



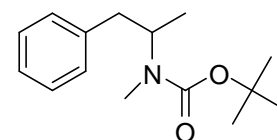
CERTIFIED REFERENCE MATERIAL CERTIFICATE OF ANALYSIS

NMIA D1068: N-tert-Butoxycarbonyl-methamphetamine

Report ID: D1068.2023.01

Chemical Formula: C₁₅H₂₃NO₂

Molecular Weight: 249.4 g/mol



Certified value

Batch No.	CAS No.	Purity (mass fraction)
17-D-02	1334921-74-2 ([1S]-enantiomer)	97.0 ± 1.4%

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

Synonyms: N-Methyl-N-1-methyl-2-phenylethyl-1,1-dimethylethyl ester carbamic acid
t-Boc-methamphetamine
N-Boc-methamphetamine

Expiration of certification: The property values are valid till 14 July 2026, three 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: Colourless oil 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%.

Stability: In the absence of long term 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 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.
20 July 2023

This report supersedes any issued prior to 20 July 2023.

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

Warning: This material is sensitive to the quality of the silanised glass liner when injected at elevated temperature ~ 250 °C into a GC instrument.

GC-FID: Instrument: Varian CP-3800 or Agilent 7890
Column: VF-1MS or 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 = 99.9%, s = 0.007% (7 sub samples in duplicate, February 2017)
Re-analysis: Mean = 99.4%, s = 0.015% (5 sub samples in duplicate, March 2018)
Re-analysis: Mean = 98.9%, s = 0.05% (5 sub samples in duplicate, April 2019)
Re-analysis: Mean = 98.9%, s = 0.02% (5 sub samples in duplicate, May 2020)
Re-analysis: Mean = 98.1%, s = 0.04% (5 sub samples in duplicate, June 2021)
Re-analysis: Mean = 97.5%, s = 0.04% (5 sub samples in duplicate, July 2023)

Karl Fischer analysis: Moisture content 0.3% mass fraction (February 2017, March 2019, and July 2023)
Moisture content 0.4% mass fraction (January 2018, March 2020 and May 2021)

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

Spectroscopic and other characterisation data

GC-MS:	Parent compound:	
	Instrument:	Agilent 6890/5973
	Column:	HP-1MS, 30 m x 0.25 mm I.D. x 0.25 μ m
	Program:	60 °C (1 min), 10 °C/min to 100 °C, 15 °C/min to 300 °C (3 min)
	Injector:	180 °C
	Split ratio:	20/1
	Transfer line temp:	280 °C
	Carrier:	Helium, 1.0 mL/min
	Scan range:	50-550 <i>m/z</i>
	The retention time of the parent compound 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.	
	Parent (11.7 min):	176 (4), 158 (16), 119 (7), 102 (40), 91 (25), 58 (100), 41 (69) <i>m/z</i>
ESI-MS:	Instrument:	Micromass Quatro LC Micro
	Operation:	Positive ion mode, direct infusion at 10 μ L/min
	Ionisation:	ESI spray voltage at 3.0 kV positive ion
	EM voltage:	650 V
	Cone voltage:	20 V
	Peak:	272.07 (M+Na ⁺) <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 μ 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:	Ethyl acetate
TLC:	Conditions:	Kieselgel 60F ₂₅₄ . Hexane/ethyl acetate (7:3) Single spot observed, R _f = 0.5. Visualisation with UV at 254 nm and/or vanillin stain.
IR:	Instrument:	Bruker Alpha Platinum ATR
	Range:	4000-400 cm ⁻¹ , neat
	Peaks:	2974, 2930, 1686, 1453, 1393, 1365, 1335, 1141, 995, 770, 740, 698, 539, 509 cm ⁻¹
¹ H NMR:	Instrument:	Bruker Avance III-500
	Field strength:	500 MHz
	Solvent:	DMSO- <i>d</i> ₆ (2.50 ppm) at 340K
	Spectral data:	δ 1.11 (3H, d, <i>J</i> = 6.8 Hz), 1.28 (9H, s), 2.64 (3H, s), 2.68 (1H, dd, <i>J</i> = 6.3, 13.8 Hz), 2.74 (1H, dd, <i>J</i> = 8.8, 13.8 Hz), 4.31 (1H, m), 7.10-7.22 (3H, m), 7.26 (2H, m) ppm Ethyl acetate, hexane, dichloromethane and di- <i>tert</i> -butyl dicarbonate estimated at 0.1%, 0.1%, 0.02% and 0.03% mass fraction respectively was observed in the ¹ H NMR.
¹³ C NMR:	Instrument:	Bruker Avance III-500
	Field strength:	126 MHz
	Solvent:	DMSO- <i>d</i> ₆ (39.5 ppm) at 340K
	Spectral data:	δ 17.2 [*] , 27.6 [*] , 27.7, 39.2 [*] , 51.3 [*] , 77.8, 125.6, 127.7, 128.5, 138.9, 154.3 [*] Observed <i>via</i> HSQC correlation
Melting point:		N/A
Microanalysis:	Found:	C = 72.4%; H = 9.5%; N = 5.8% (February 2017)
	Calculated:	C = 72.3%; H = 9.3%; N = 5.6% (Calculated for C ₁₅ H ₂₃ NO ₂)