Australian Government
Department of Industry, Science and Resources

National Measurement Institute

NATA
WORLD RECOGNISED ACCREDITATION

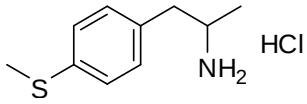
CERTIFIED REFERENCE MATERIAL CERTIFICATE OF ANALYSIS

NMIA D687b: (±)-4-Methylthioamphetamine hydrochloride

Report ID: D687b.2021.02

Chemical Formula: $C_{10}H_{16}ClNS$

Molecular Weight: 217.8 g/mol (HCl), 181.1 g/mol (base)



Certified value

Batch No.	CAS No.	Purity (mass fraction)
11-D-17	**94784-92-6(HCl)** **14116-06-4 (base)**	**98.0 ± 1.2%**

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

IUPAC name: 1-[4-(Methylsulfanyl)phenyl]-2-propanaminium chloride

Expiration of certification: The property values are valid till 30 August 2026, 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 may be used for instrument calibration.

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%. 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 three years. The measurement uncertainty at the 95% coverage 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.

Safety: Treat as 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.
14 September 2022

This report supersedes any issued prior to 14 September 2022.

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 headspace GC-MS analysis of occluded solvents and elemental microanalysis.

GC-FID:	Instrument:	Varian CP-3800 or Agilent 6890N
	Column:	HP-1, 30 m × 0.32 mm I.D. × 0.25 µm
	Program:	60 °C (1 min), 10 °C/min to 100 °C, 15 °C/min to 300 °C (3 min)
	Injector:	180 °C
	Detector Temp:	320 °C
	Carrier:	Helium
	Split ratio:	20/1
	Relative mass fraction of the main component:	
	Initial analysis:	Mean = 98.3%, s = 0.2% (10 sub samples in duplicate, February 2012)
GC-FID:	Instrument:	Agilent 7890A/8890
	Column:	HP-1ms, 30 m × 0.32 mm I.D. × 0.25 µm
	Program:	60 °C (1 min), 10 °C/min to 100 °C, 15 °C/min to 300 °C (3 min)
	Injector:	180 °C
	Detector Temp:	320 °C
	Carrier:	Helium
	Split ratio:	20/1
	Relative mass fraction of the main component:	
	Initial analysis:	Mean = 98.2%, s = 0.3% (10 sub samples in duplicate, February 2012)
	Re-analysis:	Mean = 98.3%, s = 0.1% (5 sub samples in duplicate, January 2013)
	Re-analysis:	Mean = 98.2%, s = 0.5% (7 sub samples in duplicate, December 2015)
	Re-analysis:	Mean = 98.3%, s = 0.1% (5 sub samples in duplicate, October 2018)
	Re-analysis:	Mean = 98.6%, s = 0.1% (5 sub samples in duplicate, August 2021)
Karl Fischer analysis:		Moisture content < 0.5% mass fraction (February 2012, January 2013, December 2015, October 2018 and August 2021)
Thermogravimetric analysis:		The volatile content (e.g. organic solvents and/or water) could not be determined because of the inherent volatility of the material. The non-volatile residue was < 0.2% mass fraction (February 2012)

Spectroscopic and other characterisation data

ESI-MS:	Instrument:	Waters Acquity UPLC/TQD
	Operation:	Positive ion mode, direct infusion at 20 µL/min
	Ionisation:	ESI spray voltage at 3.0 kV positive ion
	Capillary voltage:	3.0 kV
	Cone voltage:	20 V
	Peak:	182.10 (M^+H^+) *m/z*
GC-MS:	Instrument:	Agilent 6890/5973
	Column:	TG-1MS, 30 m x 0.25 mm I.D. x 0.25 µm
	Program:	60 °C (1 min), 10 °C/min to 100 °C, 15 °C/min to 300 °C (3 min)
	Injector:	250 °C
	Transfer line temp:	280 °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.	
	(11.2 min):	181 (M^+, 2), 164 (3), 138 (100), 122 (28), 91 (20), 78 (13) 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:	None detected
TLC:	Conditions:	Kieselgel 60F_{254}. Methanol/ammonia (100/0.5) Single spot observed, Rf = 0.30. Visualisation with UV at 254 nm vanillin stain.
IR:	Instrument:	Biorad FTS3000MX FT-IR
	Range:	4000-400 cm^{-1}, KBr powder
	Peaks:	3199, 2914, 2807, 2707, 2608, 2521, 2504, 2060, 1605, 1509, 1494, 1388, 1212, 1083, 795, 521, 460 cm^{-1}
^{1}H NMR:	Instrument:	Bruker AvanceIII-400
	Field strength:	400 MHz
	Solvent:	D_2O (4.79 ppm)
	Spectral data:	δ 1.28 (3H, d, *J* = 6.6 Hz), 2.48 (3H, s), 2.89 (2H, d, *J* = 7.2 Hz), 3.59 (1H, m), 7.24 (2H, d, *J* = 8.4 Hz), 7.32 (2H, d, *J* = 8.4 Hz) ppm
^{13}C NMR:	Instrument:	Bruker DMX-500
	Field strength:	126 MHz
	Solvent:	MeOH-d_4 (49.0 ppm)
	Spectral data:	δ 15.7, 18.3, 41.2, 50.2, 128.0, 130.9, 134.0, 139.2 ppm
Melting point:		183-187 °C
Microanalysis:	Found:	C = 55.2%; H = 7.5%; N = 6.4%; Cl = 16.2%; S = 14.6% (February, 2012)
	Calculated:	C = 55.2%; H = 7.4%; N = 6.4%; Cl = 16.3%; S = 14.7% (Calculated for $C_{10}H_{16}ClNS$)