1MS, 30 m x 0.25 mm I.D. x 0.25 µm
	Program:	90 °C (1 min), 10 °C/min to 180 °C (7 min), 30 °C/min to 300 °C (3 min)
	Injector:	200 °C
	Transfer line temp:	180 °C
	Carrier:	Helium, 1.0 mL/min
	Split ratio:	20/1
	The retention time of the free base is reported along with the major peaks in the mass spectrum. The latter are reported as mass/charge ratios and (in brackets) as a percentage relative to the base peak.	
	Free base (5.9 min):	105 (8), 91 (9), 77 (6), 44 (100) *m/z*
ESI-MS:	Instrument:	Micromass Quatro LC Micro
	Operation:	Positive ion mode, direct infusion at 10 µL/min
	Ionisation:	ESI spray voltage at 3.5 kV positive ion
	EM voltage:	650 V
	Cone voltage:	5 V
	Peak:	150.0 ($M+H^+$) *m/z*
HS-GC-MS:	Instrument:	Agilent 6890/5973/G1888
	Column:	DB-624, 30 m x 0.25 mm I.D. x 1.4 µm
	Program:	50 °C (5 min), 7 °C/min to 120 °C, 15 °C/min to 220 °C (8.3 min)
	Injector:	150 °C
	Transfer line temp:	280 °C
	Carrier:	Helium, 1.2 mL/min
	Split ratio:	50/1
	Solvents detected:	Isopropanol, 4-methylphenyl acetone, diethyl ether
TLC:	Conditions:	Kieselgel 60F254. Hexane/ethyl acetate /diethyl amine (10:20:1) Single spot observed, Rf = 0.21. Visualisation with UV at 254 nm
IR:	Instrument:	FT-IR, Biorad FTS 3000MX
	Range:	4000-400 cm-1, KBr
	Peaks:	3300-2700 (broad), 2062, 1616, 1499, 1385, 1213, 1084, 1003, 893, 795, 757 cm^{-1}
^{1}H NMR:	Instrument:	Bruker Avance-400
	Field strength:	400 MHz
	Solvent:	CD_3OD (3.31 ppm)
	Spectral data:	δ 1.25 (3H, d, *J* = 6.4 Hz), 2.32 (3H, s), 2.76 (1H, dd, *J* =8.4, 13.6 Hz), 2.96 (1H, dd, *J* =6.0, 13.6 Hz), 3.49 (1H, m), 7.13 (2H, d, *J* = 8.2 Hz) 7.17 (2H, d, *J* = 8.1 Hz) ppm
	Isopropanol estimated at 0.13% and 4-methylphenylacetone at 0.12% mass fraction were observed in the 1H NMR	
^{13}C NMR:	Instrument:	Bruker DMX-300
	Field strength:	75 MHz
	Solvent:	CD_3OD
	Spectral data:	δ 18.3, 21.1, 41.4, 50.3, 130.2, 130.6, 134.2, 138.1 ppm
Melting point:		155-159 °C
Microanalysis:	Found:	C = 65.1%; H = 8.8%; N = 7.6% (October, 2011)
	Calculated:	C = 64.7%; H = 8.7%; N = 7.5% (Calculated for $C_{10}H_{15}N.HCl$)