



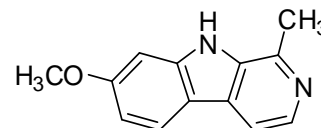
CERTIFIED REFERENCE MATERIAL CERTIFICATE OF ANALYSIS

NMIA D884: Harmine

Report ID: D884.2021.02

Chemical Formula: C₁₃H₁₂N₂O

Molecular Weight: 212.3 g/mol



Certified value

Batch No.	CAS No.	Purity (mass fraction)
04-D-21	442-51-3	99.9 ± 0.3%

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

IUPAC name: 7-Methoxy-1-methyl-9H-β-carboline.

Expiration of certification: The property values are valid till 9 November 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 needles 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 °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: 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 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.
19 September 2022

This report supersedes any issued prior to 19 September 2022.

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 elemental microanalysis.

GC-FID: Instrument: Agilent 6890/8890
 Column: HP-1/HP-5, 30 m x 0.32 mm I.D. x 0.25 μ m
 Program: 180 $^{\circ}$ C (1 min), 10 $^{\circ}$ C/min to 300 $^{\circ}$ C (2 min)
 Injector: 250 $^{\circ}$ C
 Detector Temp: 320 $^{\circ}$ C
 Carrier: Helium
 Split ratio: 20/1
 Relative mass fraction of the main component:
 Initial analysis: 99.9%, s = 0.01% (7 sub samples in duplicate, November 2004)
 Re-analysis: 99.9%, s = 0.004% (5 sub samples in duplicate, January 2008)
 Re-analysis: 99.9%, s = 0.015% (5 sub samples in duplicate, November 2021)

GC-FID: Instrument: Varian CP-3800
 Column: VF-1MS, 30 m x 0.32 mm I.D. x 0.25 μ m
 Program: 180 $^{\circ}$ C (1 min), 10 $^{\circ}$ C/min to 300 $^{\circ}$ C (3 min)
 Injector: 250 $^{\circ}$ C
 Detector Temp: 320 $^{\circ}$ C
 Carrier: Helium
 Split ratio: 20/1
 Relative mass fraction of the main component:
 Initial analysis: Mean = 99.9%, s = 0.01% (5 sub samples in duplicate, January 2011)
 Re-analysis: Mean = 100 %, s = 0.004% (5 sub samples in duplicate, November 2015)

Thermogravimetric analysis: Volatiles content < 0.1% and non-volatile residue < 0.2% mass fraction (December 2004, 2005 and 2007)

Karl Fischer analysis: Moisture content < 0.1% mass fraction (December 2007, January 2011 & November 2015)
 Moisture content < 0.2% mass fraction (November 2021)

Spectroscopic and other characterisation data

GC-MS:	Parent compound:	
	Instrument:	Agilent 6890/5973
	Column:	Zebtron ZB-5, 30 m x 0.25 mm I.D. x 0.3 μ m
	Program:	80 °C, 15 °C/min to 100 °C, 15 °C/min to 300 °C (8 min)
	Injector:	200 °C
	Transfer line temp:	320 °C
	Carrier:	Helium, 1.0 mL/min
	Split ratio:	40/1
	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 (11.6 min):	212 (M+, 100), 211 (7), 197 (22), 183 (5), 170 (7), 169 (52), 168 (8), 106 (5) <i>m/z</i>
IR:	Instrument:	Biorad FTS3000MX FT-IR
	Range:	4000-400 cm^{-1} , KBr powder
	Peaks:	3295, 2910, 2365, 2200, 2037, 1844, 1724, 1603, 1446, 1251, 1099, 1038, 922, 862, 805 and 768 cm^{-1}
^1H NMR:	Instrument:	Bruker DMX-600
	Field strength:	600 MHz
	Solvent:	CD_3OD (3.31 ppm)
	Spectral data:	δ 2.80 (3H, s), 3.95 (3H, s), 6.90 (1H, dd, $J = 2.2, 8.7$ Hz), 7.08 (1H, d, $J = 2.0$ Hz), 7.82 (1H, d, $J = 5.2$ Hz), 8.02 (1H, d, $J = 8.9$ Hz), 8.14 (1H, d, $J = 5.6$ Hz) ppm
^{13}C NMR:	Instrument:	Bruker DMX-600
	Field strength:	150 MHz
	Solvent:	CD_3OD (49.0 ppm)
	Spectral data:	δ 19.5, 56.0, 95.4, 110.9, 113.3, 116.4, 123.5, 130.1, 136.3, 138.0, 142.1, 144.2 and 162.6 ppm
Melting point:		264-266 °C
Microanalysis:	Found:	C = 73.5%; H = 5.8%; N = 13.2% (December, 2004)
	Calculated:	C = 73.6%; H = 5.7%; N = 13.2% (Calculated for $\text{C}_{13}\text{H}_{12}\text{N}_2\text{O}$)