



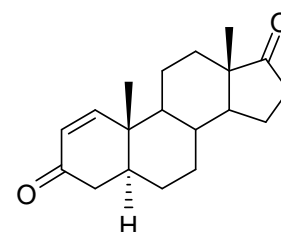
CERTIFIED REFERENCE MATERIAL CERTIFICATE OF ANALYSIS

NMIA D845: 1-Androstendione

Report ID: D845.2021.02 (Ampouled 100330)

Chemical Formula: C₁₉H₂₆O₂

Molecular Weight: 286.4 g/mol



Certified value

Batch No.	CAS No.	Mass per ampoule
03-S-23	571-40-4	981 ± 16 µg

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

IUPAC name: (5α)-Androst-1-ene-3,17-dione.

Expiration of certification: The property values are valid till 14 October 2031, i.e. 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 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 D845. This material was prepared by synthesis, 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 three times with a suitable organic solvent (e.g. *tert*-butyl methyl ether). This will transfer 981 ± 16 µg of anhydrous 1-androstendione. 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 °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 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.
15 November 2022

This report supersedes any issued prior to 15 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 6890/8890
 Column: HP-1, 30 m x 0.32 mm I.D. x 0.25 µm
 Program: 210 °C (20 min), 20 °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:

Initial analysis: Mean = 98.5%, s = 0.02% (7 ampoules in duplicate, April 2010)
 Re-analysis: Mean = 98.5%, s = 0.03% (5 ampoules in duplicate, May 2011)
 Re-analysis: Mean = 98.5%, s = 0.02% (5 ampoules in duplicate, March 2014)
 Re-analysis: Mean = 98.5%, s = 0.01% (5 ampoules in duplicate, February 2017)
 Re-analysis: Mean = 98.6%, s = 0.06% (5 ampoules in duplicate, October 2021)

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

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: HP 6890
 Column: HP-1, 30 m x 0.32 mm I.D. x 0.25 µm
 Program: 210 °C (20 min), 30 °C /min to 300 °C (5 min)
 Injector: 250 °C
 Detector Temp: 320 °C
 Carrier: Helium
 Split ratio: 30/1

Relative mass fraction of main component:

Initial analysis: Mean = 99.3%, s = 0.02% (10 sub samples in duplicate, October 2003)

Thermogravimetric analysis: Volatiles content and non-volatile residue < 0.3% mass fraction (October 2003, February 2006, February 2010)

Karl Fischer analysis: Moisture content < 0.2% mass fraction (February 2010)

Spectroscopic and other characterisation data

GC-MS: Parent compound:
 Instrument: HP 5890/5971A
 Column: BPX-5, 30 m x 0.25 mm I.D. x 0.25 μ m
 Program: 220 °C (2 min), 10 °C /min to 300 °C (5 min)
 Injector: 280 °C
 Transfer line temp: 310 °C
 Carrier: Helium, 1.0 mL/min
 Split ratio: 20/1
Bis-TMS derivative:
 Instrument: Agilent 6890/5973
 Column: Ultra 1, 17m x 0.2mm I.D.x 0.11 μ m
 Program: 189 °C (0.2 min), 3 °C /min to 240 °C, 10 °C /min to 265,
 30 °C /min to 310 °C (3 min)
 Injector: 250 °C
 Transfer line temp: 300 °C
 Carrier: Helium, 1.0 mL/min
 Split ratio: 14:1

The retention times of the parent compound and *bis*-TMS derivative are reported 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 (10.9 min): 286 (M⁺, 18), 244 (33), 202 (17), 147 (17), 122 (100), 109 (41), 91(32), 79 (40) *m/z*
Bis-TMS (10.3 min): 430 (29, M⁺), 415 (94), 223 (14), 221 (15), 194 (29), 179 (17), 147 (16), 73 (100) *m/z*

Note: Treatment with MSTFA/TMSI or neat MSTFA results in the formation of artefact peaks in addition to the derivatised material.

TLC: Conditions: Kieselgel 60F₂₅₄. Chloroform/ethyl acetate (3:1)
 Single spot observed, R_f = 0.54. Visualization with UV light (254 nm)

IR: Instrument: BioRad FTS3000MX FT-IR
 Range: 4000-400 cm⁻¹, KBr powder
 Peaks: 2930, 2854, 1739, 1674, 1467, 1377, 1251, 1049, 780 cm⁻¹

¹H NMR: Instrument: Bruker DMX-600
 Field strength: 600 MHz
 Solvent: CDCl₃ (7.26 ppm)
 Key spectral data: δ 0.90 (3H, s), 1.03 (3H, s), 2.24 (1H, dd, *J* = 2.9, 14.3 Hz), 2.38 (1H, dd, *J* = 11.8, 14.7 Hz), 2.46 (1H, dd, *J* = 7.0, 16.1 Hz), 5.86 (1H, d, *J* = 8.6 Hz), 7.12 (1H, d, *J* = 8.5 Hz) ppm

¹³C NMR: Instrument: Bruker DMX-600
 Field strength: 150.9 MHz
 Solvent: CDCl₃ (77.2 ppm)
 Spectral data: δ 13.0, 13.9, 20.5, 21.7, 27.3, 30.1, 31.4, 35.2, 35.7, 39.0, 40.9, 44.2, 47.8, 50.1, 51.2, 127.6, 157.7, 199.8, 220.5 ppm

Melting point: 140-143 °C

Microanalysis: Found: C = 79.4%; H = 9.2% (December 2003)
 Calculated: C = 79.7%; H = 9.2% (Calculated for C₁₉H₂₆O₂)

- 981 ± 16 μ g Upgrade to 10 years shelf-life