Australian Government
Department of Industry, Science and Resources

National Measurement Institute

NATA
WORLD RECOGNISED ACCREDITATION

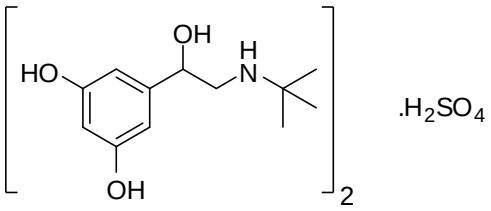
CERTIFIED REFERENCE MATERIAL CERTIFICATE OF ANALYSIS

NMIA M647b: Terbutaline sulfate

Report ID: M647b.2021.02

Chemical Formula: $(C_{12}H_{19}NO_3)_2.H_2SO_4$

Molecular Weight: 548.6 g/mol (HCl)



Certified value

Batch No.	CAS No.	Purity (mass fraction)
11-D-29	**23031-32-5**	**99.7 ± 0.8%**

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

IUPAC name: 5-{1-Hydroxy-2-[(2-methyl-2-propanyl)amino]ethyl}-1,3-benzenediol sulfate**.**

Expiration of certification: The property values are valid till 23 September 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 powder 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.

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 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. 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 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 ^{1}H qNMR on five randomly selected 10-30 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.
12 October 2022

This report supersedes any issued prior to 12 October 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 by qNMR was obtained using the eighteen-proton singlet at 1.35 ppm measured against a certified internal standard of sodium acetate.

Supporting evidence is provided by thermogravimetric analysis, Karl Fischer analysis, headspace GC-MS analysis of occluded solvents and elemental microanalysis.

Karl Fischer analysis:		Moisture content ≤ 0.1% mass fraction (November 2011, November 2013 and November 2016) Moisture content 0.1% mass fraction (September 2021)
Thermogravimetric analysis:		Volatiles content < 0.1% and non-volatile residue < 0.2% mass fraction (November 2011)
QNMR:	Instrument:	Bruker Avance-DMX-600
	Field strength:	600 MHz
	Solvent:	D_2O (4.8 ppm)
	Internal standard:	Sodium acetate (60.1% mass fraction)
	Initial analysis:	Mean (1.38 ppm) = 99.9%, s = 0.3% (5 sub samples, November 2011)
	Initial analysis:	Mean (6.40 ppm) = 100.0%, s = 0.4% (5 sub samples, November 2011)
	Re-analysis:	Mean (1.34 ppm) = 99.0%, s = 0.38% (5 sub samples, November 2013)
	Re-analysis:	Mean (1.35 ppm) = 99.7%, s = 0.25% (5 sub samples, October 2016)

Spectroscopic and other characterisation data

GC-MS:	*Tris*-TMS derivative:	
	Instrument:	Agilent 6890/5973
	Column:	TG-1MS, 30 m x 0.25 mm I.D. x 0.25 µm
	Program:	100 °C (1 min), 15 °C/min to 220 °C, 10 °C/min to 250 °C, 30°C/min to 300°C (3 min)
	Injector:	250 °C
	Split ratio:	20/1
	Transfer line temp:	280 °C
	Carrier:	Helium, 1.0 mL/min
	Scan range:	50-550 *m/z*
	The retention time of the *tris*-TMS derivative 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.	
	Tris-TMS (10.3 min):	426 (3), 356 (91), 336 (4), 280 (6), 265 (4), 147 (4), 86 (100), 75 (24), 73 (53), 57 (13) *m/z*
ESI-MS:	Instrument:	Micromass Quatro LC Micro
	Operation:	Positive ion mode, direct infusion at 10 µL/min
	Ionisation:	ESI spray voltage at 3.5 kV positive ion
	EM voltage:	650 V
	Cone voltage:	15 V
	Peak:	226 ($M+H^+$) *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
	Split ratio:	50/1
	Transfer line temp:	280 °C
	Carrier:	Helium, 1.2 mL/min
	Solvents detected:	Methyl acetate, isopropanol
TLC:	Conditions:	Kieselgel 60F_{254}. Methanol/concentrated ammonia (200/3) Single spot observed, R_f = 0.50. Visualisation with UV at 254 nm.
IR:	Instrument:	Biorad FTS3000MX FT-IR
	Range:	4000-400 cm^{-1}, KBr powder
	Peaks:	3332, 3055, 2973, 2814, 2668, 2505, 1610, 1488, 1343, 1313, 1205, 1158, 1130, 1110, 1054, 975, 857 cm^{-1}
^{1}H NMR:	Instrument:	Bruker Avance III-400
	Field strength:	400 MHz
	Solvent:	D_2O (4.80 ppm)
	Spectral data:	δ 1.38 (18H, s), 3.15 (2H, dd, *J* = 9.7, 12.8 Hz), 3.25 (2H, dd, *J* = 3.2, 12.8 Hz), 4.87 (2H, dd, *J* = 3.2, 9.7 Hz), 6.38 (2H, t, *J* = 2.2 Hz), 6.50 (4H, d, *J* = 2.2 Hz) ppm Isopropanol and methyl acetate were quantified at 0.04% and 0.004% mass fraction respectively.
^{13}C NMR:	Instrument:	Bruker Avance III-400
	Field strength:	101 MHz
	Solvent:	D_2O
	Spectral data:	δ 24.7, 47.4, 57.4, 69.1, 102.5, 105.0, 143.1, 157.1 ppm
Microanalysis:	Found:	C = 52.8%; H = 7.5%; N = 5.2% (January 2012)
	Calculated:	C = 52.5%; H = 7.4%; N = 5.1% (Calculated for $(C_{12}H_{29}NO_3.HCl)_2.H_2SO_4$)