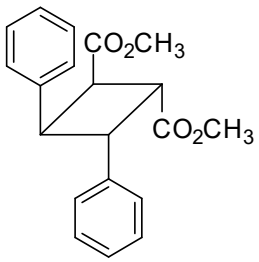
Australian Government
Department of Industry, Science and Resources

National Measurement Institute

NATA
WORLD RECOGNISED ACCREDITATION

CERTIFIED REFERENCE MATERIAL CERTIFICATE OF ANALYSIS

NMIA D953: Dimethyl μ-truxinate



Report ID: D953.2024.02

Chemical Formula: $C_{20}H_{20}O_4$

Molecular Weight: 324.4 g/mol

Certified value

Batch No.	CAS No.	Purity (mass fraction)
10-D-04	**52305-38-1**	**99.8 ± 0.5%**

The uncertainty has been calculated according to ISO 33405 and is stated at the 95% confidence limit (k = 2).

Synonyms: 3,4-Diphenyl-1,2-cyclobutanedicarboxylic acid dimethyl ester
Dimethyl-3,4-diphenylcyclobutane-1,2-dicarboxylate

Expiration of certification: The property values are valid till 22 July 2034, 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 sample bottles that have been opened. In such cases it is recommended that the end-user conduct their own in-house stability trials. The material will be re-tested periodically to ensure that the property values are still valid. In the event a product fails the stability trial, notification will be sent to all impacted customers.

Description: Off-white powder prepared by synthesis, 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 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 ten years. The measurement uncertainty at the 95% coverage 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.

Caution: 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.
3 August 2026

This report supersedes any issued prior to 28 July 2026.

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, 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 qualitative elemental microanalysis.

GC-FID:	Instrument:	Varian CP-3800
	Column:	VF-1MS, 30 m × 0.32 mm I.D. × 0.25 μm
	Program	120 °C (1 min), 20 °C/min to 220 °C (5 min), 30 °C/min to 300 °C (3 min)
	Injector:	200 °C
	Detector Temp:	320 °C
	Carrier:	Helium
	Split ratio:	20/1
	Relative mass fraction of the main component:	
	Initial analysis:	Mean = 99.9%, s = 0.01% (10 sub samples in duplicate, June 2010)
	Re-analysis:	Mean = 99.9%, s = 0.01% (5 sub samples in duplicate, June 2011)
	Re-analysis:	Mean = 99.9%, s = 0.01% (5 sub samples in duplicate, February 2015)
	Re-analysis:	Mean = 99.9%, s = 0.01% (5 sub samples in duplicate, March 2020)
GC-FID:	Instrument:	Varian CP-3800
	Column:	HP-5, 30 m × 0.32 mm I.D. × 0.25 μm
	Program	120 °C (1 min), 20 °C/min to 220 °C (7 min), 30 °C/min to 300 °C (3 min)
	Injector:	200 °C
	Detector Temp:	300 °C
	Carrier:	Helium
	Split ratio:	20/1
	Relative mass fraction of the main component:	
	Initial analysis:	Mean = 99.9%, s = 0.01% (10 sub samples in duplicate, June 2010)
GC-FID:	Instrument:	Agilent 8890
	Column:	HP-1, 30 m × 0.32 mm I.D. × 0.25 μm
	Program	120 °C (1 min), 20 °C/min to 220 °C (5 min), 30 °C/min to 300 °C (3 min)
	Injector:	200 °C
	Detector Temp:	300 °C
	Carrier:	Helium
	Split ratio:	20/1
	Relative mass fraction of the main component:	
	Initial analysis:	Mean = 99.9%, s = 0.07% (5 sub samples in duplicate, July 2024)
Thermogravimetric analysis:		Non volatile residue < 0.1% mass fraction (October 2010). The volatile content (e.g. organic solvents and/or water) could not be analysed accurately because of the inherent volatility of the material.
Karl Fischer analysis:		Moisture content 0.1% mass fraction (June 2010) Moisture content 0.2% mass fraction (June 2011) Moisture content 0.1% mass fraction (February 2015) Moisture content 0.1% mass fraction (March 2020) Moisture content 0.1% mass fraction (July 2024)

Spectroscopic and other characterisation data

GC-MS:	Instrument:	Agilent 6890/5973
	Column:	HP-1ms, 30 m × 0.25 mm I.D. × 0.25 μm
	Program:	180 °C (1 min), 10 °C/min to 300 °C (3 min)
	Injector:	250 °C
	Transfer line temp:	300 °C
	Carrier:	Helium, 1.0 mL/min
	Split ratio:	20/1
	The retention time of the parent compound is reported along 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.	
	16.7 min:	264 (58), 205 (47), 180 (100), 162 (83), 131 (62), 113 (50), 103 (17), 77 (13) m/z
ESI-MS:	Instrument	Micromass Quatro Micro
	Operation:	Positive ion mode, direct infusion at 5 μL/min
	Ionisation:	ESI spray voltage at 3.5 kV positive ion
	EM voltage:	650 V
	Cone voltage:	20 V
	Peak:	347 ($M+Na^+$) *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:	No solvents detected
TLC:	Conditions:	Kieselgel 60F_{254}. Hexane/ethyl acetate (80/20) Single spot observed, R_f = 0.43 Visualization with UV light (254 nm)
IR:	Instrument:	BioRad FTS3000MX FT-IR
	Range:	4000-500 cm^{-1}, KBr powder
	Peaks:	3066, 3030, 2943, 2847, 1736, 1497, 1436, 1318, 1257, 1210, 1181, 1021, 896, 784, 749, 702, 529 cm^{-1}
^{1}H NMR:	Instrument:	Bruker Avance III-400
	Field strength:	400 MHz
	Solvent:	$CDCl_3$ (7.26 ppm)
	Spectral data:	δ 3.32 (6H, s), 3.89 (2H, m), 4.58 (2H, m), 7.16-7.28 (10H, m) ppm
^{13}C NMR:	Instrument:	Bruker Avance DMX-600
	Field strength:	151 MHz
	Solvent:	$CDCl_3$ (77.16 ppm)
	Spectral data:	δ 44.0, 45.0, 51.6, 127.2, 127.3, 128.4, 139.0, 172.6 ppm
Melting point:		119-120 °C
Microanalysis:	Found:	C = 74.1%; H = 6.2% (March 2010)
	Calculated:	C = 74.1%; H = 6.2% (Calculated for $C_{20}H_{20}O_4$)