Australian Government
Department of Industry, Science and Resources

National Measurement Institute

NATA
WORLD RECOGNISED ACCREDITATION

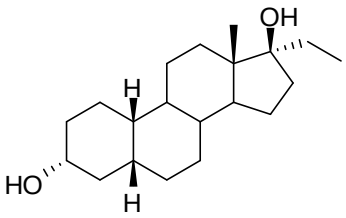
CERTIFIED REFERENCE MATERIAL CERTIFICATE OF ANALYSIS

NMIA D559: 17α-Ethyl-5β-estrane-3α,17β-diol

Report ID: D559.2021.02 (Ampouled 160414)

Chemical Formula: $C_{20}H_{34}O_2$

Molecular Weight: 306.5 g/mol



Certified value

Batch No.	CAS No.	Mass per ampoule
98-002942	**31658-50-1**	**1003 ± 24 µg**

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

IUPAC name: (3α,5β,17α)-19-Norpregnane-3,17-diol.

Expiration of certification: The property values are valid till 12 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 ampoules that have been opened. In such cases it is recommended that the end-user conduct their own in-house stability trials.

Description: The compound is supplied as a dried aliquot in a sealed ampoule under an atmosphere of argon. The CRM is intended for a single use to prepare a standard solution containing D559. Material was sourced from an external supplier, and certified for identity and purity by NMIA.

Intended use: This certified reference material is suitable for use as a primary calibrator.

Instructions for use: Open the ampoule and carefully rinse the interior at least five times with a suitable organic solvent (e.g. chloroform). This will transfer 1003 ± 24 µg of anhydrous 17α-ethyl-5β-estrane-3α, 17β-diol. The mass of analyte in each ampoule is calculated from the assigned purity of the bulk and the concentration of bulk material in a stock solution used to prepare the ampoules.

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 three 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 ampoules 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 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.

Legal notice: Terms and Conditions associated with the provision of this reference material can be found on the NMIA website.

Characterisation Report:

GC-FID:	Instrument:	Agilent 6890
	Column:	HP-1 Capillary, 30 m × 0.32 mm I.D. × 0.25 µm
	Program:	180 °C (1 min), 20 °C/min to 260 °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 = 99.8%, s = 0.01% (7 ampoules in duplicate, April 2016)
	Re-analysis:	Mean = 99.8%, s = 0.04% (5 ampoules in duplicate, March 2017)
	Re-analysis:	Mean = 99.8%, s = 0.01% (6 ampoules in duplicate, April 2018)
	Re-analysis:	Mean = 99.7%, s = 0.01% (5 ampoules in duplicate, April 2019)

The following analytical data was obtained on the bulk material subsequently used in the preparation of the ampoules.

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 ^{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 elemental microanalysis.

GC-FID:	Instrument:	Agilent 6890
	Column:	HP-1 Capillary, 30 m × 0.32 mm I.D. × 0.25 µm
	Program:	180 °C (1 min), 20 °C/min to 280 °C (5 min), 20 °C/min to 300 °C (1 min)
	Injector:	250 °C
	Detector Temp:	320 °C
	Carrier:	Helium
	Split ratio:	20/1
	Relative mass fraction of the main component:	
	Initial analysis:	Mean = 99.9%, s = 0.1% (7 sub samples in duplicate, November 1998)
	Re-analysis:	Mean = 99.8%, s = 0.01% (5 sub samples in duplicate, January 2007)
	Re-analysis:	Mean = 99.8%, s = 0.02% (7 sub samples in duplicate, April 2016)
	Re-analysis:	Mean = 99.8%, s = 0.01% (7 sub samples in duplicate, November 2021)
Karl Fischer analysis:		Moisture content 0.2 % mass fraction (May 2016)
Thermogravimetric analysis:		Volatiles content < 0.1% and non-volatile residue < 0.2% mass fraction (June 1999 & January 2007)

Spectroscopic and other characterisation data

GC-MS: Parent compound:

Instrument:	Agilent 6890/5973
Column:	HP Ultra 2, 17 m x 0.20 mm I.D. x 0.10 µm
Program:	180 °C (1 min), 10 °C/min to 220 °C, 20 °C/min to 300 °C (3 min)
Injector:	280 °C
Split ratio:	20/1
Transfer line temp:	300 °C
Carrier:	Helium, 1.0 mL/min
Scan range:	50-550 *m/z*

Bis-TMS derivative:

Instrument:	Agilent 6890/5973
Column:	HP Ultra 1, 17 m x 0.22 mm I.D. x 0.11 µm
Program:	170 °C (0.5 min), 3 °C/min to 234 °C, 10 °C/min to 265 °C (3 min)
Injector:	280 °C
Split ratio:	20/1
Transfer line temp:	300 °C
Carrier:	Helium
Scan range:	50-550 *m/z*

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 (6.02 min):	306 (M^+, 2), 288 (13), 277 (33), 259 (37), 216 (100), 201 (41) *m/z*
Bis-TMS (11.76 min):	435 (M^+-Me, 3), 421 (26), 241 (12), 157 (100), 144 (70) *m/z*

The *bis*-TMS derivative of the synthetic material co-elutes on GC-MS with a derivatised comparison sample of 17α-ethyl-5β-estrane-3α,17β-diol and gives a matching mass spectrum.

TLC: Conditions: Kieselgel 60F_{254}. Hexane/ethyl acetate/chloroform (15:10:5)
Single spot observed, R_f = 0.24 (5 sub samples)

IR:

Instrument:	FT-IR, Biorad WIN FTS40
Range:	4000-400 cm^{-1}, neat
Peaks:	3374, 1452, 1378, 1043, 974 cm^{-1}

^{1}H NMR:

Instrument:	Bruker Avance-300
Field strength:	300 MHz
Solvent:	$CDCl_3$ (7.26 ppm)
Key spectral data:	δ 0.87 (3H, s), 0.98 (3H, t), 3.62 (1H, m) ppm

^{13}C NMR:

Instrument:	Bruker Avance-300
Field strength:	75 MHz
Solvent:	$CDCl_3$ (77.2 ppm)
Spectral data:	δ 7.8, 14.5, 23.5, 25.3, 26.1, 26.1, 28.8, 29.7, 31.5, 31.6, 33.7, 35.8, 36.4, 38.5, 40.0, 42.7, 46.6, 49.6, 71.7, 83.6 ppm

Melting point: 183-184 °C

Microanalysis:

Found:	C = 78.2%; H = 11.3% (November, 1998)
Calculated:	C = 78.4%; H = 11.2% (Calculated for $C_{20}H_{34}O_2$)