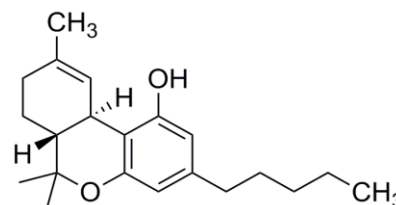


Certificate of Analysis

(±)- Δ^9 -THC

(±)-1-Hydroxy-3-n-amy-6,6,9-trimethyl-6a,10a-trans-6a,7,8,10a-tetrahydrodibenzo[b,d]pyran

Product No.: T-047-1ML
Lot No.: FE06112190
Description: (±)- Δ^9 -THC in n-Heptane (Solution)
Expiration Date: February 2027 See Stability Section
Storage: Store unopened in freezer (-10 °C to -25 °C).
Shipping: Ambient. See Stability Section
Chemical formula: C₂₁H₃₀O₂
CAS No.: 6465-30-1
Regulatory: USDEA Exempt | Canadian TK # 61-1558



Component	Solution Purity	Prepared Concentration
(±)- Δ^9 -THC	86.8% as sum of the enantiomers	100.0 µg/mL

Metrological traceability: Traceable to the SI and higher order standards from NIST through an unbroken chain of comparisons. See "Details on metrological traceability" on page 2.

Measurement method: The value is calculated from high precision weighing of thoroughly characterized starting material.

Intended use: For laboratory and qualitative use only. Not suitable for human or animal consumption.

Minimum sample size: 1 µL for quantitative applications

Instructions for handling and correct use: Concentration is corrected for chromatographic purity, residual water, residual solvents, and residual inorganics. No adjustment required before use. Users should quantitatively transfer desired volume using established good laboratory practices to spike into matrix or to dilute to the desired concentration. Each ampoule is intended for one-time use.

Health and safety information: Danger. Please refer to the Safety Data Sheet for detailed information about the nature of any hazard and appropriate precautions to be taken.

Darron Ellsworth, Quality Assurance Manager

May 31, 2022

Issue Date

Cerilliant Corporation, 811 Paloma Drive, Suite A, Round Rock, TX, 78665, USA,
 Tel: 800-848-7837 / 512-238-9974; www.cerilliant.com
 Sigma-Aldrich Production GmbH is a subsidiary of Merck KGaA, Darmstadt, Germany.



Packaging: 2 mL amber USP Type I glass ampoule containing not less than 1 mL of solution. Ampoules are overfilled to ensure a minimum 1 mL volume can be transferred when using a 1 mL Class A volumetric pipette.

Details on starting materials: Each raw material utilized has been identified and thoroughly characterized through the use of multiple analytical techniques and is assigned a Purity Factor. Spectral data is provided on subsequent pages of this CoA.

Certificate of Origin: Cerilliant Corporation certifies no material of animal origin (BSE/TSE) was used in the preparation of this product. This material is a product of the USA.

Details on metrological traceability:

- ♦ This standard has been gravimetrically prepared using balances that have been fully qualified and calibrated to ISO 17025 requirements. All calibrations utilize NIST traceable weights which are calibrated externally by a qualified ISO 17025 accredited calibration laboratory to NIST standards. Qualification of each balance includes the assignment of a minimum weighing by a qualified and ISO 17025 accredited calibration vendor taking into consideration the balance and installed environmental conditions to ensure compliance with USP tolerances of NMT 0.10% relative error.
- ♦ Fill volume to predetermined specifications is gravimetrically verified throughout the dispensing process using qualified and calibrated balances.
- ♦ The density and material Purity Factor of each raw material is traceable to the SI and higher order reference materials through mass measurement and instrument qualification and calibrations.

Standard Solution Homogeneity

Enantiomer	Area Count (mAU) ¹	%RSD ²
(+)- Δ^9 -THC	630.3	0.4
(-)- Δ^9 -THC	691.0	0.4

¹ Standard solution homogeneity is determined by average area count during random sample analysis by HPLC.

² The %RSD of the new lot demonstrates homogeneity across the lot.

Analyte Certification - Mass Balance Purity Factor

Each analyte is thoroughly identified and characterized using an orthogonal approach. A mass balance purity factor is assigned incorporating chromatographic purity and residual impurities. The mass balance purity factor and salt adjustment are utilized to calculate the weighing adjustment necessary to ensure accuracy of the solution standard concentration.

Material Name:	(±)- Δ^9 -THC	Chemical Formula:	C ₂₁ H ₃₀ O ₂
Material Lot:	FC020608-01	CAS Number:	6465-30-1
		Molecular Weight :	314.46

Material Characterization Summary

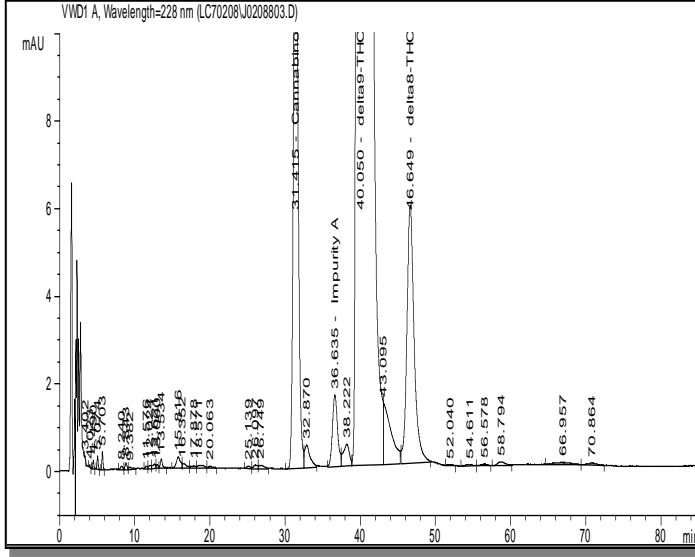
Analytical Test	Method	Results
Chromatographic Purity by HPLC/UV Analysis	20384348	97.7%
Chiral Purity by HPLC/UV Analysis	20398066	ee = 5.48%
Exo-THC Determination by GC/FID	20397988	1.16%
Identity by GC/MS Analysis	20384214	Consistent with Structure
Identity by ¹ H-NMR Analysis	20384224	Consistent with Structure
Residual Solvent Analysis by GC/FID Headspace	20397799 ¹	2.12%
Purity Factor		94.44%

¹ Validated analytical method

- ♦ Purity Factor = [(100 - wt% residual solvent - wt% exo-THC - wt% residual inorganics) x Chromatographic Purity/100].

Spectral and Physical Data

HPLC/UV



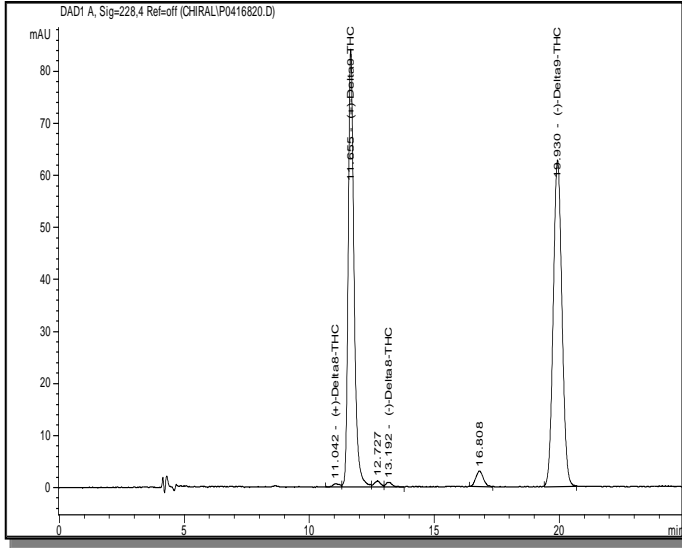
Column: Luna C18, 3.0 μ m, 4.6 x 150 mm
Mobile Phase: Methanol:Water:Tetrahydrofuran (71:24:5)
Flow Rate: 1.0 mL/min
Wavelength: 228 nm

Sample Name: FC020608-01
Acquired: February 07, 2008

Peak #	Ret Time	Area %	
1	3.40	0.00	
2	4.02	0.00	
3	4.49	0.00	
4	5.07	0.01	
5	5.70	0.01	
6	8.24	0.00	
7	8.84	0.01	
8	9.38	0.00	
9	11.58	0.00	
10	12.02	0.01	
11	12.62	0.01	
12	13.00	0.00	
13	13.53	0.01	
14	15.82	0.02	
15	16.35	0.01	
16	17.88	0.00	
17	18.57	0.01	
18	20.06	0.00	
19	25.14	0.00	
20	26.10	0.01	
21	26.75	0.01	
22	31.42	0.56	Cannabinol
23	32.87	0.07	
24	36.64	0.20	
25	38.22	0.07	
26	40.05	97.65	
27	43.10	0.25	
28	46.65	0.99	Δ^8 -THC
29	52.04	0.00	
30	54.61	0.01	
31	56.58	0.01	
32	58.79	0.01	
33	66.96	0.02	
34	70.86	0.01	

Spectral and Physical Data (cont.)

Chiral Purity by HPLC Analysis



Column: Chiralpak AD-H, 5.0 μm
4.6 x 250 mm

Mobile Phase: Isopropanol:Water:Heptane
(31:9:950)

Flow Rate: 0.7 mL/min

Wavelength: 228 nm

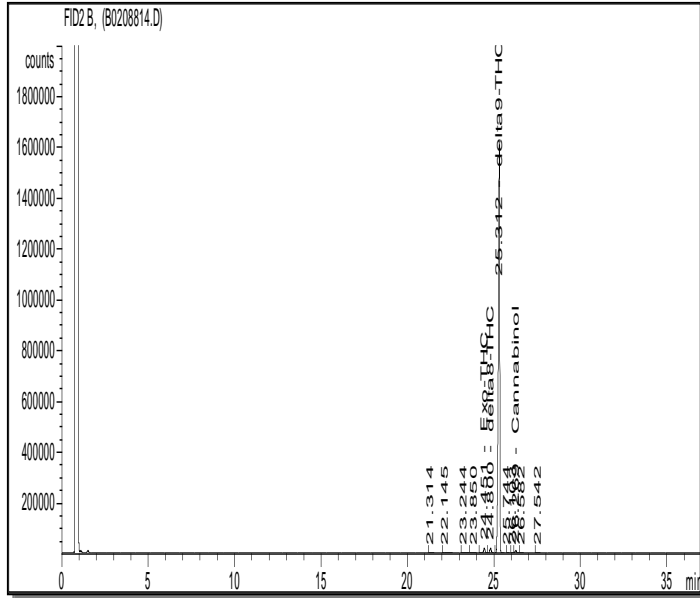
Sample Name: FC020608-01

Acquired: April 16, 2008

Peak #	Compound	Ret Time	Area %
1	(+)-Δ ⁸ -THC	11.04	0.47
2	(+)-Δ ⁹ -THC	11.66	45.42
3	(-)-Δ ⁸ -THC	13.19	0.60
4	(-)-Δ ⁹ -THC	19.93	50.69

%ee : 5.48

exo-THC by GC/FID Analysis



Column: DB-35ms, 30 m x 0.53 mm ID,
1.0 μm film thickness

Temp Program: 60°C to 200°C at 10°C/min
200°C to 280°C at 5°C/min
hold 7 min

Injector Temp: Cool-on-Column

Detector Temp: 325°C

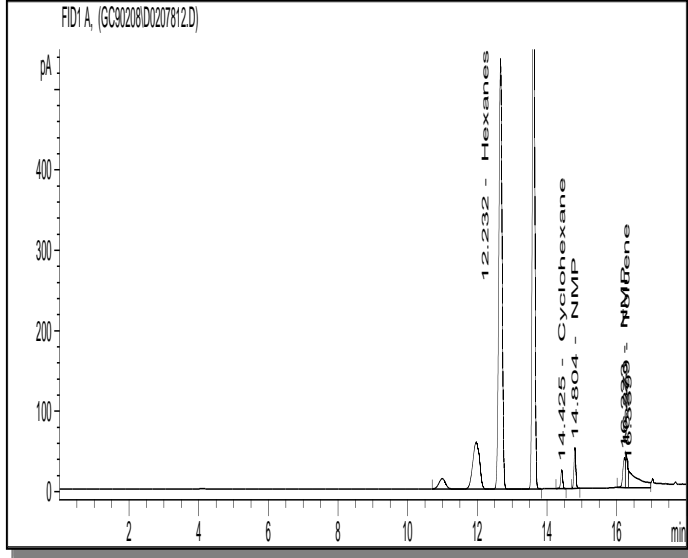
Sample Name: FC020608-01

Acquired: February 08, 2008

Peak #	Ret Time	Area %	Compound
1	21.31	0.01	
2	22.15	0.02	
3	23.24	0.04	
4	23.85	0.09	
5	24.45	1.16	exo-THC
6	24.80	1.13	Δ ⁸ -THC
7	25.31	96.92	Δ ⁹ -THC
8	25.74	0.01	
9	26.10	0.01	
10	26.27	0.56	Cannabinol
11	26.58	0.01	
12	27.54	0.02	

Spectral and Physical Data (cont.)

Residual Solvent Analysis by GC/FID Headspace



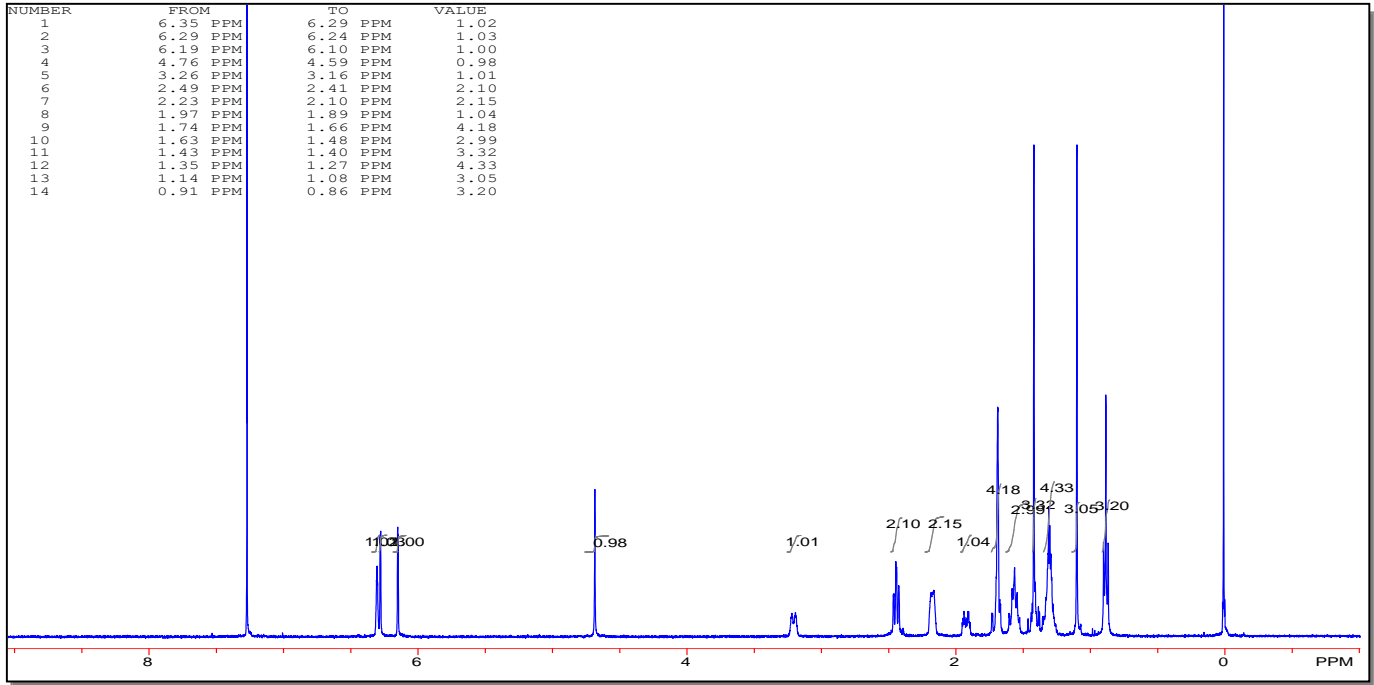
Column: DB-ALC1 30 m x 0.53 mm, 3 µm film thickness
Temp Program: 40°C hold 12 min to 220°C at 40°C/min hold 5.5 min
Carrier Gas: Helium
Flow Rate: 2.0 mL/min
Detector Heater Temp: 250°C
Injector: Headspace Sampler
HS Oven Temp: 60°C
Vial Equilibration: 10 minutes

Sample Name: FC020608-01
Acquired: February 08, 2008

Peak	Compound	Area	Weight %
1	Hexanes	8219.57	0.89
2	Cyclohexane	91.88	0.01
3	Toluene	184.69	0.14
4	Unknown # 1	420.38	1.08
5	NMP	NA	NA
Total			2.12

¹H NMR

Instrument: Bruker 400 DRX
Solvent: Chloroform-D



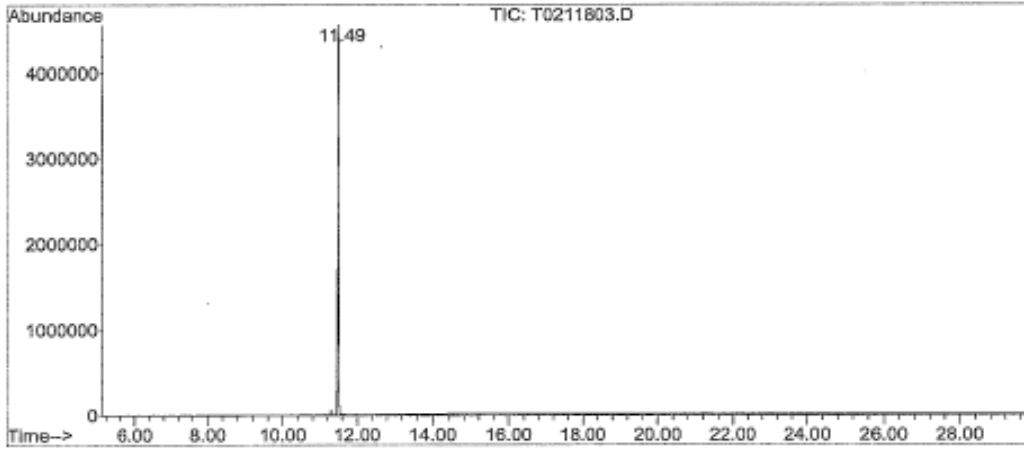
Spectral and Physical Data (cont.)

GC/MS

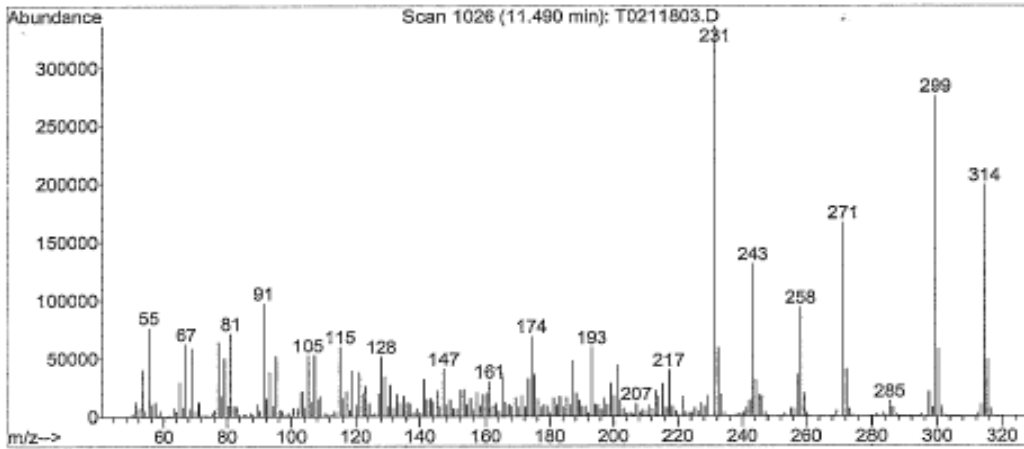
Compound Name : (+)-delta9-THC
Lot Number : FC020608-01
Instrument : Agilent 5973N MSD/6890N GC
Operator-Inst ID : RPC - C10477
Date Reported : Mon Feb 11 12:36:23 2008
Column Type : DB-5ms, 30m x 0.25mm ID, 0.25um film thickness
Temp. Program : 50°C to 200°C@40°C/min, 200°C to 300°C@10°C/min, 16min hold
Injector Temp. : Cool on-column
Carrier Gas : Helium
Flow Rate (mL/min) : 0.80 mL/min
Transfer Line Temp. : 280°C

Scan Range : 50-600

Total Ion Chromatogram



Mass Spectrum



Stability

Short term stability studies have been performed under accelerated conditions for a period of up to four weeks. Short term data is utilized to predict long term stability and to support transport conditions and normal laboratory use. Real-time stability studies are performed at the recommended storage conditions over the life of the product.

Short Term Stability: A summary of accelerated stability findings for this product is listed below.

Storage Condition	Mean Kinetic Temperature (MKT)	Time Period/Result
Freezer	-15°C	No decrease in purity was noted after four weeks.
Refrigerator	4°C	
Room Temperature	21°C	
40°C	40°C	

Transport/Shipping: Stability studies support the transport of this product at ambient conditions.

COA Revision History

Revision No.	Date	Reason for Revision
00	May 31, 2022	Initial version.

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