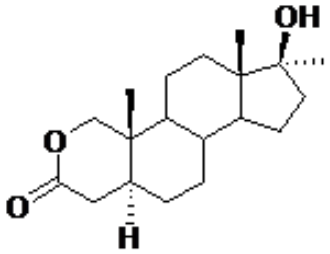
Australian Government
Department of Industry, Science and Resources

National Measurement Institute

NATA
WORLD RECOGNISED ACCREDITATION

CERTIFIED REFERENCE MATERIAL CERTIFICATE OF ANALYSIS

S040: Oxandrolone



Report ID: S040.2021.02 (Bottled 160616)

Chemical Formula: $C_{19}H_{30}O_3$

Molecular Weight: 306.4 g/mol

Certified value

Batch No.	CAS No.	Purity (mass fraction)
16-S-01	53-39-4	99.5 ± 0.5%

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

IUPAC name: (4aS,4bS,6aS,7S,9aS,9bR,11aS)-7-Hydroxy-4a,6a,7-trimethyltetradecahydroindeno[4,5-h]isochromen-2(1H)-one.

Expiration of certification: The property values are valid till 16 December 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: White solid 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 4 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%.

Stability: This material has demonstrated stability over a minimum period of 3 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 eight 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.
1 November 2022

This report supersedes any issued prior to 1 November 2022.

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

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, 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.

Supporting evidence is provided by qualitative headspace GC-MS analysis of occluded solvents and elemental microanalysis.

GC-FID:	Instrument:	Varian CP-3800 or Agilent 8890
	Column:	HP-5 or HP-1MS, 30 m × 0.32 mm I.D. × 0.25 μm
	Program:	160 °C (1 min), 15 °C/min to 280 °C (5 min), 30 °C/min to 300 °C (3 min)
	Injector:	250 °C
	Detector Temp:	320 °C
	Carrier:	Helium
	Split ratio:	20/1
	Relative mass fraction of the main component:	
	Initial analysis:	Mean = 99.6%, s = 0.01% (8 sub samples in duplicate, January 2016)
	Re-analysis:	Mean = 99.8%, s = 0.01% (5 sub samples in duplicate, February 2017)
	Re-analysis:	Mean = 99.7%, s = 0.01% (5 sub samples in duplicate, February 2018)
	Re-analysis:	Mean = 99.7%, s = 0.004% (5 sub samples in duplicate, January 2019)
	Re-analysis:	Mean = 99.7%, s = 0.02% (5 sub samples in duplicate, December 2021)
Thermogravimetric analysis:		Volatile content < 0.1 % and non-volatile residue < 0.2 % mass fraction (February 2016)
Karl Fischer analysis:		Moisture content < 0.1% mass fraction (February 2016, January 2017, January 2018, February 2019 and September 2021)

Spectroscopic and other characterisation data

GC-MS:	Instrument:	Agilent 6890/5973
	Column:	HP-1MS, 30 m x 0.25 mm I.D. x 0.25 μm
	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 parent compound and *bis*-TMS derivative are 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 (23.7 min):	306 (M^+, 6), 291 (65), 273 (100), 248 (46), 233 (25), 189 (16), 176 (32), 161 (20), 147 (21), 135 (18), 133 (17), 123 (36), 121 (37), 107 (40), 93 (59), 91 (52), 81 (47), 79 (47), 71 (90), 67 (37), 55 (30), 43 (61), 41 (34) *m/z*
	Bis-TMS (24.6 min):	378 (M^+, 4), 363 (22), 321 (15), 308 (27), 273 (7), 176 (7), 143 (100), 130 (16), 115 (9), 107 (7), 75 (27), 73 (42) *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:	None
IR:	Instrument:	Biorad FTS300MX FT-IR
	Range:	4000-400 cm^{-1}, neat
	Peaks:	3515, 2934, 2918, 2895, 2859, 1718, 1439, 1365, 1254, 1230, 1202, 1159, 1046, 1035, 1026, 930, 608, 514 cm^{-1}
^{1}H NMR:	Instrument:	Bruker Avance III-500
	Field strength:	500 MHz
	Solvent:	$CDCl_3$ (7.26 ppm)
	Spectral data:	δ 0.80 (1H, m), 0.85 (3H, s), 0.91 (1H, m), 0.99 (3H, s), 1.13-1.38 (4H, m), 1.20 (3H, s), 1.39-1.63 (6H, m), 1.64-1.76 (3H, m), 1.80 (1H, m), 2.21 (1H, dd, *J* = 13.1, 18.8 Hz), 2.51 (1H, dd, *J* = 5.9, 18.8 Hz), 3.91 (1H, d, *J* = 10.7 Hz), 4.22 (1H, d, *J* = 10.7 Hz).
^{13}C NMR:	Instrument:	Bruker Avance III-500
	Field strength:	126 MHz
	Solvent:	$CDCl_3$ (77.1 ppm)
	Spectral data:	δ 10.2, 13.9, 21.0, 23.3, 25.8, 27.1, 30.8, 31.2, 33.8, 34.7, 35.6, 38.7, 40.4, 45.4, 49.7, 50.2, 81.1, 81.6, 170.6 ppm.
Melting point:		215-225 °C
Microanalysis:	Found:	C = 74.4%; H = 10.0% (February 2016)
	Calculated:	C = 74.5%; H = 9.9% (Calculated for $C_{19}H_{30}O_3$)