Australian Government
Department of Industry, Science and Resources

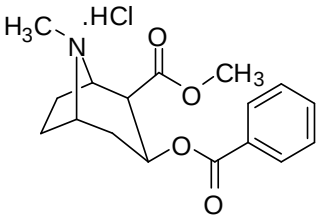
National Measurement Institute

CIPM MRA

NATA
WORLD RECOGNISED ACCREDITATION

CERTIFIED REFERENCE MATERIAL CERTIFICATE OF ANALYSIS

NMIA D747c: Cocaine hydrochloride



Report ID: D747c.2023.01 (Bottled 190911)

Chemical Formula: $C_{17}H_{21}NO_4.HCl$

Molecular Weight: 339.8 g/mol

Certified value

Batch No.	CAS No.	Purity (mass fraction)
12-D-06	**53-21-4**	**99.8 ± 1.0%**

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

Synonyms: 3β-Hydroxy-1αH, 5αH-tropane-2β-carboxylic acid methyl ester benzoate hydrochloride
Benzoylmethylecgonine hydrochloride
Ecgonine methyl ester benzoate hydrochloride

Expiration of certification: The property values are valid till 11 May 2028, 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 sourced from an external supplier, 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%. 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 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.
15 May 2023.

This report supersedes any issued prior to 15 May 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.

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 ^{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

The certified purity value by qNMR was obtained using the three-proton singlet at 2.9 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.

GC-FID:	Instrument:	Varian CP-3800 or Agilent
	Column:	HP-5 or HP-1, 30 m × 0.32 mm I.D. × 0.25 μm
	Program:	150 °C (1 min), 10 °C/min to 300 °C (5 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 = 0.001% (10 sub samples in duplicate, April 2012)
	Re- analysis:	Mean = 99.9%, s = 0.01% (5 sub samples in duplicate, March 2013)
	Re- analysis:	Mean = 99.9%, s = 0.05% (5 sub samples in duplicate, February 2016)
	Re- analysis:	Mean = 99.9%, s = 0.04% (5 sub samples in duplicate, January 2019)
	Re- analysis:	Mean = 99.6%, s = 0.02% (5 sub samples in duplicate, May 2023)
Thermogravimetric analysis:		Non-volatile residue < 0.2% mass fraction (April 2012). 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 ≤ 0.3% mass fraction (April 2012 - May 2023).
QNMR:	Instrument:	Bruker Avance-III-400
	Field strength:	400 MHz
	Solvent:	D_2O (4.79 ppm)
	Internal standard:	Maleic acid (98.7% mass fraction)
	Initial analysis:	Mean (2.9 ppm) = 99.6%, s = 0.1% (5 sub samples, May 2012)

Spectroscopic and other characterisation data

GC-MS:	Parent compound:	
	Instrument:	Agilent 6890/5973
	Column:	TG-1MS, 30 m x 0.25 mm I.D. x 0.25 μm
	Program:	150 °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 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.	
	Parent (10.7 min):	303 (M^+, 25), 182 (100), 152 (7), 122 (12), 105 (29), 94 (31), 82 (97), 77 (26) *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:	Methanol and acetone
TLC:	Conditions:	Kieselgel 60F254. Ethyl acetate/methanol/diethylamine (50/50/2). Single spot observed, Rf = 0.6. Visualisation with UV at 254 nm.
IR:	Instrument:	Biorad FTS3000MX FT-IR
	Range:	4000-400 cm^{-1}, KBr powder
	Peaks:	3023, 2970, 2958, 2900, 2756, 2698, 2680, 2654, 2617, 2541, 1731, 1715, 1597, 1487, 1456, 1430, 1374, 1269, 1109, 731 cm^{-1}.
^{1}H NMR:	Instrument:	Bruker AvanceIII-400
	Field strength:	400 MHz
	Solvent:	D_2O (4.79 ppm)
	Spectral data:	δ 2.18-2.25 (2H, m), 2.36-2.57 (4H, m), 2.89 (3H, s), 3.62 (3H, s), 3.65 (1H, m), 4.09 (1H, m), 4.24 (1H, m), 5.58 (1H, m), 7.54 (2H, m), 7.70 (1H, m), 7.96 (2H, m) ppm
		Acetic acid, acetone and methanol quantified at 0.01%, 0.01% and 0.01% mass fraction by ^{1}H NMR
^{13}C NMR:	Instrument:	Bruker AvanceIII-400
	Field strength:	101 MHz
	Solvent:	D_2O
	Spectral data:	δ 22.5, 23.5, 32.5, 38.7, 46.0, 53.2, 63.0, 63.8, 64.3, 128.4, 128.9, 129.4, 134.3, 167.0, 173.2 ppm
Melting point:		193-196 °C
Microanalysis:	Found:	C = 60.2%; H = 6.5%; N = 4.1%, Cl = 10.5% (April 2012)
	Calculated:	C = 60.1%; H = 6.5%; N = 4.1%, Cl = 10.5% (Calculated for $C_{25}H_{34}O_8$)