



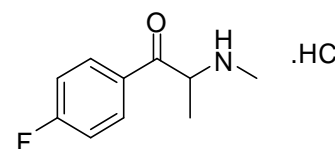
CERTIFIED REFERENCE MATERIAL CERTIFICATE OF ANALYSIS

NMIA D969b: 4-Fluoromethcathinone hydrochloride

Report ID: D969b.2024.01

Chemical Formula: C₁₀H₁₂FNO.HCl

Molecular Weight: 217.7 g/mol (HCl)



Certified value

Batch No.	CAS No.	Purity (mass fraction)
12-D-14	7589-38-7	99.6 ± 0.5%

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

IUPAC name: 1-(4-Fluorophenyl)-2-(methylamino)-1-propanone hydrochloride

Expiration of certification: The property values are valid till 22 January 2034, ten 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 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%. 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 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 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.
2 February 2024

This report supersedes any issued prior to 02 February 2024.

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, qNMR and elemental microanalysis.

GC-FID: Instrument: Varian CP-3800
 Column: DB-17, 30 m × 0.32 mm I.D. × 0.25 μm
 HP-1, 30 m × 0.32 mm I.D. × 0.25 μm
 TG-17 or VF-1MS, 30 m × 0.32 mm I.D. × 0.25 μm
 Program: 100 °C (1 min), 15 °C/min to 200 °C (8 min), 30 °C/min to 280 °C (10 min)
 Injector: 250 °C
 Detector Temp: 320 °C
 Carrier: Helium
 Split ratio: 20/1

Relative mass fraction of the main component as the *N*-acetyl derivative:

Initial analysis: Mean = 99.6%, s = 0.05% (7 sub samples in duplicate, October 2012)
 Initial analysis: Mean = 99.5%, s = 0.05% (7 sub samples in duplicate, October 2012)
 Re-analysis: Mean = 99.7%, s = 0.03% (7 sub samples in duplicate, August 2013)
 Re-analysis: Mean = 99.5%, s = 0.04% (7 sub samples in duplicate, June 2016)
 Re-analysis: Mean = 99.7%, s = 0.15% (5 sub samples in duplicate, June 2019)
 Re-analysis: Mean = 99.7%, s = 0.03% (5 sub samples in duplicate, January 2024)

HPLC: Instrument: Shimadzu Binary pump LC-20AB, SIL-20 A HT autosampler
 Column: Ascentis C-18, 2.7 μm (4.6 mm × 150 mm)
 Column oven: 40 °C
 Mobile Phase: Acetonitrile/MilliQ water (12:88)
 The aqueous phase was buffered at pH 4.2 using 20mM NH₄OAc and TFA pH 3
 Flow rate: 0.6 mL/min
 Detector: PDA operating at 255 nm
 Relative peak area of the main component:
 Initial analysis: Mean = 99.98 %, s = 0.003% (10 sub samples in duplicate, October 2012)

Thermogravimetric analysis: The volatile content (e.g. organic solvents and/or water) could not be determined because of the inherent volatility of the material and/or degradation at elevated temperatures. = Non volatile residue < 0.2% mass fraction (September 2012)

Karl Fischer analysis: Moisture content < 0.2% mass fraction (September 2012, August 2013, June 2016, May 2019 and January 2024)

Spectroscopic and other characterisation data

GC-MS:	Free base:	
	Instrument:	Agilent 6890/5973
	Column:	TG-1 MS, 30 m x 0.25 mm I.D. x 0.25 μ m
	Program:	90 °C (1 min), 10 °C/min to 180 °C (7 min), 30°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
	<i>N</i> -Acetyl derivative:	
	Instrument:	Agilent 6890/5973
	Column:	TG-1 MS, 30 m x 0.25 mm I.D. x 0.25 μ m
	Program:	90 °C (1 min), 5 °C/min to 220 °C, 20 °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 <i>N</i> -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:	(6.9 min): 123 (12), 95 (20), 75 (11), 58 (100), 56 (35), 42 (6) <i>m/z</i>
	<i>N</i> -Acetyl derivative:	(16 min): 223 (M^+ , 1), 123 (11), 100 (60), 95 (14), 75 (7), 58 (100), 56 (6) <i>m/z</i>
LC/ESI-MS:	Instrument:	Micromass Quattro LC Micro
	Operation:	Positive ion mode, direct infusion at 10 μ L/min
	Ionisation:	ESI spray voltage at 3 kV positive ion
	EM voltage:	650 V
	Cone voltage:	20 V
	Peak:	182.1 ($M+H^+$) <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:	No solvents detected.
TLC:	Conditions:	Kieselgel 60F ₂₅₄ . Methanol/NH ₃ (50:0.035) Single spot observed, R _f = 0.6. Visualisation with UV at 254 nm
IR:	Instrument:	Biorad FTS3000MX FT-IR
	Range:	4000-400 cm^{-1} , KBr powder
	Peaks:	3359, 2461, 2103, 2021, 1931, 1799, 1687, 1600, 1513, 1471, 1303, 1364, 1303, 1243, 1167, 902, 849, 601, 493 cm^{-1}
¹ H NMR:	Instrument:	Bruker Avance-400
	Field strength:	400 MHz
	Solvent:	D ₂ O (4.79 ppm)
	Spectral data:	δ 1.61 (3H, d, <i>J</i> = 7.2 Hz), 2.81 (3H, s), 5.10 (1H, q, <i>J</i> = 7.2 Hz), 7.33 (2H, m) 8.09 (2H, m) ppm
¹³ C NMR:	Instrument:	Bruker Avance 400
	Field strength:	101 MHz
	Solvent:	D ₂ O (4.79 ppm)
	Spectral data:	δ 15.2, 30.9, 59.5, 116.4 (d, <i>J</i> _{C-F} = 23 Hz), 128.8 (d, <i>J</i> _{C-F} = 3 Hz), 132.0 (d, <i>J</i> _{C-F} = 10 Hz), 166.7(d, <i>J</i> _{C-F} = 256 Hz), 196.0 ppm
¹⁹ F NMR:	Instrument:	Bruker Avance-400
	Field strength:	376 MHz
	Solvent:	D ₂ O (4.79 ppm)
	Spectral data:	δ -102.1 ppm
Melting point:	245-246 °C	
Microanalysis:	Found:	C = 55.3%; H = 6.0%; N = 6.5%; F = 8.8%; Cl = 16.3% (September, 2012)
	Calculated:	C = 55.2%; H = 6.0%; N = 6.4%; F = 8.7%; Cl = 16.3% (Calculated for C ₁₀ H ₁₃ OCIFNO)