



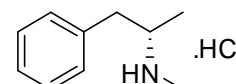
# CERTIFIED REFERENCE MATERIAL CERTIFICATE OF ANALYSIS

## NMIA D830b: S-(+)-Methamphetamine hydrochloride

Report ID: D830b.2023.01 (Bottled 170314)

Chemical Formula: C<sub>10</sub>H<sub>15</sub>N.HCl

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



### Certified value

Batch No.	CAS No.	Purity (mass fraction)
17-D-01	51-57-0	99.5 ± 1.2%

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

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

**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:** White powder sourced from an external supplier, 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:** In the absence of stability data the measurement uncertainty at the 95% coverage interval has been expanded to accommodate any potential change in the property value. The stability component has been estimated from stability trials conducted on similar materials by NMI Australia over the last 10 years. 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 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.  
21 April 2023

This report supersedes any issued prior to 21 April 2023.

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

**CIPM MRA notice:** This certificate is consistent with the capabilities that are included in Appendix C of the CIPM MRA drawn up by the CIPM. Under the CIPM MRA, all participating institutes recognize the validity of each other's calibration and measurement certificates for the quantities, ranges and measurement uncertainties specified in Appendix C. The "CIPM MRA Logo" and this statement attest only to the measurement(s) applied for determining the certified values on the certificate (for details see <http://www.bipm.org>).

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

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## Characterisation Report:

The identity was confirmed by a range of spectroscopic techniques, NMR, IR and MS. The certified purity value was obtained from a combination of traditional analytical techniques and quantitative nuclear magnetic resonance (qNMR). The techniques used in the mass balance approach include GC-FID thermogravimetric analysis, Karl Fischer analysis and <sup>1</sup>H NMR spectroscopy. The purity value is calculated as per Equation 1.

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

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

The purity value by qNMR was obtained using a combination of the three-proton doublet at 1.22 ppm and the one-proton multiplet at 3.48 ppm measured against a certified internal standard of maleic acid. Supporting evidence is provided by qualitative headspace GC-MS analysis of occluded solvents and elemental microanalysis.

Enantiomeric purity:  $d-(+)$  ≈ 100.0%

**The enantiomeric purity of this material was estimated by capillary electrophoresis over dynamically coated capillaries using cyclodextrin as chiral additive in buffer.**

**Note: Amphetamine hydrochloride (0.3-0.4% mass fraction) is present in this material.**

GC-FID: Instrument: Agilent 8890 or Varian CP-3800  
 Column: HP-1MS or VF-1MS, 30 m × 0.32 mm I.D. × 0.25 μm  
 Program: 60 °C (1 min), 10 °C/min to 100 °C (4 min), 30 °C/min to 300 °C (3 min)  
 Injector: 200 °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 = 99.5%, s = 0.02% (10 sub samples in duplicate, February 2017)  
 Re-analysis: Mean = 99.8%, s = 0.02% (5 sub samples in duplicate, January 2018)  
 Re-analysis: Mean = 99.7%, s = 0.02% (5 sub samples in duplicate, December 2020)  
 Re-analysis: Mean = 99.5%, s = 0.02% (5 sub samples in duplicate, April 2023)

Thermogravimetric analysis: The volatile content (e.g. organic solvents and/or water) could not be determined by thermogravimetric analysis and non-volatile residue < 0.2% mass fraction (February 2017)

Karl Fischer analysis: Moisture content 0.2% mass fraction (February 2017, January 2018, and April 2023)  
 Moisture content 0.1% mass fraction (September 2020)

QNMR: Instrument: Bruker Avance-III-500  
 Field strength: 500 MHz  
 Solvent: D<sub>2</sub>O (4.79 ppm)  
 Internal standard: Maleic acid (98.7% mass fraction)  
 Initial analysis: Mean (1.2 ppm) = 99.4%, s = 0.2% (5 sub samples, February 2017)  
 Initial analysis: Mean (3.5 ppm) = 99.5%, s = 0.2% (5 sub samples, February 2017)

## Spectroscopic and other characterisation data

GC-MS:	Instrument:	Agilent 6890/5973
	Column:	HP1-MS, 30 m x 0.25 mm I.D. x 0.25 $\mu$ m
	Program:	60 °C (1 min), 10 °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 times of the free base and acetyl derivative are reported along 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 (7.9 min):	148 (M <sup>+</sup> -H, 1), 91 (16), 65 (7), 58 (100), 56 (11), 42 (7) <i>m/z</i>
	N-Acetyl (13.1 min):	191 (M <sup>+</sup> , 1), 148 (1), 117 (7), 100 (68), 91 (13), 65 (5), 58 (100), 56 (6), 43 (11) <i>m/z</i>
ESI-MS:	Instrument:	Waters Acquity TQ API mass spectrometer
	Operation:	Positive ion mode, direct infusion at 10 $\mu$ L/min
	Ionisation:	ESI spray voltage at 3.5 kV positive ion
	EM voltage:	650 V
	Cone voltage:	20 V
	Peak:	149.9 (M+H <sup>+</sup> ) <i>m/z</i>
HS-GC-MS:	Instrument:	Agilent 6890/5973/G1888
	Column:	DB-624, 30 m x 0.25 mm I.D. x 1.4 $\mu$ m
	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:	Acetone
TLC:	Conditions:	Kieselgel 60F <sub>254</sub> Hexane/ethyl acetate/diethylamine (8:2:1) Single spot observed, R <sub>f</sub> = 0.20
IR:	Instrument:	FT-IR, Biorad WIN FTS3000MX
	Range:	4000-400 cm <sup>-1</sup> , KBr
	Peaks:	2967, 2461, 2056, 1599, 1483, 1386, 1190, 1078, 749, 700 cm <sup>-1</sup>
<sup>1</sup> H NMR:	Instrument:	Bruker Avance III 500
	Field strength:	500 MHz
	Solvent:	D <sub>2</sub> O (4.79 ppm)
	Spectral data:	$\delta$ 1.26 (3H, d, <i>J</i> = 6.6 Hz), 2.68 (3H, s), 2.89 (1H, dd, <i>J</i> = 8.0, 13.9 Hz), 3.05 (1H, dd, <i>J</i> = 6.3, 13.9 Hz), 3.53 (1H, m), 7.30-7.31 (2H, m), 7.33-7.36 (1H, m), 7.39-7.42 (2H, m) ppm
	Acetone estimated at 0.02% mass fraction was observed in the <sup>1</sup> H NMR	
<sup>13</sup> C NMR:	Instrument:	Bruker Avance III 500
	Field strength:	126 MHz
	Solvent:	D <sub>2</sub> O
	Spectral data:	$\delta$ 14.8, 29.9, 38.7, 56.4, 127.4, 129.0, 129.5, 135.7 ppm
Melting point:	174-175 °C	
Microanalysis:	Found:	C = 64.9%; H = 9.0%; N = 7.7%; Cl = 19.1% (March 2017)
	Calculated:	C = 64.7%; H = 8.7%; N = 7.5%; Cl = 19.1% (Calculated for C <sub>10</sub> H <sub>15</sub> N.HCl)