

Validation of a UPLC Method for Cannabinoids Concentration Quantification in Cannabis Flower

Objective

The purpose of this study is to validate a UPLC method using a Perkin Elmer Altus A-30 UPLC system in the Cannabis Testing Laboratory Branch. This method is used to quantify nine cannabinoids in cannabis flower sample. The nine cannabinoids of interest are CBDA, THCV, CBD, CBG, CBN, THCA, Δ9-THC, Δ8-THC and CBC.

Study Design

This study will follow the FDA's Guidelines for the Validation of Chemical Methods for the FDA FVM Program, 3rd Edition at the level three: multi-laboratory validation.

Nine individual cannabinoid standards were mixed to prepare the mixed cannabinoids standards at concentrations ranging from 0.5 ppm to 100 ppm. A seven-point standard calibration curve was generated for quantitation of the samples. Three samples were weighed out and analyzed from the ground cannabis flower sample for day 1 to evaluate the precision of the method. Another two samples were weighed out and analyzed on day 2, day 3 and day 4, respectively, to evaluate the reproducibility of the method. ACN:Methanol 80:20 was used as method blank. Cellulose powder was used as matrix blank. A mixture of the nine cannabinoids standards was also spiked into blank matrix samples (cellulose powder) as well as the method blank. Recoveries of the cannabinoids were calculated based on these spiked samples. Robustness of the method is evaluated by altering injection volume from 2ul to 3 ul and testing on another matrix, hemp, on day 4. Measurement uncertainty will be calculate using recovery of the matrix spike samples from the 4 different runs.

Materials and Equipment:

Cannabinoids Standards:

1. Cannabidiolic Acid (CBDA), 1.0 mg/ml, Cayman, Lot: 0587881
2. Tetrahydrocannabivarin (THCV), 1.0 mg/ml, Cayman, Lot: 0606999
3. Cannabidiol (CBD), 1.0 mg/ml, Cayman, Lot: 0586575
4. Cannabigerol (CBG), 1.0 mg/ml, Cayman, Lot: 0567652
5. Cannabinol (CBN), 1.0 mg/ml, Cayman, Lot: 0584229
6. Delta9-Tetrahydrocannabinol (Dleta9-THC), 1.0 mg/ml, Cayman, Lot: 0612973
7. Delta8-Tetrahydrocannabinol (Dleta8-THC), Cerilliant, Lot: FE12271903
8. Tetrahydrcannabinolic Acid (THCA), 1.0 mg/ml, Cayman, Lot: 0626035
9. Cannabichromene (CBC), 1.0 mg/ml, Cayman, Lot: 0586327
10. Cannabidiolic Acid (CBDA), 1.0 mg/ml, Cerilliant, Lot: FE02202007
11. Tetrahydrcannabivarin (THCV), 1.0 mg/ml, Cerilliant, Lot: FE10111901
12. Cannabidiol (CBD), 1.0 mg/ml, Cerilliant, Lot: FE10071912
13. Cannabigerol (CBG), 1.0 mg/ml, Cerilliant, Lot: FN03072001
14. Cannabinol (CBN), 1.0 mg/ml, Cerilliant, Lot: FE11211801
15. Delta9-Tetrahydrocannabinol (Dleta9-THC), 1.0 mg/ml, Cerilliant, Lot: FE02072001
16. Delta8-Tetrahydrocannabinol (Dleta8-THC), 1.0 mg/ml, Cerilliant, Lot: FE04282108

17. Tetrahydrocannabinolic Acid (THCA), 1.0 mg/ml, Cerilliant, Lot: FE11102003

18. Cannabichromene (CBC), 1.0 mg/ml, Cerilliant, Lot: FE06152005

Reagents:

1. Water, LC-MS grade
2. Methanol, LC-MS grade
3. Acetonitrile, LC-MS grade
4. Formic Acid, LC-MS grade

Cannabis flower sample (19-01597-CE), ground

Equipment:

1. Analytical balance Mettler Toledo XPE204
2. Disposable glass Pasteur pipette
3. Pipettes and pipet tips (20ul, 100ul, 1ml)
4. Conical polypropylene centrifuge tubes, 50ml
5. Centrifuge (capable of 4000 rpm)
6. Sonicator
7. HPLC vials, amber
8. HPLC caps
9. UPLC, PerkinElmer Altus A-30
10. Column: Waters Cortex C18 2.1 x 100mm, 1.6um
11. Disposable syringes with Luer-Lok tips, 5ml
12. Syringe filter disk, 0.2um PTFE
13. HPLC solvent bottles, 1L
14. Vortex mixer
15. Griffin glass beakers
16. Graduated cylinder

Methods:

LC parameters

1. Column: Restek Raptor ARC-18 2.1 x 150mm, 2.7um
2. Mobile phase A: Water with 0.05% formic acid
Mobile phase B: Acetonitrile with 0.05% formic acid
3. Gradient Program:

Time (min)	Flow rate (mL/min)	% Mobile Phase A	% Mobile Phase B
0	0.4	25	75
7.00	0.4	25	75
7.01	0.4	0	100
9.00	0.4	0	100
9.01	0.4	25	75
12.00	0.4	25	75

4. Flow Rate: 0.4 mL/min
5. Run time: total 12.00 min: 7.00 min + 2 min washing period + 3 min column re-equilibration
6. Column Temperature: 35°C
7. Autosampler Temperature: 15°C
8. Injection Volume: 2 μ l (day 1 to day 3) or 3 μ l (day 4)

PDA detector

1. Spectrum data range: 210 - 400 nm
2. Wavelength for detection:

Compound	Wavelength for detection
CBDA	220 nm
CBG	220 nm
CBD	220 nm
THCV	220 nm
CBN	220 nm
Delta9-THC	220 nm
Delta8-THC	220 nm
CBC	220 nm
THCA	220 nm

Day 0

1. Prepare nine-cannabinoids-mix standards from the first source at concentration of 0.5, 2, 5, 10, 20, 50 and 100 ppm
 - Prepare 100 ppm first source (A) and 10 ppm first source (B) nine-cannabinoids working standards from the 1mg/ml cannabinoids stock standards. Store in freezer under -20 °C before use.
 - Prepare 20, 50 and 100 ppm calibration standards by appropriate dilution of the 100 ppm cannabinoids mix working standards (A) using acetonitrile/methanol (80:20) as diluent.
 - Prepare 0.5, 2, 5 and 10 ppm calibration standards by appropriate dilution of the 10 ppm cannabinoids mix working standards (B) using acetonitrile/ methanol (80:20) as diluent
2. Prepare working standards from the second source at concentration of 100 and 10 ppm.
 - Prepare 100 ppm second source (C) and 10 ppm second source (D), nine-cannabinoids working standards from the 1mg/ml cannabinoids stock standards. Store in freezer under -20 °C before use.
3. Prepare mobile phase A: Water with 0.05% formic acid; B: Acetonitrile with 0.05% formic acid. To prepare mobile phase A, add 0.5 ml formic acid to 1 L water. To prepare mobile phase B, add 0.5 ml formic acid to 1 L Acetonitrile.
4. Prepare matrix blank samples. Weigh 200 mg cellulose powder into 50ml centrifuge tube. Record the weight of the sample. Repeat this procedure to obtain 5 replicate samples (total 5 samples, 2 for day 1, 1 for day 2, 1 for day 3 and 1 for day 4).

5. Prepare cannabis flower and hemp samples. Weigh 200 mg ground flower samples into a 50 ml centrifuge tube. Record the weight of the sample. Repeat this procedure to obtain 9 replicate samples (total 9 samples, 3 for day 1, 2 for day 2, 2 for day 3 and 2 for day 4). Weigh 200 mg ground hemp samples into a 50 ml centrifuge tube. Record the weight of the sample. Repeat this procedure to obtain 3 replicate samples for day 4. Sample extraction and dilution is performed on the day of analysis: Add 40ml of 80:20 ACN:MeOH to each tubes with sample and vortex for 30 seconds to mix. Extract in a sonicating bath with ice for 30 minutes. Centrifuge at 3900 rpm for 15 minutes. Take the top layer liquid and filter each sample through a 0.2 um PTFE filter into an HPLC vial. Then dilute each sample 5 times with 80:20 ACN:MeOH.
6. Prepare matrix spiked samples at 3 spike levels

Matrix Spike sample 1 (MS1): Weigh 200mg cellulose powder into 50ml centrifuge tube. Record the weight of the sample. Add 2 ml 100 ppm 9-mix standards to the tube.

Matrix Spike sample 2 (MS2): Weigh 200mg cellulose powder into 50ml centrifuge tube. Record the weight of the sample. Add 1.4 ml 100 ppm 9-mix standards to the tube.

Matrix Spike sample 3 (MS3): Weigh 200mg cellulose powder into 50ml centrifuge tube. Record the weight of the sample. Add 1 ml 100 ppm 9-mix standards to the tube.

Extract both spike samples in a sonicating bath for 30 minutes. Centrifuge at 3900 rpm for 15 minutes. Take the top layer liquid and filter each sample through a 0.2 um PTFE filter into an HPLC vial.

On day 2, day 3 and day 4, prepare a matrix spike sample following the same procedure as spike sample 3 of day 1, respectively.
7. Prepare method standard sample.

Add 2 ml 100ppm 9-mix standards to the tube with 40ml 80:20 ACN:MeOH. Vortex for 30 seconds to mix.

Extract method standard samples in a sonicating bath for 30 minutes. Centrifuge at 3900 rpm for 15 minutes. Filter each sample through a 0.2 um PTFE filter into an HPLC vial.
8. Prepare post-dilution spike sample

Add the last step of sample dilution, add 25 ul sample extract and 200 ul 100 ppm 9-mix standards, then add 275 ul 80:20 ACN:MeOH. This is spiking 40 ppm of each cannabinoids to 20x dilution of the extracted flower sample.

Day 1

1. Extract and dilute 1 method blank, 2 matrix blanks, 1 method standard, 2 matrix spikes (3 levels in cellulose powder), 3 replicates of flower sample and 1 post dilution spike in flower sample.
2. Equilibrate the UPLC system with the mobile phases. Set injection volume at 2 ul.
3. Inject the standards used to generate the seven-point calibration curve and ICV sample using a set of second-source cannabinoids standards (CRM).
4. Inject the samples, including the 1 method blank, 2 matrix blanks, 1 method standard, 3 matrix spikes (3 levels in cellulose powder), 3 replicates of flower sample and 1 post dilution spike in flower sample.
5. After every 10 injections, re-inject a check standard using one of the calibration standards and a solvent blank (80:20 ACN: MeOH) for quality control purposes.
6. At the end of the run, re-inject a check standard using one of the calibration standards and a blank for quality control purposes

Day 2

1. Extract and dilute 1 method blank, 1 matrix blanks, 1 matrix spike sample (1 level in cellulose powder), 2 replicates of flower sample and 1 post dilution spike in flower sample.
2. Equilibrate the UPLC system with the mobile phases. Set injection volume at 2 ul.
3. Inject the standards used to generate the seven-point calibration curve and ICV sample using a set of second-source cannabinoids standards (CRM).
4. Inject the samples, including the 1 method blank, 1 matrix blanks, 1 matrix spike sample (1 level in cellulose powder), 2 replicates of flower sample and 1 post dilution spike in flower sample.
5. After every 10 injections, re-inject a check standard using one of the calibration standards and a solvent blank (80:20 ACN: MeOH) for quality control purposes.
6. At the end of the run, re-inject a check standard using one of the calibration standards and a blank for quality control purposes.

Day 3

1. Extract and dilute 1 method blank, 1 matrix blanks, 1 matrix spike sample (1 level in cellulose powder), 2 replicates of flower sample, and 1 post dilution spike in flower sample.
2. Equilibrate the UPLC system with the mobile phases. Set injection volume at 2 ul.
3. Inject the standards used to generate the seven-point calibration curve and ICV sample using a set of second-source cannabinoids standards (CRM).
4. Inject the samples, including the 1 method blank, 1 matrix blanks, 1 matrix spike sample (1 level in cellulose powder), 2 replicates of flower sample and 1 post dilution spike in flower sample.
5. After every <10 injections, re-inject a check standard using one of the calibration standards and a solvent blank (80:20 ACN: MeOH) for quality control purposes.
6. At the end of the run, re-inject a check standard using one of the calibration standards and a blank for quality control purposes.

Day 4 – alter injection volume, test on another matrix (hemp)

1. Extract and dilute 1 method blank, 1 matrix blanks, 1 matrix spike sample (1 level in cellulose powder), 2 replicates of flower sample, 1 post dilution spike in flower sample and 3 replicates of hemp sample.
2. Equilibrate the UPLC system with the mobile phases. Set injection volume at 3 ul.
3. Inject the standards used to generate the seven-point calibration curve and ICV sample using a set of second-source cannabinoids standards (CRM).
4. Inject the samples, including the 1 method blank, 1 matrix blanks, 1 matrix spike sample (1 level in cellulose powder), 2 replicates of flower sample, 3 replicates of hemp sample and 1 post dilution spike in flower sample.
5. After every <10 injections, re-inject a check standard using one of the calibration standards and a solvent blank (80:20 ACN: MeOH) for quality control purposes.
6. At the end of the run, re-inject a check standard using one of the calibration standards and a blank for quality control purposes

Acceptance Criteria

Calibration curves should have correlation coefficient >0.99. All the calibration check standards should be within 80-120% recovery. Matrix Spikes and post dilution spikes should be within 70-130% recovery. Method standard should be within 80-120% recovery.

Results and Discussion:

Calibration curve and range: 7 data points (not including 0) for all analytes ranges from 0.5 ppm - 100 ppm, using linear regression with 1/x weighting, R² value for all analytes are greater than 0.99.

Accuracy

Accuracy is assessed by the recovery of the QC samples below:

ICV: Initial calibration verification, second source standards (CRMs) run after calibration curve, recovery within 80-120%, please see attached QC reports for day 1 to day 4

CCV: Continuing calibration verification run after every <10 samples, recovery within 80-120%, please see attached QC reports for day 1 to day 5

Method standard (CRM) recovery: using Cannabinoids CRMs, 80-120%

Recovery% = Found/Amount Spiked X 100

Table 1: Recovery of Method Standard (CRM)

	Recovery								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
Method Std	0.1927	0.1925	0.1858	0.1863	0.1814	0.1909	0.1898	0.1860	0.1954
Found (mg)	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000
Amount Spiked (mg)	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000
Recovery	96%	96%	93%	93%	91%	95%	95%	93%	98%

Matrix spikes recovery: 70-130 % at two different spike levels using Cannabinoids CRMs

Recovery % = Found/Amount Spiked X 100

Table 2: Recovery of Matrix Spike

	Matrix Spike								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
Level 1	0.1943	0.1884	0.1867	0.1884	0.1880	0.1892	0.1888	0.1920	0.1893
Found (mg)	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000
Amount Spiked (mg)	97%	94%	93%	94%	94%	95%	94%	96%	95%
Recovery	101%	98%	93%	93%	94%	99%	99%	99%	99%
Level 2	0.1409	0.1375	0.1300	0.1303	0.1321	0.1381	0.1388	0.1392	0.1381
Found (mg)	0.1400	0.1400	0.1400	0.1400	0.1400	0.1400	0.1400	0.1400	0.1400
Amount Spiked (mg)	101%	98%	93%	93%	94%	99%	99%	99%	99%
Recovery	0.1006	0.0987	0.0969	0.0971	0.0986	0.0980	0.0970	0.1000	0.0979
Level 3	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000
Found (mg)	101%	99%	97%	97%	99%	98%	97%	100%	98%
Amount Spiked (mg)	101%	99%	97%	97%	99%	98%	97%	100%	98%

Post dilution spike recovery: 70-130% using Cannabinoids CRMs

Recovery% = (Spiked – Unspiked/2)/Amount Spiked X 100

Table 3: Recovery of Post-dilution Spike

	Post-dilution Spike in 20x Sample Extract								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
Unspiked 10x (mg/L)	0.00	0.00	0.00	1.17	1.92	28.75	1.63	48.89	0.50
Spiked 20x (mg/L)	42.66	42.09	39.59	39.96	40.51	56.37	42.27	67.36	41.70
Amount Spiked (mg/L)	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Recovery	107%	105%	99%	98%	99%	105%	104%	107%	104%

Cannabinoids Concentration in flower samples:

All nine cannabinoids are identified in the cannabis flower sample. CBD is below the reporting limit. The reporting limit is calculated from the lowest calibration standards, 0.5 ppm, which is equivalent to 0.100 mg/g for CBDA, CBD, THCV, CBG, CBC, Δ8-THC and CBN in the sample, and 1 mg/g for THCA and Δ9-THC. All raw data and calculation can be viewed in the attached spreadsheet.

Table 4: Concentration of nine cannabinoids in sample on day 1 (mg/g)

	Cannabinoids Concentration in Sample (mg/g)								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
F1-1	0.477	0.450	NF*	2.424	4.107	60.29	3.800	104.70	0.976
F1-2	0.459	0.456	NF*	2.338	3.834	57.29	3.612	99.19	0.912
F1-3	0.453	0.436	NF*	2.342	3.844	57.10	3.642	97.10	0.911
Avg	0.463	0.447	<RL**	2.368	3.929	58.22	3.684	100.33	0.933
RL	0.100	0.100	0.100	0.100	0.100	1.00	0.100	1.00	0.100

NF*: Not found.

RL**: Reporting limit.

Intra-Day Precision

Table 5 listed the intra-day precision data.

Table 5: RSD of concentration of nine cannabinoids in sample measured in day 1

	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
RSD	2.7%	2.3%	NA*	2.1%	3.9%	3.1%	2.7%	3.9%	4.0%

*NA: Not applicable.

Sensitivity

Sensitivity is the smallest amount of analytes in a sample that can be accurately measured by the method. It is shown by analyzing blanks and lowest level matrix spike samples (0.1 mg/g) – LOD samples. LOD samples were prepared by Spike 20 ug of cannabinoids to blank matrix (cellulose powder), go through all sample prep procedures, this is equivalent to 0.1 mg/g in flower sample and 0.5 ppm in vial (lowest calibration point), prepare 7 sample replicates separately and run them in one sequence, calculate the LOD from the standard deviation ($LOD = t \times S$, where $t=3.14$ for 7 replicates at 99% confidence level). LOQ = 3 x LOD, should be in calibration curve and 1.0 mg/g or lower for all cannabinoids analyzed and reported.

Method Blank and Matrix Blank

ACN:MeOH 80:20 was used as the method blank. Cellulose powder was used as the matrix blank. No cannabinoids peaks were identified in those blank sample.

LOD and LOQ:

LOD in sample = LOD x 0.04/0.2

LOQ in sample = 3 x LOD in sample

Table 6: LOD and LOQ

	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
LOD-1 (mg/L)	0.607	0.694	0.764	0.677	0.511	0.571	0.498	0.502	0.541
LOD-2 (mg/L)	0.624	0.612	0.592	0.559	0.517	0.528	0.445	0.464	0.528
LOD-3 (mg/L)	0.628	0.54	0.531	0.534	0.502	0.528	0.534	0.479	0.567
LOD-4 (mg/L)	0.612	0.562	0.509	0.503	0.513	0.534	0.526	0.506	0.555
LOD-5 (mg/L)	0.604	0.563	0.531	0.522	0.516	0.537	0.522	0.472	0.544
LOD-6 (mg/L)	0.589	0.552	0.605	0.589	0.511	0.534	0.426	0.448	0.559
LOD-7 (mg/L)	0.581	0.541	0.539	0.532	0.509	0.58	0.595	0.466	0.555
Standard deviation (S)	0.017	0.056	0.088	0.059	0.005	0.022	0.057	0.021	0.013
LOD (mg/L)	0.054	0.175	0.275	0.184	0.016	0.068	0.179	0.066	0.041
LOQ (mg/L)	0.161	0.524	0.826	0.553	0.047	0.203	0.538	0.197	0.123
LOD in sample (mg/g)	0.011	0.035	0.055	0.037	0.003	0.014	0.036	0.013	0.008
LOQ in sample (mg/g)	0.032	0.105	0.165	0.111	0.009	0.041	0.108	0.039	0.025

Reproducibility

Reproducibility is assessed by analyzing cannabis sample replicates on 3 different days to compare results (sample replicates are prepared separately). The average cannabinoids concentrations of each day are calculated. The RSD of cannabinoids concentrations are calculated for the day 1 to day 3.

Table 7: Cannabinoids Concentration for samples analyzed on 3 different days

	Cannabinoids Concentration in Sample (mg/g)								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
Day1	0.463	0.447	<RL	2.368	3.929	58.224	3.684	100.331	0.933
Day2	0.455	0.423	<RL	2.286	3.875	56.543	3.592	97.986	0.922
Day3	0.446	0.440	<RL	2.240	3.842	55.072	3.834	97.837	0.898
RSD	1.89%	2.81%	NA	2.82%	1.12%	2.79%	3.30%	1.42%	1.94%

Note: The concentration of each cannabinoid is the average of the samples analyzed in each day.

Robustness

Robustness is evaluated by 1. altering injection volume (2 ul vs 3 ul) and 2. testing on another matrix, hemp on day 4.

Results in Table 8 show that when applying a different injection volume, the method is still robust.

Table 8: Comparison for using less sample weight

	Cannabinoids Concentration in Sample (mg/g)								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
Day 1-3*	0.456	0.438	<RL	2.308	3.889	56.843	3.701	98.948	0.920
Day 4	0.463	0.450	<RL	2.344	4.004	56.939	3.616	101.752	0.928
RPD	1.57%	2.69%	NA	1.53%	2.93%	0.17%	2.33%	2.79%	0.90%

Day1-3*: Average of all samples from day 1 to day 3.

Results in Table 9 show that the cannabinoids concentrations determined in this work do not have significant difference from those in CoA. The RPDs are all below 20%.

when applying the same method on hemp, the method is still robust.

Table 9: Comparison of the cannabinoids concentrations in hemp determined in this work and from CoA

Day 4	Cannabinoids Concentration in Sample (mg/g)								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
UPLC*	65.887	<RL	54.775	1.685	0.267	3.150	0.161	0.923	3.576
CoA**	67.160	NA	52.300	1.425	0.267	2.987	NA	1.078	3.193
PD***	1.9%	NA	4.7%	18.2%	0.0%	5.5%	NA	14.4%	12.0%

UPLC*: The concentration of each cannabinoid is the average in all hemp samples in day 4.

CoA**: The concentration of each cannabinoid is from the CoA provided by the seller.

PD***: Percentage difference.

Retention Time Study

In general, the retention times of all the nine cannabinoids in this method are stable. Standard deviation of retention time was calculated using all seven calibration standards for each day of validation. The standard deviations of all nine cannabinoids are smaller or equal to 0.02 min (see in Table 10). This demonstrates a good stability of the retention times in this method. The resolution of retention time was calculated using the highest calibration standard (100 ppm) for day 1 to day 3. The resolutions of the peaks are all above 1.3, which demonstrates an acceptable separation.

Table 10: Retention time study for the nine cannabinoids in four different days

	Day 1	Day 2	Day 3	Day 4	AVG	STDEV	Resolution*	Diff. 2 peaks**	2.5% AVG
CBDA	2.16	2.17	2.16	2.17	2.16	0.004			0.05
CBG	2.38	2.39	2.38	2.39	2.38	0.006	3.4	0.22	0.06
CBD	2.51	2.53	2.52	2.53	2.52	0.006	2.0	0.14	0.06
THCV	2.71	2.73	2.72	2.73	2.72	0.006	2.8	0.20	0.07
CBN	3.65	3.67	3.67	3.68	3.67	0.011	11.5	0.94	0.09
Delta9-THC	4.57	4.59	4.59	4.60	4.59	0.015	9.1	0.92	0.11
Delta8-THC	4.72	4.74	4.74	4.76	4.74	0.016	1.3	0.15	0.12
CBC	5.67	5.70	5.70	5.72	5.70	0.020	7.6	0.96	0.14
THCA-A	6.12	6.15	6.14	6.16	6.14	0.015	2.9	0.44	0.15

Resolution*: The resolution of the peak and the previous peak.

Diff. 2 peaks*: The retention time difference between the peak and the previous peak.

The retention time acceptance window of each cannabinoid was then calculated using the average retention time of the calibration standards in the same run of the samples. The acceptance window is set as the average retention time +/- 2.5% of the average retention time. The retention time acceptance windows on day 1 are given in Table 11 and the windows for the other days can be find in the attached spread sheets.

Table 11: Retention time acceptance window on day 1

	Average	Acceptance Window (Avg ± 2.5%Avg)	Control Limit
CBDA	2.16	2.16 ± 0.05	2.10 - 2.21
CBG	2.38	2.38 ± 0.06	2.32 - 2.43
CBD	2.51	2.51 ± 0.06	2.45 - 2.58
THCV	2.71	2.71 ± 0.07	2.65 - 2.78
CBN	3.65	3.65 ± 0.09	3.56 - 3.74
Δ9-THC	4.57	4.57 ± 0.11	4.45 - 4.68
Δ8-THC	4.72	4.72 ± 0.12	4.60 - 4.84
CBC	5.67	5.67 ± 0.14	5.53 - 5.81
THCA	6.12	6.12 ± 0.15	5.97 - 6.28

Measurement Uncertainty

Measurement Uncertainty for this method is calculate using recovery of the matrix spike samples from 4 different runs (MS3 from day 1, MS from day 2, day 3 and day 4).

Table 12: Cannabinoids Concentration in Matrix Spike samples on 5 different days

Matrix Spike	Cannabinoids Concentration in Matrix Spike (mg/g)								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
Day 1	0.0025	0.0025	0.0024	0.0024	0.0025	0.0024	0.0024	0.0025	0.0024
Day 2	0.0026	0.0024	0.0024	0.0024	0.0024	0.0025	0.0025	0.0026	0.0026
Day 3	0.0025	0.0025	0.0023	0.0024	0.0023	0.0025	0.0024	0.0024	0.0025
Day 4	0.0026	0.0025	0.0024	0.0024	0.0024	0.0025	0.0025	0.0024	0.0026
RSD	1.68%	1.52%	1.15%	0.78%	2.29%	1.69%	2.12%	3.86%	2.73%

Measurement Uncertainty = 2 x RSD at 95% confidence level

Table 13: Measurement Uncertainty for the 9 cannabinoids

	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
Measurement Uncertainty	3.4%	3.0%	2.3%	1.6%	4.6%	3.4%	4.2%	7.7%	5.5%

Conclusion

This UPLC method is suitable for measuring the nine cannabinoids concentration (CBDA, THCV, CBD, CBG, CBN, Δ9-THC, Δ8-THC, THCA and CBC) in cannabis flower sample.

Reference

1. Guidelines for the Validation of Chemical Methods in Food, Feed, Cosmetics, and Veterinary Products, 3rd Edition, US Food & Drug Administration, October 2019

Validation Data Package

All the data, calculation and reports can be found in G:\MCSB\CTLB\Potency\Cannabinoids UPLC Validation_Mar2022.

Department of Cannabis Control - Cannabis Testing Laboratory Branch

Method Validation and Verification Plan

GO-019 W1

Validation

Verification

I. REQUEST AND APPROVAL

A. Customer Requirements

Communicated by (Name and Organization): Miaotian Sun	
Received by: Gordon Vrdoljak	Date: 3/8/2022
General Description and Intended Use: Quantify 9 cannabinoids in cannabis flower samples accurately and selectively	
Proposed Scope (e. g. sample types and matrices, target analyte range, etc.): Cannabis flower sample, 9 cannabinoids (THCA, CBD, CBDA, CBN, CBG, THCV, CBC, delta-8 and delta-9 THC), range from 0.1mg/g-1000mg/g in sample	
Performance requirements and other relevant needs: Demonstrate method performance by calibration range, accuracy, precision, sensitivity, selectivity, reproducibility, robustness, LOD and LOQ	

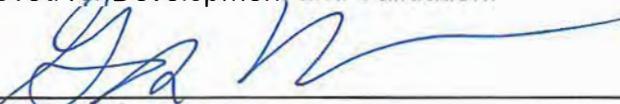
B. Review of Capabilities and Resources:

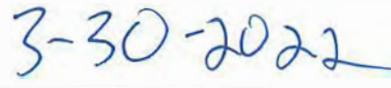
Estimate needed resources for new work.			
1. Adequate Numbers of Trained or Appropriate Staff?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	
2. Validated Method?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
3. Adequate and Safe Laboratory Space?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	N/A <input type="checkbox"/>
4. Adequate and Appropriate Instrumentation?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	N/A <input type="checkbox"/>
5. Adequate Equipment, Reagents, Standards and Supplies?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	N/A <input type="checkbox"/>

Additional Comments:

C. Request Approval

Approved for Development and Validation:


Branch Chief


Date

Department of Cannabis Control - Cannabis Testing Laboratory Branch

Method Validation and Verification Plan

GO-019 W1

II. PLAN

Team Members: Miaotian Sun, Yun Wang	
Scope of work (method development, validation, verification, modification, extension, etc): To validate a UPLC method to determine the concentrations of 9 cannabinoids in cannabis flower samples.	
Source of method description (if applicable): Developed in house	
CTLB SOP#: CM-XXX	Title: Determination of Cannabinoids Concentration by UPLC
Start date: 3/14/2022	Planned End Date: 3/25/2022

III. PARAMETERS

A. Description

How performed (i.e. general description): Validate the method in cannabis flower matrix according to level 1 requirements in FDA FVM validation guideline 3rd Ed, Oct 2019 and DCC regulation requirements
Types and number of samples to be tested: 1 Cannabis flower sample (5 replicates), 1 method blank, 2 matrix blank (cellulose), 1 method standard, 2 matrix spikes (2 levels in cellulose), 1 post dilution spike in flower samples, ICV (2nd source), CCVs and solvent blanks (every 10 samples)
Additional reference standards or materials used (if not specified in method):

B. Characteristics and Requirements

<small>Calibration curve and range: 7 data points (not including 0) for all analytes ranges from 0.5-100ppm. using linear regression with 1/x weighting, R² value for all analytes are greater than 0.99. Accuracy is assessed by the recovery of the QC samples below: (CV: Initial calibration verification, second source standards (CRMs) run after calibration curve, recovery within 80-120% CV: continuing calibration verification, every 10 samples, recovery within 80-120% Matrix standard containing Cannabinoids CRMs 10-120% Matrix spikes recovery: 70-130% at two different spike levels using Cannabinoids CRMs Post dilution spike recovery: 70-130% using Cannabinoids CRMs Precision is evaluated by calculating the RSD% of the 3 replicate samples run on the same day, RSD% within 20% Sensitivity is the smallest amount of analytes in a sample that can be accurately measured the method. It is shown by analyzing blanks and lowest level matrix spike samples (0.5 mg/g). The lowest level matrix spike samples recovery should be within 50-100%. The blanks to be analyzed in the method validation are: Sample: 1 Method blank and right after calibration curve and after every 10 samples to show no carry over. 1 Method blank and 2 Matrix blank (cellulose powder) Selectivity is the extent to which a method can determine particular analyte(s) in a matrix without interferences from other components of similar behavior. The selectivity of this method is achieved by separating all 9 cannabinoids based on their retention times. Retention Time Acceptance Window: The retention time acceptance window of each cannabinoid is calculated using the average retention time of the calibration standards in the same run of the samples. The acceptance window is set as the average retention time +/- 2.5% of average retention time. LOD: Spike 0.5 mg/g of cannabinoids to blank matrix (cellulose powder), go through all sample prep procedures, this is equivalent to 0.1 mg/g in flower sample and 0.5 ppm in vial (lowest calibration point), prepare 7 sample replicates separately and run them in one sequence, calculate the LOD from the standard deviation (LOD = 3 x S, where t=3.14 for 7 replicates at 95% confidence level) LOQ: LOQ = 3 x LOD, should be in calibration curve and 1.0 mg/g or lower for all cannabinoids analyzed and reported. Reproducibility is assessed by analyzing cannabis sample replicates on 3 different days to compare results (sample replicates are prepared separately) Day 1 includes 1 method blank, 2 matrix blanks, 1 method standard (5 ppm in vial), 3 matrix spikes in cellulose powder (3 levels, 5, 5.5 and 2.5 ppm in vial), 3 replicates of flower sample (2 dilutions each), 1 post dilution spike in flower sample, ICV, CCVs and solvent blanks; Day 2 includes 1 method blank, 1 matrix blank, 1 matrix spike (1 level in cellulose powder), 2 duplicates of flower samples, ICV, CCVs and solvent blanks; Day 3 will be a repeat of day 2. RSD% of the results for the flower samples between 3 days is within 20%. Robustness is evaluated by 1. altering injection volume (2 uL vs 3 uL) and 2. testing on another matrix, hemp oil on day 4. Day 4 includes 1 method blank, 1 matrix blank, 1 matrix spike (1 level in cellulose powder), 2 duplicates of flower samples, 3 replicates of hemp samples. Measurement Uncertainty will be calculated using recovery of the matrix spike samples from 4 different runs.</small>
--

Approved by (Branch Chief, written signature not required)

3-3-2022

Date

Department of Cannabis Control - Cannabis Testing Laboratory Branch

Method Validation and Verification Plan

GO-019 W1

- IV. RESULTS (accuracy and range required if applicable: attach or refer to logbooks, sample data packets as relevant, state result and acceptable/unacceptable for each matrix/sample type)

Matrix/Sample type	Results	Acceptable (Y/N)
Cannabis flower, cellulose powder, hemp	-Calibration correlation coefficient >0.99	Y
Cannabis flower, cellulose powder, hemp	-Calibration check standards within 80-120% recovery	Y
Cannabis flower, cellulose powder, hemp	-Spikes within 70-130% recovery	Y
Cannabis flower, cellulose powder, hemp	-Method standards within 80-120% recovery	Y

Additional Comments: All results (e.g., accuracy and range) are included in the attached data packets.

- V. ESTIMATE OF MEASUREMENT UNCERTAINTY (if applicable): N/A

Measurement uncertainty is in the range of 1.6 - 7.7% for 9 cannabinoids.

- VI. APPROVAL/DISAPPROVAL

Analytical method IS suitable for its intended use.

is/is not


Branch Chief (written signature not required)


Date

Validation Plan for Cannabinoids testing in flower by Perkin Elmer Altus A-30

- Characteristics and Requirements

Calibration curve and range: 7 data points (not including 0) for all analytes ranges from 0.5-100ppm, using linear regression with 1/x weighting, R² value for all analytes are greater than 0.99.

Accuracy is assessed by the recovery of the QC samples below:

ICV: Initial calibration verification, second source standards (CRMs) run after calibration curve, recovery within 80-120%

CCV: continuing calibration verification run after every 10 samples, recovery within 80-120%

Method standard recovery: using Cannabinoids CRMs, 80-120%

Matrix spikes recovery: 70-130% at two different spike levels using Cannabinoids CRMs

Post dilution spike recovery: 70-130% using Cannabinoids CRMs

Precision is evaluated by calculating the RSD% of the 3 replicate samples run on the same day, RSD% within 20%

Sensitivity is the smallest amount of analytes in a sample that can be accurately measured by the method. It is shown by analyzing blanks and lowest level matrix spike samples (0.5 mg/g). The lowest level matrix spike samples recovery should be within 50-100%. The blanks to be analyzed in the method validation are:

Solvent blanks: run right after calibration curve and after every 10 samples to show no carry over.

1 Method blank and

2 Matrix blank (cellulose powder)

Selectivity is the extent to which a method can determine particular analyte(s) in a matrix without interferences from other components of similar behavior. The selectivity of this method is achieved by separating all 9 cannabinoids based on their retention times.

Retention Time Acceptance Window: The retention time acceptance window of each cannabinoid is calculated using the average retention time of the calibration standards in the same run of the samples. The acceptance window is set as the average retention time +/- 2.5% of the average retention time.

LOD: Spike 0.02 mg of cannabinoids to blank matrix (cellulose powder), go through all sample prep procedures, this is equivalent to 0.1 mg/g in flower sample and 0.5 ppm in vial (lowest calibration point), prepare 7 sample replicates separately and run them in one sequence, calculate the LOD from the standard deviation (LOD = t x S, where t=3.14 for 7 replicates at 99% confidence level)

LOQ: LOQ = 3 x LOD, should be in calibration curve and 1.0 mg/g or lower for all cannabinoids analyzed and reported.+

Reproducibility is assessed by analyzing cannabis sample replicates on 3 different days to compare results (sample replicates are prepared separately)

Day 1 includes 1 method blank, 2 matrix blanks, 1 method standard (5 ppm in vial), 3 matrix spikes in cellulose powder (3 levels, 5, 3.5 and 2.5 ppm in vial), 3 replicates of flower sample (2 dilutions each), 1 post dilution spike in flower sample, ICV, CCVs and solvent blanks;

Day 2 includes 1 method blank, 1 matrix blank, 1 matrix spike (1 level in cellulose powder), 2 duplicates of flower samples, ICV, CCVs and solvent blanks;

Day 3 will be a repeat of day 2.

RSD% of the results for the flower samples between 3 days is within 20%.

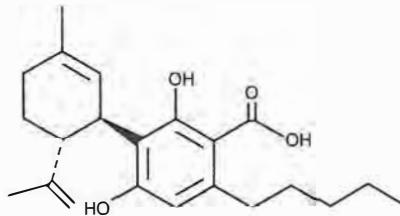
Robustness is evaluated by 1. altering injection volume (2 ul vs 3 ul) and 2. testing on another matrix, hemp on day 4. Day 4 includes 1 method blank, 1 matrix blank, 1 matrix spike (1 level in cellulose powder), 2 duplicates of flower samples, 3 replicates of hemp samples, ICV, CCVs and solvent blanks.

Measurement Uncertainty will be calculate using recovery of the matrix spike samples from 4 different runs.

CERTIFICATE of ANALYSIS

Cannabidiolic Acid (CRM)

Certified Reference Material



ACCREDITED
ISO/IEC 17025 #AT-1773
ISO 17034 #AR-1774

Item No.: 18090

Batch No.: 0587881

CAS Registry No.: 1244-58-2

Molecular Formula: C₂₂H₃₀O₄

Formula Weight: 358.50 amu

Expiry Date: 02MAY2022 (valid from date of certification)

Supplied as: A 1 mg/ml (nominal) solution in acetonitrile

Volume per Ampule: Not less than 1 ml. Ampules are overfilled.

Storage: Unopened at -20°C.

Safety: Refer to Safety Data Sheet

Intended Use: For analytical testing purposes only, not intended for human or animal use.

Instructions for Use: This product is designated for one-time use and should be used immediately after opening. It is advised that laboratories warm the vial to room temperature prior to opening and use measured volumes.

Certified Concentration · 1.000 mg/ml ± 0.012 mg/ml

Concentration is calculated based on product mass, solution mass, corrected purity, and density at 20°C. It is traceable to SI units through an unbroken chain of measurements. Uncertainty of concentration is expressed as an expanded uncertainty in accordance with ISO standards for Testing Laboratories and Reference Material Producers at the approximate 95% confidence interval using a coverage factor of k=2 and incorporates uncertainties from the corrected purity, solution preparation, homogeneity, and long- and short-term stability. Concentration was verified by comparison to an independently prepared calibration standard.

Corrected Purity · 99.45% ± 0.56%

Corrected purity is determined as follows: Corrected Purity = [(100 - % LOD - % ROI)*Chromatographic Purity/100] or [(100 - % KF - % RS - % ROI)*Chromatographic Purity/100]. All measurement uncertainties are expressed as expanded uncertainties in accordance with ISO standards for Testing Laboratories and Reference Material Producers at the approximate 95% confidence interval using an appropriate coverage factor. Where applicable, optical rotation, chiral purity, and/or isotopic purity testing are performed to support the identification of the reference material, therefore the uncertainty is considered null.

Approval:

Title: ISO Quality Manager

Certification Date: 02MAY2020

Cayman Chemical certifies that this standard meets the specifications stated in this certificate and warrants this product to meet the stated acceptance criteria through the expiration date when stored unopened as recommended.





CERTIFICATE of ANALYSIS

CRM Assay

Method Parameters

Cayman Method	TST SD173
Column	4.6 x150 mm, 2.7 µm NexLeaf CBX
Mobile Phase	A: 0.17% Phosphoric Acid in water B: 0.17% Phosphoric Acid in methanol
Gradient	<i>Time (min)</i> %B 0-3.3 65% 3.3-10.6 65-72% 10.6-14.6 72-95% 14.6-16.6 95% 16.6-17 95-65% 17-20 65%
Flow Rate	1.5 ml/min
Column Temp	50°C
Wavelength	UV monitored at 220 nm

Homogeneity

A minimum sample size of 1.0 µg was used to determine homogeneity. Homogeneity was determined by HPLC using ampules selected from a random sampling plan from early, middle, and late fill positions.

%RSD	Acceptance Criteria
0.89%	≤3%

The recommended minimum quantity for use is 1.0 µg. Quantities below this have not been evaluated.

Neat Material Quality Information (Item No.: 14028, Batch No.: 0575936)

Qualifier	Method	Result
Chromatographic Purity, HPLC	Cayman Method TST SD173	99.75% ± 0.18%
Identity, LC-MS	Cayman Method TST SD13, +ESI	359.2 amu
Identity, FTIR	USP<854> (diamond ATR)	Conforms
% Water, Karl Fischer	Cayman Method TST SD02	<0.10% ± 0.03%
% Residual Solvent , GC Headspace	Cayman Method TST SD11	<0.10% ± 0.20%
% ROI	Cayman Method TST SD06	<0.10% ± 0.49%
Identity, NMR	¹ H NMR	Conforms
Total THC ((THCA*0.877) + Δ ⁹ -THC)	Cayman Method TST SD163	≤0.3%

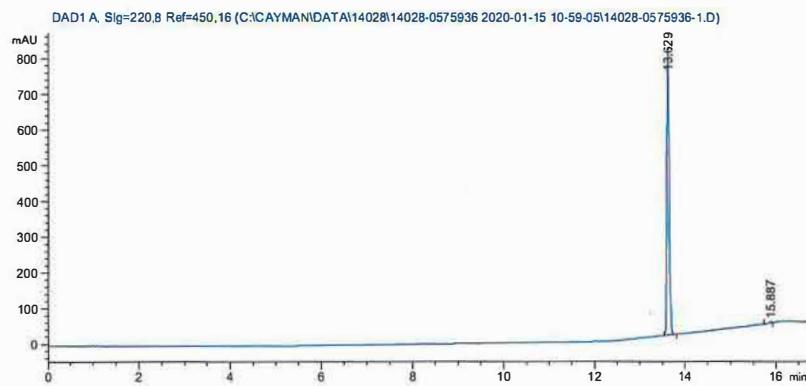
NMR, total THC, and optical rotation (if applicable) are provided as supplemental information but are not within scope of ISO accreditation.
Property values are traceable to SI units through an unbroken chain of measurements.

CERTIFICATE of ANALYSIS



Supplemental Data (Neat Material)

HPLC-UV



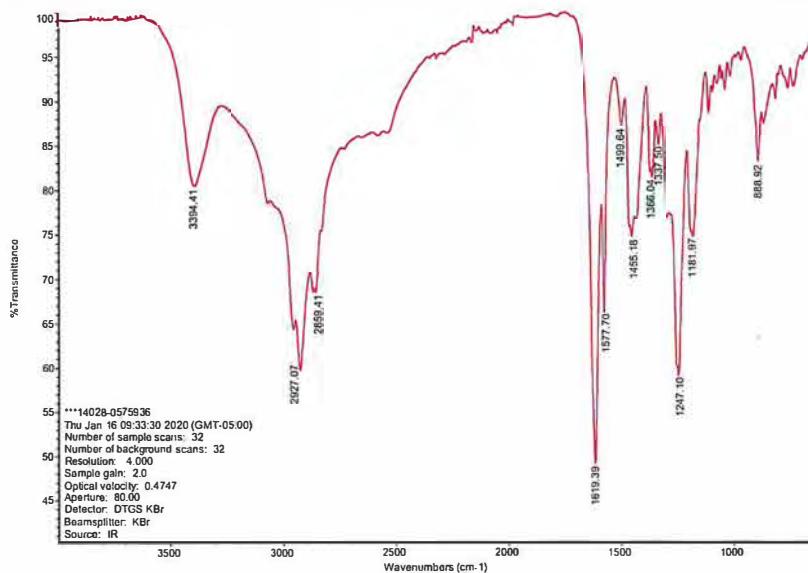
Conditions

Instrument	Agilent 1100/1200 Series
Column	4.6 x150 mm, 2.7 μ m NexLeaf CBX
Mobile Phase	A: 0.17% Phosphoric Acid in water B: 0.17% Phosphoric Acid in methanol
Gradient	Time (min) %B 0-3.3 65% 3.3-10.6 65-72% 10.6-14.6 72-95% 14.6-16.6 95% 16.6-17 95-65% 17-20 65%
Flow Rate	1.5 ml/min
Column Temp	50°C
Wavelength	UV monitored at 220 nm

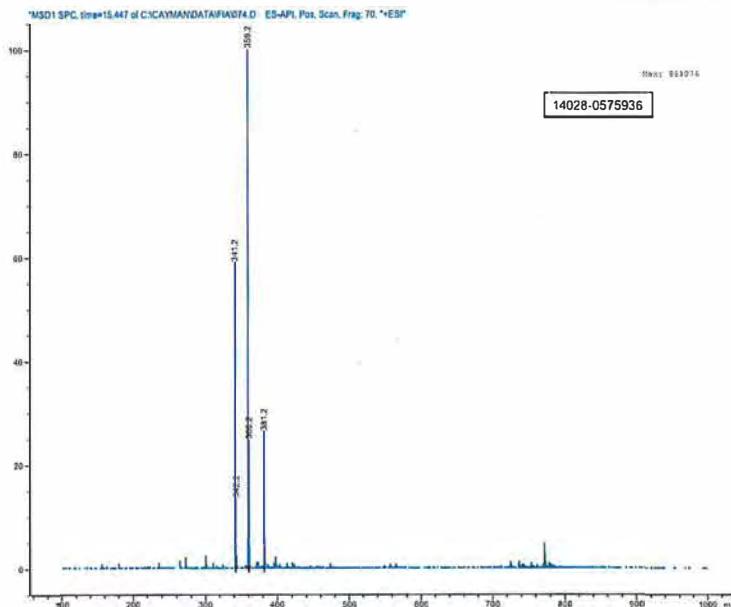
CERTIFICATE of ANALYSIS



FTIR



ESI-MS



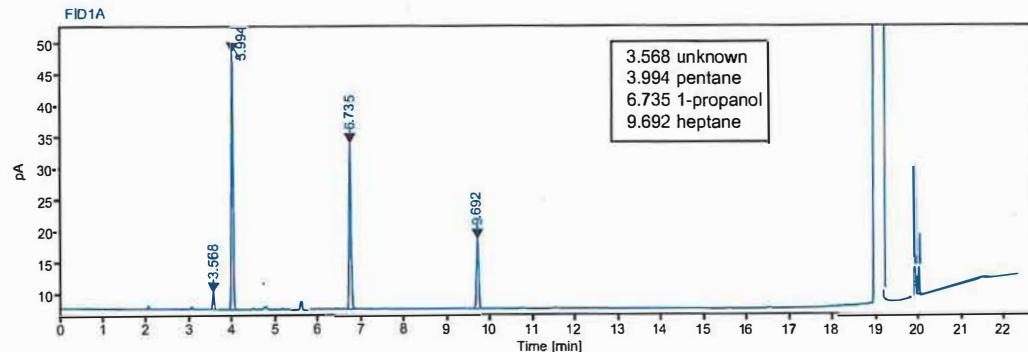
Conditions

Instrument: Thermo Nicolet iS10 FTIR / Diamond SmartATR (single bounce)
Scans: 32 scans / 32 background scans
Range: 650-4,000 cm⁻¹
Resolution: 4.000
Conditions: ATR and background corrected

CERTIFICATE of ANALYSIS



Headspace Residual Solvents



Conditions

Instrument	Agilent GC/FID
Equilibration Temp	120°C
Equilibration Time	10 min
Column	30 m x 0.32 mm, 1.8 µm Rxi-624Sil column
Carrier Gas	He
Flow Rate	1.5 ml/min
Inlet Temp	225°C
Split Ratio	40: 1
Oven Program	40°C for 4 min, ramp to 60°C at 8°C/min, then 5°C/min to 85°C, hold 5 min, then 30°C/min to 200°C, hold 2 min
FID Detector Temp	270°C

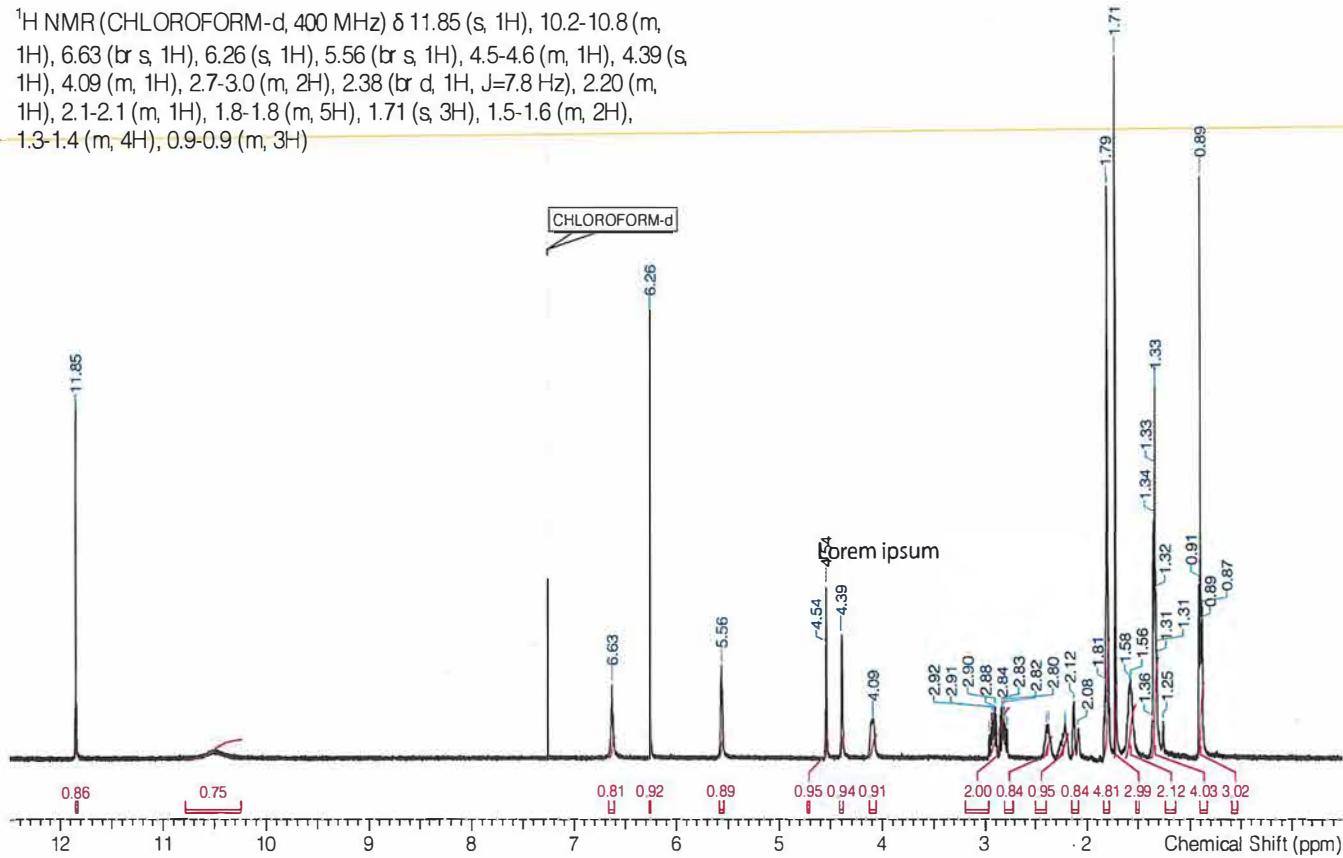
CERTIFICATE of ANALYSIS



NMR (not within scope of ISO accreditation)

File Name	\sulfur\private\nmrdata\2019\14028-0575936_20191218_14028-0575936_20191218_01\14028-0575936_20191218_001.fid\fid		
Date	Dec 18 2019	Nucleus	1H
Solvent	CHLOROFORM-d	Number of Transients	32

¹H NMR (CHLOROFORM-d, 400 MHz) δ 11.85 (s, 1H), 10.2-10.8 (m, 1H), 6.63 (br s, 1H), 6.26 (s, 1H), 5.56 (br s, 1H), 4.5-4.6 (m, 1H), 4.39 (s, 1H), 4.09 (m, 1H), 2.7-3.0 (m, 2H), 2.38 (br d, 1H, J=7.8 Hz), 2.20 (m, 1H), 2.1-2.1 (m, 1H), 1.8-1.8 (m, 5H), 1.71 (s, 3H), 1.5-1.6 (m, 2H), 1.3-1.4 (m, 4H), 0.9-0.9 (m, 3H)



Conditions

Instrument	Varian Inova 400MHZ NMR
Scans	32 scans

Stability

The effect of the components of stability on the combined standard uncertainty of the CRM property value are considered negligible unless indicated in stability studies.

Short-Term Stability

Degradation was observed at 4°C and room temperature after 2 weeks. This data supports shipping of this product on dry ice.

Long-Term Stability

Long-term stability data confirmed two years stability at the -20°C storage temperature.

CERTIFICATE of ANALYSIS



Revision History

Revision No.	Date	Reason for Revision
01	02MAY2020	Initial version
02	25SEP2020	Expiry date extension

Disclaimers

Material Safety Data

This material should be considered hazardous until information to the contrary becomes available. Do not ingest, swallow, or inhale. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. This information contains some but not all of the information required for the safe and proper use of this material. Before use, review the complete Safety Data Sheet, which has been sent via email to your institution.

Warranty and Limitation of Remedy

Cayman Chemical Company makes no warranty or guarantee of any kind, whether written or oral, expressed or implied, including without limitation, any warranty of fitness for a particular purpose, suitability and merchantability, which extends beyond the description of the chemicals hereof. Cayman warrants only to the original customer that the material will meet our specifications at the time of delivery.

Cayman will carry out its delivery obligations with due care and skill. Thus, in no event will Cayman have any obligation or liability, whether in tort (including negligence) or in contract, for any direct, indirect, incidental or consequential damages, even if Cayman is informed about their possible existence.

This limitation of liability does not apply in the case of intentional acts or negligence of Cayman, its directors or its employees.

Buyer's exclusive remedy and Cayman's sole liability hereunder shall be limited to a refund of the purchase price, or at Cayman's option, the replacement, at no cost to Buyer, of all material that does not meet our specification.

Said refund or replacement is conditioned on Buyer giving written notice to Cayman within thirty (30) days after arrival of the material at its destination. Failure of Buyer to give said notice within thirty (30) days shall constitute a waiver of Buyer of all claims hereunder with respect to said material.

For further details, please refer to our Warranty and Limitations of Remedy located on our website and in our catalog.

This Certificate shall not be reproduced except in full, without written approval from the Cayman Chemical ISO Quality Manager.

ISO CRT SD02 v 4.1

CAYMAN CHEMICAL
1180 EAST ELLSWORTH RD
ANN ARBOR, MI 48108 - USA

PHONE: [800] 364-9897
[734] 971-3335
FAX: [734] 971-3640

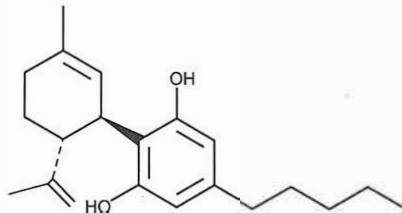
crmquality@caymancem.com
www.caymancem.com

CERTIFICATE of ANALYSIS



Cannabidiol (CRM)

Certified Reference Material



ACCREDITED
ISO/IEC 17025 #AT-1773
ISO 17034 #AR-1774

Item No.: ISO60156

Batch No.: 0586575

CAS Registry No.: 13956-29-1

Molecular Formula: C₂₁H₃₀O₂

Formula Weight: 314.50 amu

Expiry Date: 29MAR2024 (valid from date of certification)

Supplied as: A 1 mg/ml (nominal) solution in methanol

Volume per Ampule: Not less than 1 ml. Ampules are overfilled.

Storage: Unopened at -20°C.

Safety: Refer to Safety Data Sheet

Intended Use: For analytical testing purposes only, not intended for human or animal use.

Instructions for Use: This product is designated for one-time use and should be used immediately after opening. It is advised that laboratories warm the vial to room temperature prior to opening and use measured volumes.

Certified Concentration · 1.000 mg/ml ± 0.013 mg/ml

Concentration is calculated based on product mass, solution mass, corrected purity, and density at 20°C. It is traceable to SI units through an unbroken chain of measurements. Uncertainty of concentration is expressed as an expanded uncertainty in accordance with ISO standards for Testing Laboratories and Reference Material Producers at the approximate 95% confidence interval using a coverage factor of k=2 and incorporates uncertainties from the corrected purity, solution preparation, homogeneity, and long- and short-term stability. Concentration was verified by comparison to an independently prepared calibration standard.

Corrected Purity · 99.42% ± 0.56%

Corrected purity is determined as follows: Corrected Purity = [(100 - % LOD - % ROI)*Chromatographic Purity/100] or [(100 - % KF - % RS - % ROI)*Chromatographic Purity/100]. All measurement uncertainties are expressed as expanded uncertainties in accordance with ISO standards for Testing Laboratories and Reference Material Producers at the approximate 95% confidence interval using an appropriate coverage factor. Where applicable, optical rotation, chiral purity, and/or isotopic purity testing are performed to support the identification of the reference material, therefore the uncertainty is considered null.

Approval:

Title: ISO Quality Manager

Certification Date: 29MAR2020

Cayman Chemical certifies that this standard meets the specifications stated in this certificate and warrants this product to meet the stated acceptance criteria through the expiration date when stored unopened as recommended.



CERTIFICATE of ANALYSIS



CRM Assay

Method Parameters

Cayman Method	TST SD151
Column	4.6 x150 mm, 5 µm Kinetex Biphenyl
Mobile Phase	A: 0.1% Trifluoroacetic Acid DI water B: Acetonitrile
Gradient	Time (min) %B 0-12 50-90% 12-17 90% 17.1-22 50%
Flow Rate	1 ml/min
Column Temp	30°C
Wavelength	UV monitored at 232 nm

Homogeneity

A minimum sample size of 2.0 µg was used to determine homogeneity. Homogeneity was determined by HPLC using ampules selected from a random sampling plan from early, middle, and late fill positions.

%RSD	Acceptance Criteria
1.32%	≤3%

The recommended minimum quantity for use is 2.0 µg. Quantities below this have not been evaluated.

Neat Material Quality Information (Item No.: 90080, Batch No.: 0578704)

Qualifier	Method	Result
Chromatographic Purity, HPLC	Cayman Method TST SD151	99.71% ± 0.18%
Identity, LC-MS	Cayman Method TST SD13, +ESI	315.2 amu
Identity, FTIR	USP<854> (diamond ATR)	Conforms
% LOD	Cayman Method TST SD24	0.19% ± 0.49%
% ROI	Cayman Method TST SD06	<0.10% ± 0.20%
Identity, NMR	¹ H NMR	Conforms
Total THC ((THCA*0.877) + Δ ⁹ -THC)	Cayman Method TST SD163	≤0.3

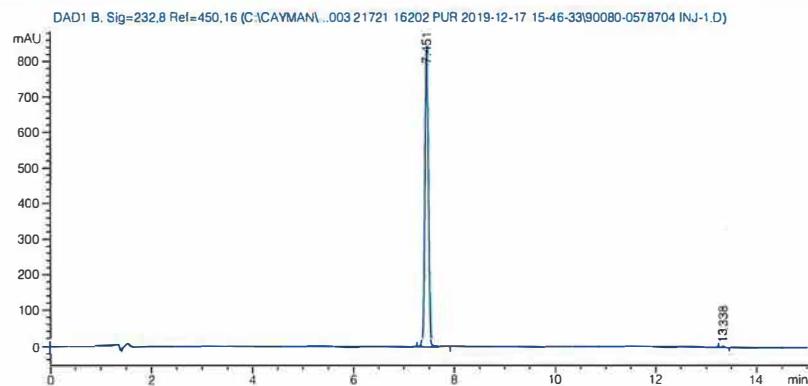
NMR, total THC, and optical rotation (if applicable) are provided as supplemental information but are not within scope of ISO accreditation.
Property values are traceable to SI units through an unbroken chain of measurements.

CERTIFICATE of ANALYSIS



Supplemental Data (Neat Material)

HPLC-UV



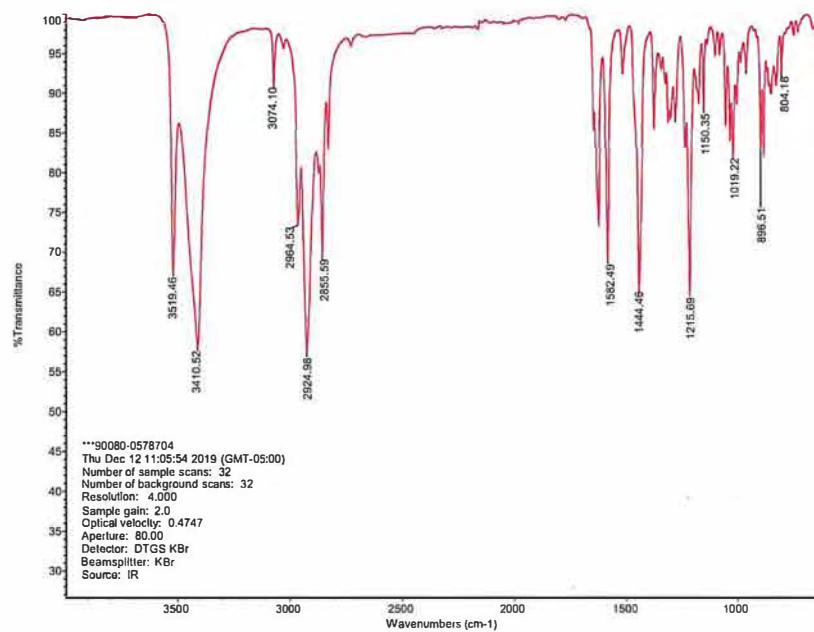
Conditions

Instrument	Agilent 1100/1200 Series
Column	4.6 x150 mm, 5 μ m Kinetex Biphenyl
Mobile Phase	A: 0.1% Trifluoroacetic Acid DI water B: Acetonitrile
Gradient	Time (min) %B 0-12 50-90% 12-17 90% 17.1-22 50%
Flow Rate	1 ml/min
Column Temp	30°C
Wavelength	UV monitored at 232 nm

CERTIFICATE of ANALYSIS



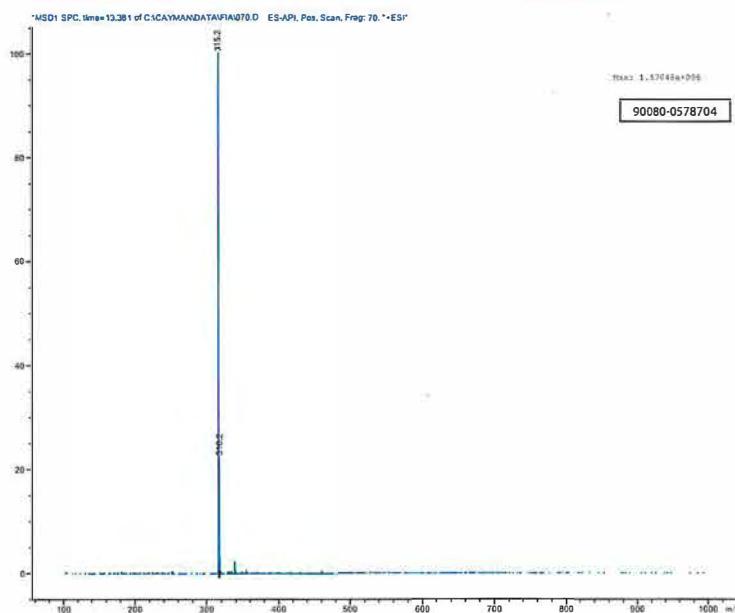
FTIR



Conditions

Instrument	Thermo Nicolet iS10 FTIR / Diamond SmartATR (single bounce)
Scans	32 scans / 32 background scans
Range	650-4,000 cm ⁻¹
Resolution	4.000
ATR and background corrected	

ESI-MS



Conditions

Instrument	Agilent HPLC MSD
Mobile Phase	50:50:0.1 methanol/water/acetic acid
Flow Rate	0.5 ml/min
Ionization Mode	+ESI
Mass Range	100-1,000 m/z
Nebulizer	60 psi
Desolvation Gas	13 L/min
Desolvation Temp	350°C
Electrospray Voltage	4kV

MS collected across peak width at half height

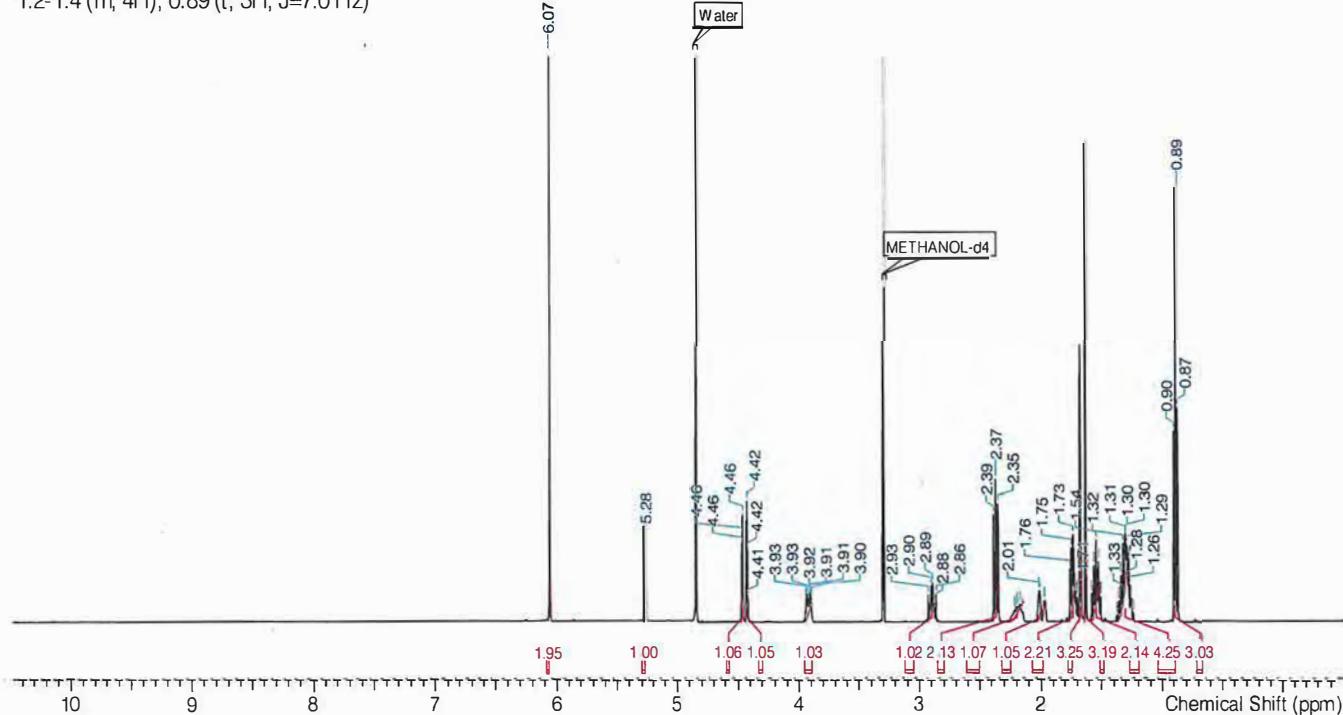
CERTIFICATE of ANALYSIS



NMR (not within scope of ISO accreditation)

Date	Nov 25 2019
File Name	\lsulfur\private\nmrdata\20190080-0578704_20191125_190080-0578704_20191125_0190080-0578704_20191125_001.fidfid
Frequency (MHz)	399.9677
Solvent	METHANOL-d4

¹H NMR (METHANOL-d₄, 400 MHz) δ 6.07 (s, 2H), 5.28 (s, 1H), 4.4-4.5 (m, 1H), 4.4-4.4 (m, 1H), 3.92 (qdd, 1H, J=2.2, 4.3, 10.6 Hz), 2.9-2.9 (m, 1H), 2.37 (t, 2H, J=7.8 Hz), 2.1-2.2 (m, 1H), 2.0-2.0 (m, 1H), 1.7-1.8 (m, 2H), 1.67 (s, 3H), 1.63 (dd, 3H, J=0.8, 1.6 Hz), 1.54 (quin, 2H, J=7.4 Hz), 1.2-1.4 (m, 4H), 0.89 (t, 3H, J=7.0 Hz)



Conditions

Instrument	Varian Inova 400MHz NMR
Scans	64 scans

Stability

The effect of the components of stability on the combined standard uncertainty of the CRM property value are considered negligible unless indicated in stability studies.

Short-Term Stability

A decrease in purity was observed at 60°C during the two-week stability study. No decrease was observed at ambient temperature during the study. This data supports cold shipment of this product.

Long-Term Stability

Long-term stability data predicts four years stability at the -20°C storage temperature. Long-term stability studies are ongoing and the Certificate of Analysis will be updated upon study completion.

CERTIFICATE of ANALYSIS



Revision History

Revision No.	Date	Reason for Revision
01	29MAR2020	Initial version

Disclaimers

Material Safety Data

This material should be considered hazardous until information to the contrary becomes available. Do not ingest, swallow, or inhale. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. This information contains some but not all of the information required for the safe and proper use of this material. Before use, review the complete Safety Data Sheet, which has been sent via email to your institution.

Warranty and Limitation of Remedy

Cayman Chemical Company makes no warranty or guarantee of any kind, whether written or oral, expressed or implied, including without limitation, any warranty of fitness for a particular purpose, suitability and merchantability, which extends beyond the description of the chemicals hereof. Cayman warrants only to the original customer that the material will meet our specifications at the time of delivery.

Cayman will carry out its delivery obligations with due care and skill. Thus, in no event will Cayman have any obligation or liability, whether in tort (including negligence) or in contract, for any direct, indirect, incidental or consequential damages, even if Cayman is informed about their possible existence.

This limitation of liability does not apply in the case of intentional acts or negligence of Cayman, its directors or its employees.

Buyer's exclusive remedy and Cayman's sole liability hereunder shall be limited to a refund of the purchase price, or at Cayman's option, the replacement, at no cost to Buyer, of all material that does not meet our specification.

Said refund or replacement is conditioned on Buyer giving written notice to Cayman within thirty (30) days after arrival of the material at its destination. Failure of Buyer to give said notice within thirty (30) days shall constitute a waiver of Buyer of all claims hereunder with respect to said material.

For further details, please refer to our Warranty and Limitations of Remedy located on our website and in our catalog.

This Certificate shall not be reproduced except in full, without written approval from the Cayman Chemical ISO Quality Manager.

ISO CRT SD02 v 4.1

CAYMAN CHEMICAL
1180 EAST ELLSWORTH RD
ANN ARBOR, MI 48108 - USA

PHONE: [800] 364-9897
[734] 971-3335
FAX: [734] 971-3640

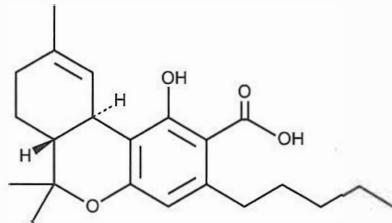
crmquality@caymanchem.com
www.caymanchem.com

CERTIFICATE of ANALYSIS



THCA-A (CRM)

Certified Reference Material



ACCREDITED
ISO 17034 #AR-1774

Item No.: ISO60175

Batch No.: 0626035

CAS Registry No.: 23978-85-0

Molecular Formula: C₂₂H₃₀O₄

Formula Weight: 358.50 amu

Expiry Date: 01SEP2024 (valid from date of certification)

Supplied as: A 1 mg/ml (nominal) solution in acetonitrile

Volume per Ampule: Not less than 1 ml. Ampules are overfilled.

Storage: Unopened at -20°C.

Safety: Refer to Safety Data Sheet

Intended Use: For analytical testing purposes only, not intended for human or animal use.

Instructions for Use: This product is designated for one-time use and should be used immediately after opening. It is advised that laboratories warm the vial to room temperature prior to opening and use measured volumes.

Certified Concentration · 1.001 mg/ml ± 0.012 mg/ml

Concentration is calculated based on product mass, solution mass, corrected purity, and density at 20°C. It is traceable to SI units through an unbroken chain of measurements. Uncertainty of concentration is expressed as an expanded uncertainty in accordance with ISO standards for Testing Laboratories and Reference Material Producers at the approximate 95% confidence interval using a coverage factor of k=2 and incorporates uncertainties from the corrected purity, solution preparation, homogeneity, and long- and short-term stability. Concentration was verified by comparison to an independently prepared calibration standard.

Corrected Purity · 97.35% ± 0.65%

Corrected purity is determined as follows: Corrected Purity = [(100 - % LOD - % ROI)*Chromatographic Purity/100] or [(100 - % KF - % RS - % ROI)*Chromatographic Purity/100]. All measurement uncertainties are expressed as expanded uncertainties in accordance with ISO standards for Testing Laboratories and Reference Material Producers at the approximate 95% confidence interval using an appropriate coverage factor. Where applicable, optical rotation, chiral purity, and/or isotopic purity testing are performed to support the identification of the reference material, therefore the uncertainty is considered null.

Approval:

Title: ISO Quality Manager

Certification Date: 31AUG2021

Cayman Chemical certifies that this standard meets the specifications stated in this certificate and warrants this product to meet the stated acceptance criteria through the expiration date when stored unopened as recommended.



CERTIFICATE of ANALYSIS



CRM Assay

Method Parameters

Cayman Method	TST SD173
Column	4.6 x150 mm, 2.7 μ m NexLeaf CBX
Mobile Phase	A: 0.17% H_3PO_4 in H_2O B: 0.17% H_3PO_4 in methanol
Gradient	<i>Time (min)</i> %B 0-3.3 65% 3.3-10.6 65-72% 10.6-14.6 72-95% 14.6-16.6 95% 16.6-17 95-65% 17-20 65%
Flow Rate	1.5 ml/min
Column Temp	50°C
Wavelength	UV monitored at 220 nm

Homogeneity

A minimum sample size of 1.0 μ g was used to determine homogeneity. Homogeneity was determined by HPLC using ampules selected from a random sampling plan from early, middle, and late fill positions.

%RSD	Acceptance Criteria
1.15%	$\leq 3\%$

The recommended minimum quantity for use is 1.0 μ g. Quantities below this have not been evaluated.

Neat Material Quality Information (Item No.: 14238, Batch No.: 0613750)

Qualifier	Method	Result
Chromatographic Purity, HPLC	Cayman Method TST SD173	97.98% \pm 0.18%
Identity, LC-MS	Cayman Method TST SD13, +ESI	359.2 amu
Identity, FTIR	USP<854> (diamond ATR)	Conforms
% Water, Karl Fischer	Cayman Method TST SD05	0.40% \pm 0.02%
% Residual Solvent , GC Headspace	Cayman Method TST SD11	0.12% \pm 0.59%
% ROI	Cayman Method TST SD06	0.12% \pm 0.19%
Identity, NMR	1H NMR	Conforms

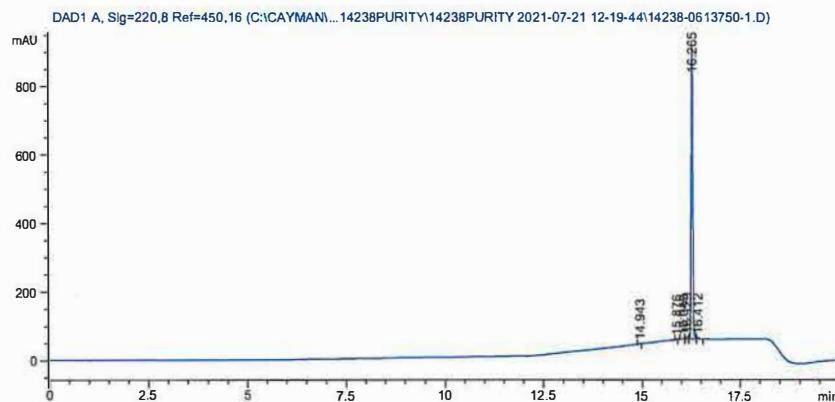
NMR and optical rotation (if applicable) are provided as supplemental information but are not within scope of ISO accreditation.
Property values are traceable to SI units through an unbroken chain of measurements.

CERTIFICATE of ANALYSIS



Supplemental Data (Neat Material)

HPLC-UV



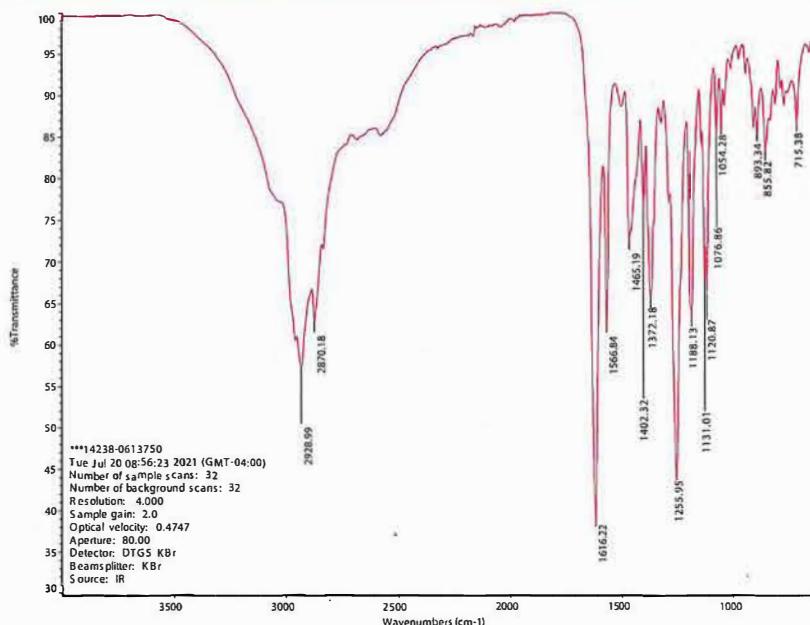
Conditions

Instrument	Agilent 1100/1200 Series
Column	4.6 x 150 mm, 2.7 μ m NexLeaf CBX
Mobile Phase	A: 0.17% H_3PO_4 in H_2O B: 0.17% H_3PO_4 in methanol
Gradient	Time (min) %B 0-3.3 65% 3.3-10.6 65-72% 10.6-14.6 72-95% 14.6-16.6 95% 16.6-17 95-65% 17-20 65%
Flow Rate	1.5 ml/min
Column Temp	50°C
Wavelength	UV monitored at 220 nm

CERTIFICATE of ANALYSIS



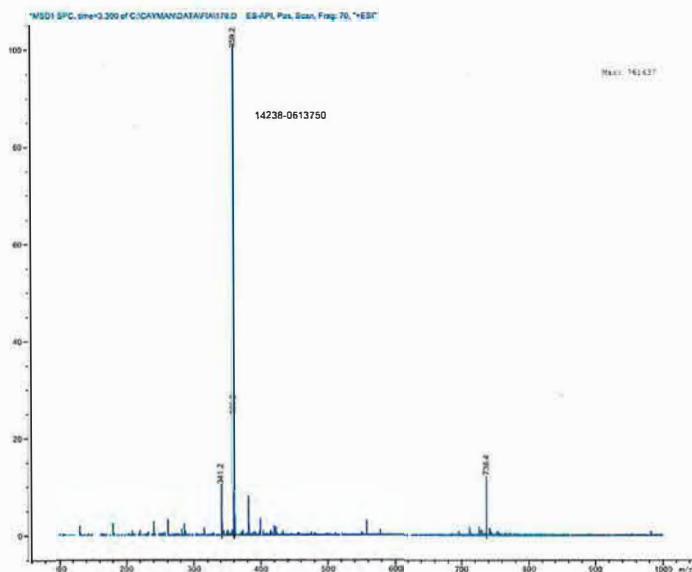
FTIR



Conditions

Instrument	Thermo Nicolet iS10 FTIR / Diamond SmartATR (single bounce)
Scans	32 scans / 32 background scans
Range	650-4,000 cm ⁻¹
Resolution	4.000
ATR and background corrected	

ESI-MS



Conditions

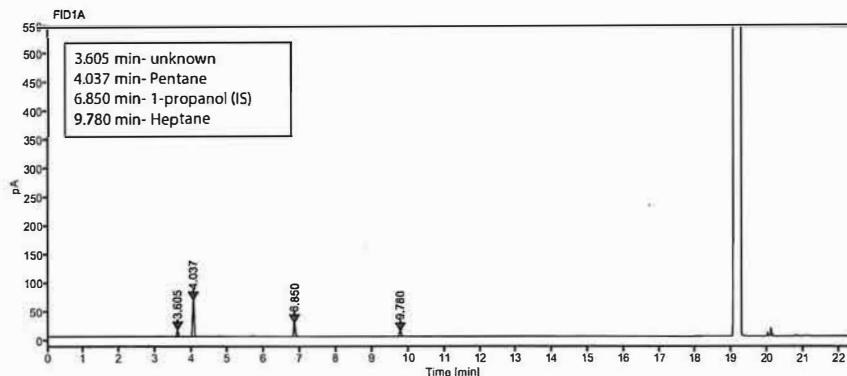
Instrument	Agilent HPLC MSD
Mobile Phase	50:50:0.1 methanol/water/acetic acid
Flow Rate	0.5 ml/min
Ionization Mode	+ESI
Mass Range	100-1,000 m/z
Nebulizer	60 psi
Desolvation Gas	13 L/min
Desolvation Temp	350°C
Electrospray Voltage	4kV

MS collected across peak width at half height

CERTIFICATE of ANALYSIS



Headspace Residual Solvents



Conditions

Instrument	Agilent GC/FID
Equilibration Temp	120°C
Equilibration Time	10 min
Column	30 m x 0.32 mm, 1.8 µm RxI-624Sil column
Carrier Gas	He
Flow Rate	1.5 ml/min
Inlet Temp	225°C
Split Ratio	40:1
Oven Program	40°C for 4 min, ramp to 60°C at 8°C/min, then 5°C/min to 85°C, hold 5 min, then 30°C/min to 200°C, hold 2 min
FID Detector Temp	270°C

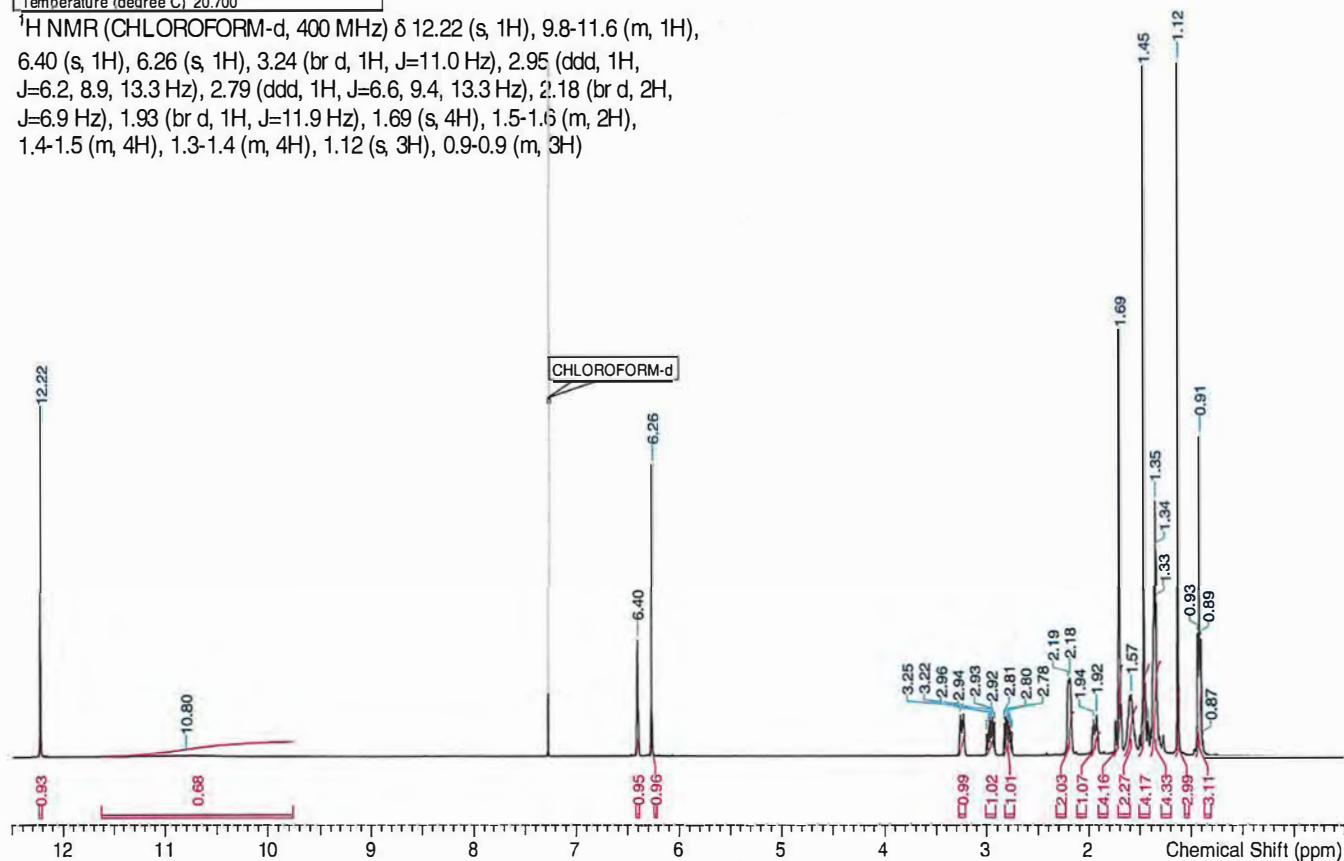
CERTIFICATE of ANALYSIS



NMR (not within scope of ISO accreditation)

File Name	\sulfur\private\nmrdata\JEOL_2021\14238-0613750\14238-0613750_PROTON_23-Jun-2021-1-1.idf		
Date	23 Jun 2021 15:42:14	Nucleus	1H
Solvent	CHLOROFORM-d	Number of Transients	16
Temperature (degree C)	20.700		

¹H NMR (CHLOROFORM-d, 400 MHz) δ 12.22 (s, 1H), 9.8-11.6 (m, 1H), 6.40 (s, 1H), 6.26 (s, 1H), 3.24 (br d, 1H, J=11.0 Hz), 2.95 (ddd, 1H, J=6.2, 8.9, 13.3 Hz), 2.79 (ddd, 1H, J=6.6, 9.4, 13.3 Hz), 2.18 (br d, 2H, J=6.9 Hz), 1.93 (br d, 1H, J=11.9 Hz), 1.69 (s, 4H), 1.5-1.6 (m, 2H), 1.4-1.5 (m, 4H), 1.3-1.4 (m, 4H), 1.12 (s, 3H), 0.9-0.9 (m, 3H)



Instrument	JEOL ECZ 400S
Scans	16 scans

Stability

The effect of the components of stability on the combined standard uncertainty of the CRM property value are considered negligible unless indicated in stability studies.

Short-Term Stability

Degradation was observed at 4°C and room temperature after 2 weeks. This data supports shipping of this product on dry ice.

Long-Term Stability

Long-term stability data confirmed three years stability at the -20°C storage temperature.

CERTIFICATE of ANALYSIS



Revision History

Revision No.	Date	Reason for Revision
01	31AUG2021	Initial version

Disclaimers

Material Safety Data

This material should be considered hazardous until information to the contrary becomes available. Do not ingest, swallow, or inhale. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. This information contains some but not all of the information required for the safe and proper use of this material. Before use, review the complete Safety Data Sheet, which has been sent via email to your institution.

Warranty and Limitation of Remedy

Cayman Chemical Company makes no warranty or guarantee of any kind, whether written or oral, expressed or implied, including without limitation, any warranty of fitness for a particular purpose, suitability and merchantability, which extends beyond the description of the chemicals hereof. Cayman warrants only to the original customer that the material will meet our specifications at the time of delivery.

Cayman will carry out its delivery obligations with due care and skill. Thus, in no event will Cayman have any obligation or liability, whether in tort (including negligence) or in contract, for any direct, indirect, incidental or consequential damages, even if Cayman is informed about their possible existence.

This limitation of liability does not apply in the case of intentional acts or negligence of Cayman, its directors or its employees.

Buyer's exclusive remedy and Cayman's sole liability hereunder shall be limited to a refund of the purchase price, or at Cayman's option, the replacement, at no cost to Buyer, of all material that does not meet our specification.

Said refund or replacement is conditioned on Buyer giving written notice to Cayman within thirty (30) days after arrival of the material at its destination. Failure of Buyer to give said notice within thirty (30) days shall constitute a waiver of Buyer of all claims hereunder with respect to said material.

For further details, please refer to our Warranty and Limitations of Remedy located on our website and in our catalog.

This Certificate shall not be reproduced except in full, without written approval from the Cayman Chemical ISO Quality Manager.

ISO CRT SD02 v 4.2

CAYMAN CHEMICAL
1180 EAST ELLSWORTH RD
ANN ARBOR, MI 48108 - USA

PHONE: [800] 364-9897
[734] 971-3335
FAX: [734] 971-3640

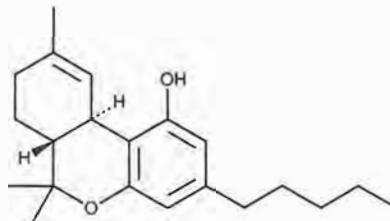
crmquality@caymanchem.com
www.caymanchem.com

CERTIFICATE of ANALYSIS



Δ^9 -THC (CRM)

Certified Reference Material



Item No.: ISO60157

Batch No.: 0612973

CAS Registry No.: 1972-08-3

Molecular Formula: C₂₁H₃₀O₂

Formula Weight: 314.50 amu

Expiry Date: 27APR2024 (valid from date of certification)

Supplied as: A 1 mg/ml (nominal) solution in methanol

Volume per Ampule: Not less than 1 ml. Ampules are overfilled.

Storage: Unopened at -20°C.

Safety: Refer to Safety Data Sheet

Intended Use: For analytical testing purposes only, not intended for human or animal use.

Instructions for Use: This product is designated for one-time use and should be used immediately after opening. It is advised that laboratories warm the vial to room temperature prior to opening and use measured volumes.

Certified Concentration · 1.000 mg/ml ± 0.008 mg/ml

Concentration is calculated based on product mass, solution mass, corrected purity, and density at 20°C. It is traceable to SI units through an unbroken chain of measurements. Uncertainty of concentration is expressed as an expanded uncertainty in accordance with ISO standards for Testing Laboratories and Reference Material Producers at the approximate 95% confidence interval using a coverage factor of k=2 and incorporates uncertainties from the corrected purity, solution preparation, homogeneity, and long- and short-term stability. Concentration was verified by comparison to an independently prepared calibration standard.

Corrected Purity · 96.21% ± 0.56%

Corrected purity is determined as follows: Corrected Purity = [(100 - % LOD - % ROI)*Chromatographic Purity/100] or [(100 - % KF - % RS - % ROI)*Chromatographic Purity/100]. All measurement uncertainties are expressed as expanded uncertainties in accordance with ISO standards for Testing Laboratories and Reference Material Producers at the approximate 95% confidence interval using an appropriate coverage factor. Where applicable, optical rotation, chiral purity, and/or isotopic purity testing are performed to support the identification of the reference material, therefore the uncertainty is considered null.

Approval:

Title: ISO Quality Manager

Certification Date: 27APR2021

Cayman Chemical certifies that this standard meets the specifications stated in this certificate and warrants this product to meet the stated acceptance criteria through the expiration date when stored unopened as recommended.



CERTIFICATE of ANALYSIS



CRM Assay

Method Parameters

Cayman Method	TST SD173
Column	4.6 x150 mm, 2.7 μm NexLeaf CBX
Mobile Phase	A: 0.17% H_3PO_4 in H_2O B: 0.17% H_3PO_4 in methanol

	Time (min)	%B
Gradient	0-3.3	65%
	3.3-10.6	65-72%
	10.6-14.6	72-95%
	14.6-16.6	95%
	16.6-17	95-65%
	17-20	65%

Flow Rate	1.5 ml/min
Column Temp	50°C
Wavelength	UV monitored at 220 nm

Homogeneity

A minimum sample size of 1.0 μg was used to determine homogeneity. Homogeneity was determined by HPLC using ampules selected from a random sampling plan from early, middle, and late fill positions.



The recommended minimum quantity for use is 1.0 μg . Quantities below this have not been evaluated.

Neat Material Quality Information (Item No.: ISO00157, Batch No.: 0583349)

Qualifier	Method	Result
Chromatographic Purity, HPLC	Cayman Method TST SD173	98.60% \pm 0.18%
Identity, LC-MS	Cayman Method TST SD13, +ESI	315.2 amu
Identity, GC-MS	Cayman Method TST SD12	Conforms
Identity, FTIR	USP<854> (diamond ATR)	Conforms
% LOD	Cayman Method TST SD153	2.32% \pm 0.49%
% ROI	Cayman Method TST SD06	<0.10% \pm 0.20%
Identity, NMR	^1H NMR	Conforms

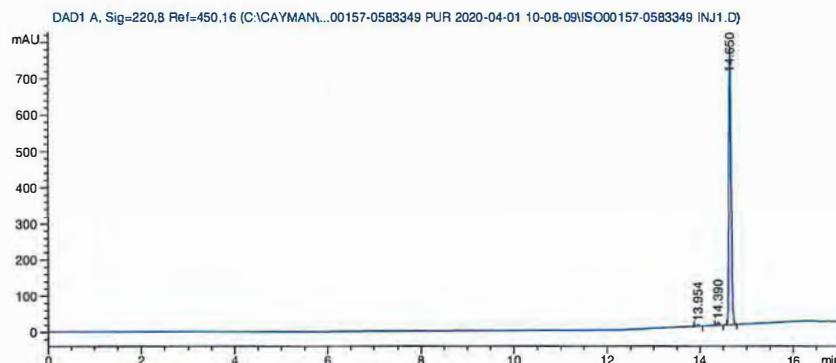
NMR and optical rotation (if applicable) are provided as supplemental information but are not within scope of ISO accreditation.
Property values are traceable to SI units through an unbroken chain of measurements.

CERTIFICATE of ANALYSIS



Supplemental Data (Neat Material)

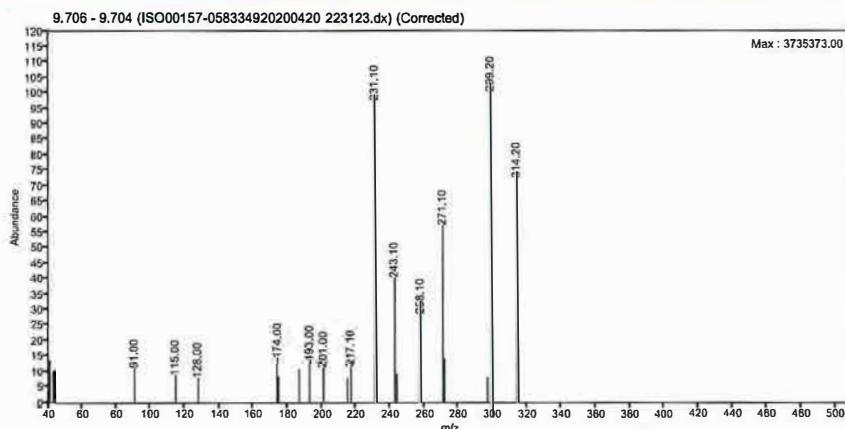
HPLC-UV



Conditions

Instrument	Agilent 1100/1200 Series	
Column	4.6 x 150 mm, 2.7 <i>NexLeaf</i> CBX	
Mobile Phase	A: 0.17% H_3PO_4 in H_2O B: 0.17% H_3PO_4 in methanol	
Gradient	Time (min)	%B
	0-3.3	65%
	3.3-10.6	65-72%
	10.6-14.6	72-95%
	14.6-16.6	95%
Flow Rate	16.6-17	95-65%
	17-20	65%
Flow Rate	1.5 ml/min	
Column Temp	50°C	
Wavelength	UV monitored at 220 nm	

GC-MS



Conditions

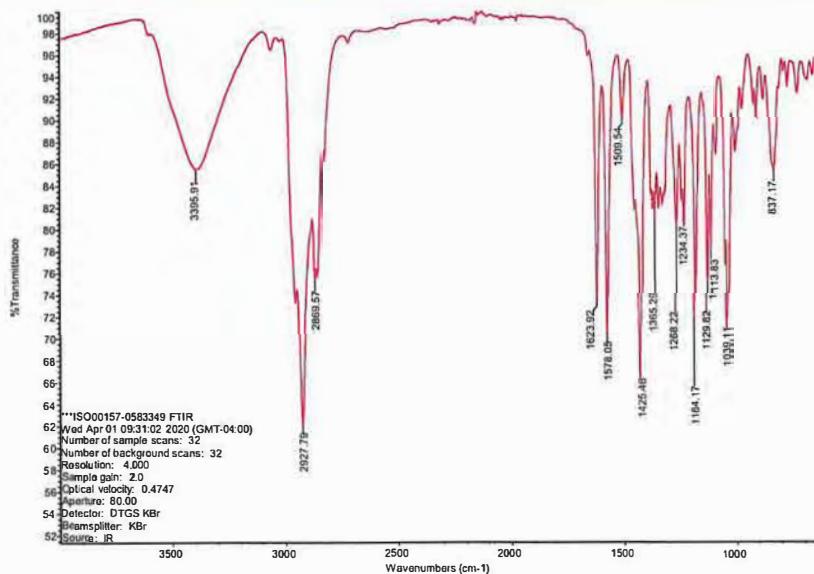
Instrument	Agilent GC MSD	
Column	30 m x 0.32 mm, 0.5 μ m Rtx-5MS	
Carrier Gas	He	
Flow Rate	2 ml/min	
Inlet Temp	300°C	
Split Ratio	15:1	
Oven Program	50°C hold for 1 min, ramp to 300°C at 30°C per min, hold at 300°C to 25 minutes	
Transfer Line Temp	300°C	
Voltage	70ev EI MS	
Scan Range	40-600 m/z	
Tune File	etune	

Apex spectrum – background (1 min window in front of peak)

CERTIFICATE of ANALYSIS



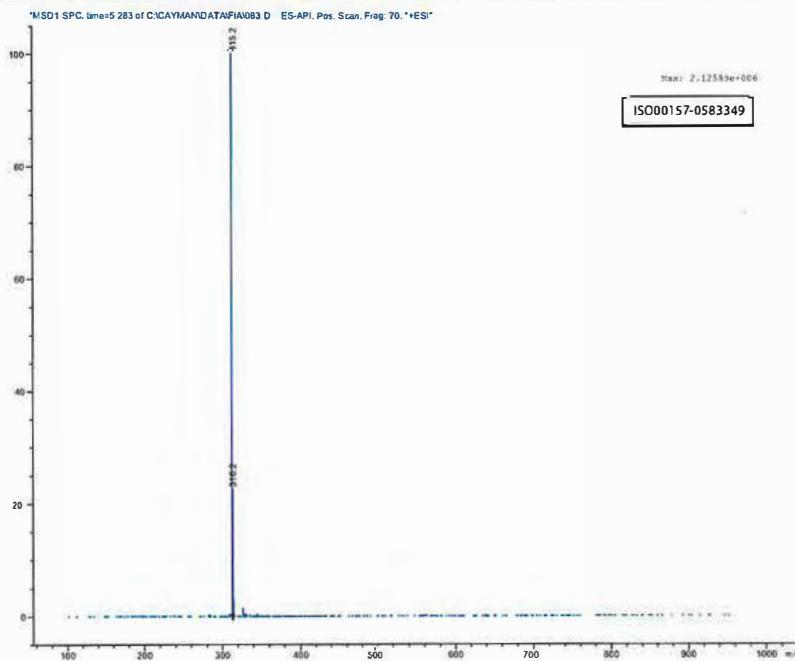
FTIR



Conditions

Instrument	Thermo Nicolet iS10 FTIR / Diamond SmartATR (single bounce)
Scans	32 scans / 32 background scans
Range	650-4,000 cm^{-1}
Resolution	4.000
Comments	ATR and background corrected

ESI-MS



Conditions

Instrument	Agilent HPLC MSD
Mobile Phase	50:50:0.1 methanol/water/acetic acid
Flow Rate	0.5 ml/min
Ionization Mode	+ESI
Mass Range	100-1,000 m/z
Nebulizer	60 psi
Desolvation Gas	13 L/min
Desolvation Temp	350°C
Electrospray Voltage	4kV

MS collected across peak width at half height

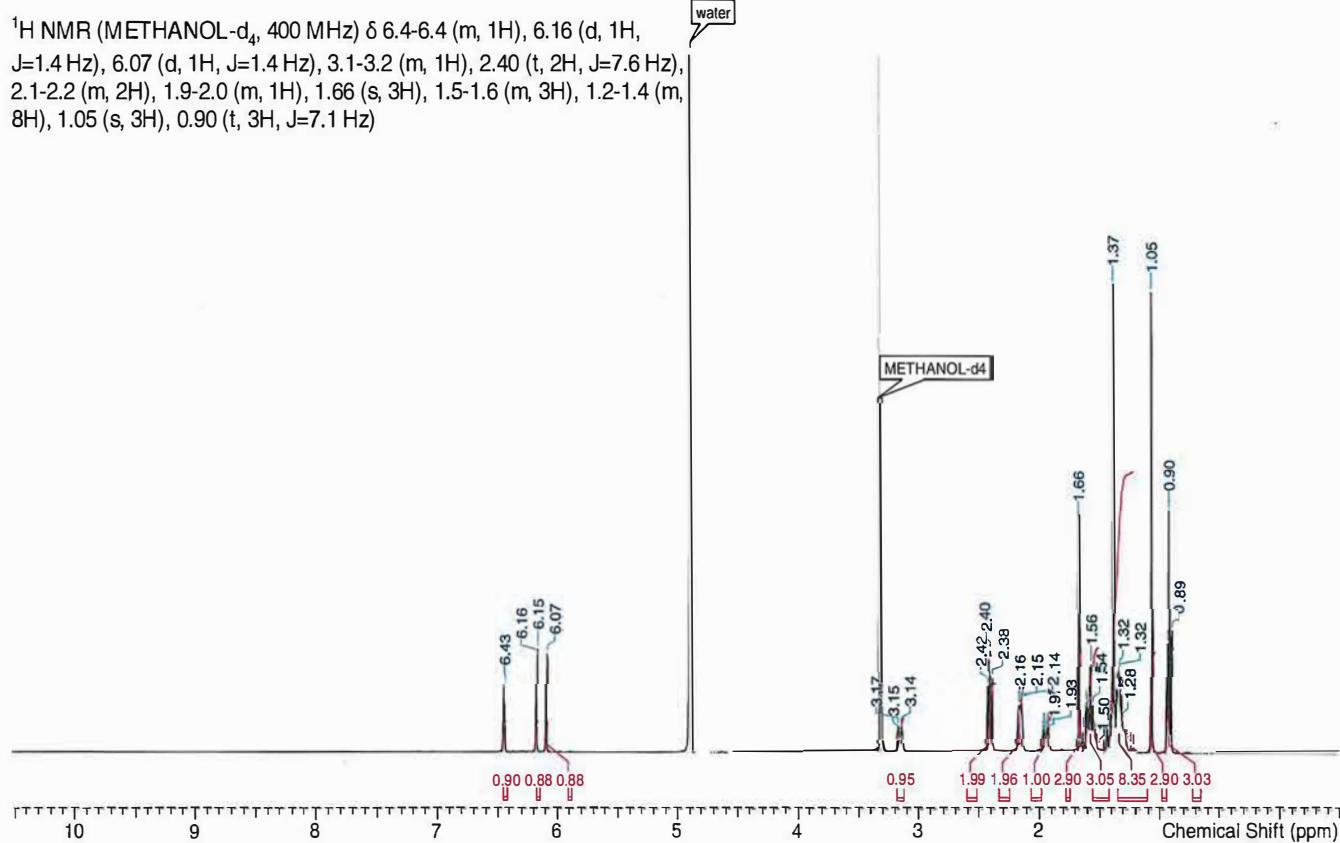
CERTIFICATE of ANALYSIS



NMR (not within scope of ISO accreditation)

File Name	\sulfur\private\nmrdata\JEOL_2020\ISO00157-0583349_PROTON_30-Mar-2020-1-1.jdf		
Date	30 Mar 2020 12:50:39	Nucleus	1H
Solvent	METHANOL-d4	Number of Transients	16

¹H NMR (METHANOL-d₄, 400 MHz) δ 6.4-6.4 (m, 1H), 6.16 (d, 1H, J=1.4 Hz), 6.07 (d, 1H, J=1.4 Hz), 3.1-3.2 (m, 1H), 2.40 (t, 2H, J=7.6 Hz), 2.1-2.2 (m, 2H), 1.9-2.0 (m, 1H), 1.66 (s, 3H), 1.5-1.6 (m, 3H), 1.2-1.4 (m, 8H), 1.05 (s, 3H), 0.90 (t, 3H, J=7.1 Hz)



Conditions

Instrument	JEOL ECZ 400S
Scans	16 scans

Stability

The effect of the components of stability on the combined standard uncertainty of the CRM property value are considered negligible unless indicated in stability studies.

Short-Term Stability

A decrease in property value was observed at 60°C during the two-week stability study. No decrease was observed at ambient temperature during the study. This data supports cold shipment of this product.

Long-Term Stability

Long-term stability data confirmed three years stability at the -20°C storage temperature.

CERTIFICATE of ANALYSIS



Revision History

Revision No.	Date	Reason for Revision
01	27APR2021	Initial version
02	17SEP2021	Updated accreditation symbols and incorrect volume per ampule listed on CofA

Disclaimers

Material Safety Data

This material should be considered hazardous until information to the contrary becomes available. Do not ingest, swallow, or inhale. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. This information contains some but not all of the information required for the safe and proper use of this material. Before use, review the complete Safety Data Sheet, which has been sent via email to your institution.

Warranty and Limitation of Remedy

Cayman Chemical Company makes no warranty or guarantee of any kind, whether written or oral, expressed or implied, including without limitation, any warranty of fitness for a particular purpose, suitability and merchantability, which extends beyond the description of the chemicals hereof. Cayman warrants only to the original customer that the material will meet our specifications at the time of delivery.

Cayman will carry out its delivery obligations with due care and skill. Thus, in no event will Cayman have any obligation or liability, whether in tort (including negligence) or in contract, for any direct, indirect, incidental or consequential damages, even if Cayman is informed about their possible existence.

This limitation of liability does not apply in the case of intentional acts or negligence of Cayman, its directors or its employees.

Buyer's exclusive remedy and Cayman's sole liability hereunder shall be limited to a refund of the purchase price, or at Cayman's option, the replacement, at no cost to Buyer, of all material that does not meet our specification.

Said refund or replacement is conditioned on Buyer giving written notice to Cayman within thirty (30) days after arrival of the material at its destination. Failure of Buyer to give said notice within thirty (30) days shall constitute a waiver of Buyer of all claims hereunder with respect to said material.

For further details, please refer to our Warranty and Limitations of Remedy located on our website and in our catalog.

This Certificate shall not be reproduced except in full, without written approval from the Cayman Chemical ISO Quality Manager.

ISO CRT SD02 v 4.1

CAYMAN CHEMICAL
1180 EAST ELLSWORTH RD
ANN ARBOR, MI 48108 · USA

PHONE: [800] 364-9897
[734] 971-3335
FAX: [734] 971-3640

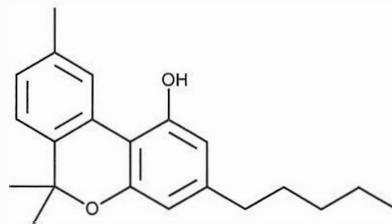
crmquality@caymanchem.com
www.caymanchem.com

CERTIFICATE of ANALYSIS



Cannabinol (CRM)

Certified Reference Material



ACCREDITED
ISO/IEC 17025 #AT-1773
ISO 17034 #AR-1774

Item No.:	ISO60183
Batch No.:	0584229
CAS Registry No.:	521-35-7
Molecular Formula:	C ₂₁ H ₂₆ O ₂
Formula Weight:	310.40 amu
Expiry Date:	13MAR2023 (valid from date of certification)
Supplied as:	A 1 mg/ml (nominal) solution in methanol
Volume per Ampule:	Not less than 1 ml. Ampules are overfilled.
Storage:	Unopened at -20°C.
Safety:	Refer to Safety Data Sheet
Intended Use:	For analytical testing purposes only, not intended for human or animal use.
Instructions for Use:	This product is designated for one-time use and should be used immediately after opening. It is advised that laboratories warm the vial to room temperature prior to opening and use measured volumes.

Certified Concentration · 1.000 mg/ml ± 0.007 mg/ml

Concentration is calculated based on product mass, solution mass, corrected purity, and density at 20°C. It is traceable to SI units through an unbroken chain of measurements. Uncertainty of concentration is expressed as an expanded uncertainty in accordance with ISO standards for Testing Laboratories and Reference Material Producers at the approximate 95% confidence interval using a coverage factor of k=2 and incorporates uncertainties from the corrected purity, solution preparation, homogeneity, and long- and short-term stability. Concentration was verified by comparison to an independently prepared calibration standard.

Corrected Purity · 96.32% ± 0.56%

Corrected purity is determined as follows: Corrected Purity = [(100 - % LOD - % ROI)*Chromatographic Purity/100] or [(100 - % KF - % RS - % ROI)*Chromatographic Purity/100]. All measurement uncertainties are expressed as expanded uncertainties in accordance with ISO standards for Testing Laboratories and Reference Material Producers at the approximate 95% confidence interval using an appropriate coverage factor. Where applicable, optical rotation, chiral purity, and/or isotopic purity testing are performed to support the identification of the reference material, therefore the uncertainty is considered null.

Approval:

Title: ISO Quality Manager

Certification Date: 13MAR2020

Cayman Chemical certifies that this standard meets the specifications stated in this certificate and warrants this product to meet the stated acceptance criteria through the expiration date when stored unopened as recommended.



CERTIFICATE of ANALYSIS



CRM Assay

Method Parameters

Cayman Method	TST SD114
Column	4.6 x150 mm, 5 µm Gemini C18
Mobile Phase	A: 90:10:0.1 mM Water:Acetonitrile:Acetic Acid B: 10:90:0.1 mM Water:Acetonitrile:Acetic Acid
Gradient	Time (min) %B 0-8 0-100% 8-13 100% 15 0%
Flow Rate	1 ml/min
Column Temp	30°C
Wavelength	UV monitored at 284 nm

Homogeneity

A minimum sample size of 2.5 µg was used to determine homogeneity. Homogeneity was determined by HPLC using ampules selected from a random sampling plan from early, middle, and late fill positions.

%RSD	Acceptance Criteria
0.44%	≤3%

The recommended minimum quantity for use is 2.5 µg. Quantities below this have not been evaluated.

Neat Material Quality Information (Item No.: 12066, Batch No.: 0541840)

Qualifier	Method	Result
Chromatographic Purity, HPLC	Cayman Method TST SD114	98.87% ± 0.18%
Identity, LC-MS	Cayman Method TST SD13, +ESI	311.2 amu
Identity, GC-MS	Cayman Method TST SD12	Conforms
Identity, FTIR	USP<854> (diamond ATR)	Conforms
% LOD	Cayman Method TST SD24	2.48% ± .048%
% ROI	Cayman Method TST SD06	<0.10% ± 0.21%
Identity, NMR	¹ H NMR	Conforms

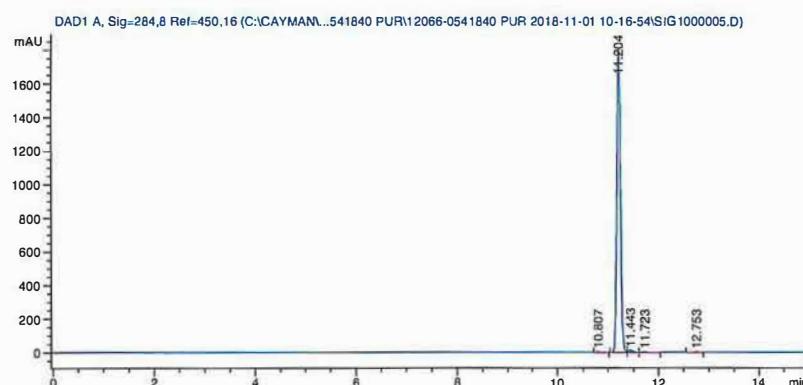
NMR and optical rotation (if applicable) are provided as supplemental information but are not within scope of ISO accreditation.
Property values are traceable to SI units through an unbroken chain of measurements.

CERTIFICATE of ANALYSIS



Supplemental Data (Neat Material)

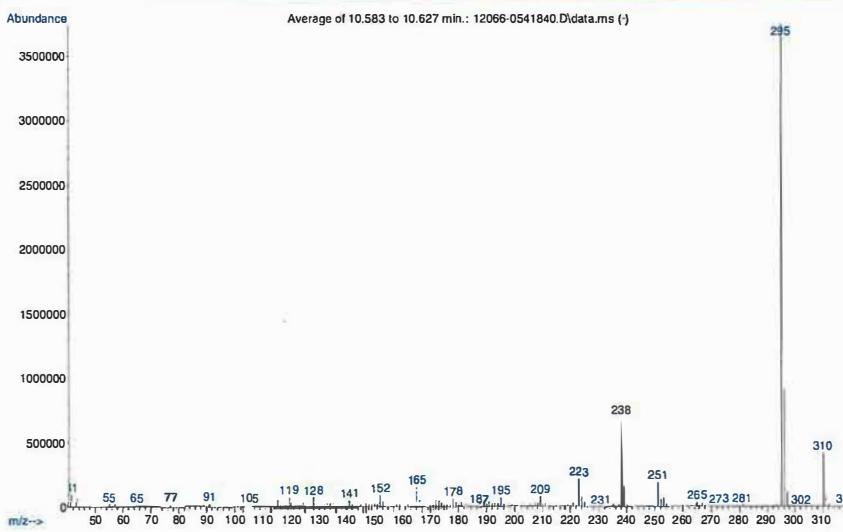
HPLC-UV



Conditions

Instrument	Agilent 1100/1200 Series	
Column	4.6 x 150 mm, 5 µm Gemini C18	
Mobile Phase	A: 90:10:0.1 mM Water:Acetonitrile:Acetic Acid B: 10:90:0.1 mM Water:Acetonitrile:Acetic Acid	
Gradient	Time (min) %B 0-8 0-100% 8-13 100% 15 0%	
Flow Rate	1 ml/min	
Column Temp	30°C	
Wavelength	UV monitored at 284 nm	

GC-MS



Conditions

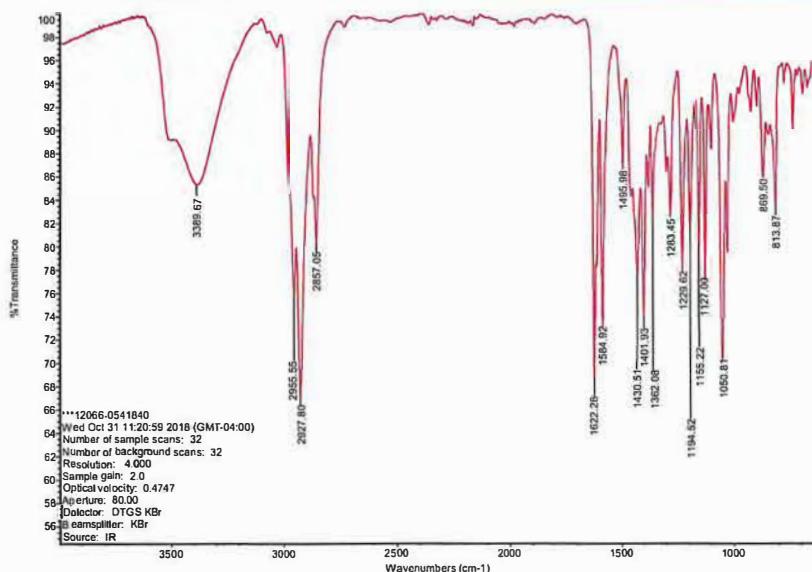
Instrument	Agilent GC MSD	
Column	30 m x 0.32 mm, 0.5 µm Rtx-5MS	
Carrier Gas	He	
Flow Rate	2 ml/min	
Inlet Temp	300°C	
Split Ratio	15:1	
Oven Program	50°C hold for 1 min, ramp to 300°C at 30°C per min, hold at 300°C to 15 minutes	
Transfer Line Temp	300°C	
Voltage	70ev EI MS	
Scan Range	40-600 m/z	
Tune File	stune	

Apex spectrum – background (1 min window in front of peak)

CERTIFICATE of ANALYSIS

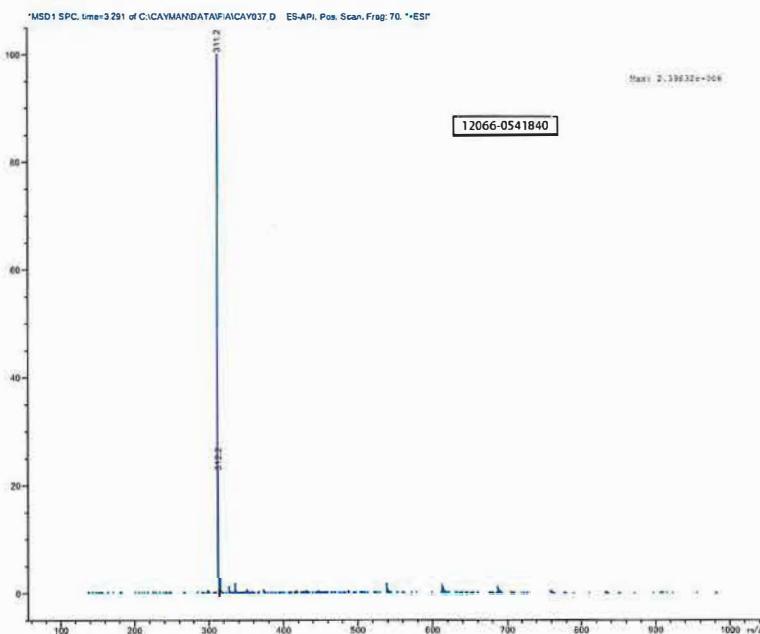


FTIR



Conditions

ESI-MS



Conditions

Instrument	Agilent HPLC MSD
Mobile Phase	50:50:0.1 methanol/water/acetic acid
Flow Rate	0.5 ml/min
Ionization Mode	+ESI
Mass Range	100-1,000 m/z
Nebulizer	60 psi
Desolvation Gas	13 L/min
Desolvation Temp	350°C
Electrospray Voltage	4kV

MS collected across peak width at half height

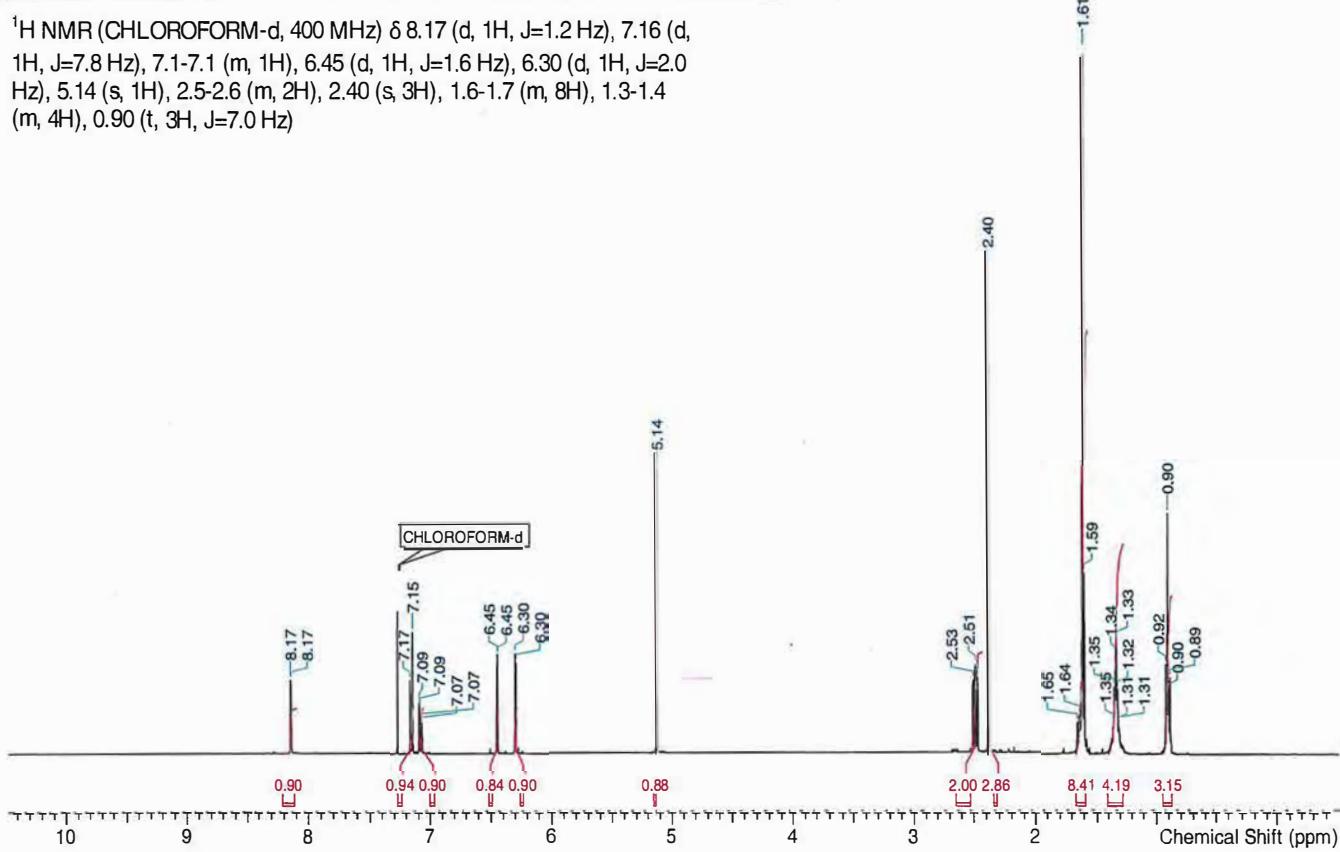
CERTIFICATE of ANALYSIS



NMR (not within scope of ISO accreditation)

Date	Oct 22 2018	
File Name	\sulfur\private\nmrdata\2018\12066-0541840_20181022\12066-0541840_20181022_01\12066-0541840_20181022_001.fid\fid	
Frequency (MHz)	399.961	Nucleus 1H
Solvent	CHLOROFORM-d	Temperature (degree C) 25.000

¹H NMR (CHLOROFORM-d, 400 MHz) δ 8.17 (d, 1H, J=1.2 Hz), 7.16 (d, 1H, J=7.8 Hz), 7.1-7.1 (m, 1H), 6.45 (d, 1H, J=1.6 Hz), 6.30 (d, 1H, J=2.0 Hz), 5.14 (s, 1H), 2.5-2.6 (m, 2H), 2.40 (s, 3H), 1.6-1.7 (m, 8H), 1.3-1.4 (m, 4H), 0.90 (t, 3H, J=7.0 Hz)



Conditions

Instrument	Varian Inova 400MHz NMR
Scans	64 scans

Stability

The effect of the components of stability on the combined standard uncertainty of the CRM property value are considered negligible unless indicated in stability studies.

Short-Term Stability

A decrease in property value was observed at 60°C during the two-week stability study. No decrease was observed at ambient temperature during the study. This data supports cold shipment of this product.

Long-Term Stability

Long-term stability data predicts three years stability at the -20°C storage temperature. Long-term stability studies are ongoing and the Certificate of Analysis will be updated upon study completion.

CERTIFICATE of ANALYSIS



Revision History

Revision No.	Date	Reason for Revision
01	13MAR2020	Initial version

Disclaimers

Material Safety Data

This material should be considered hazardous until information to the contrary becomes available. Do not ingest, swallow, or inhale. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. This information contains some but not all of the information required for the safe and proper use of this material. Before use, review the complete Safety Data Sheet, which has been sent via email to your institution.

Warranty and Limitation of Remedy

Cayman Chemical Company makes no warranty or guarantee of any kind, whether written or oral, expressed or implied, including without limitation, any warranty of fitness for a particular purpose, suitability and merchantability, which extends beyond the description of the chemicals hereof. Cayman warrants only to the original customer that the material will meet our specifications at the time of delivery.

Cayman will carry out its delivery obligations with due care and skill. Thus, in no event will Cayman have any obligation or liability, whether in tort (including negligence) or in contract, for any direct, indirect, incidental or consequential damages, even if Cayman is informed about their possible existence.

This limitation of liability does not apply in the case of intentional acts or negligence of Cayman, its directors or its employees.

Buyer's exclusive remedy and Cayman's sole liability hereunder shall be limited to a refund of the purchase price, or at Cayman's option, the replacement, at no cost to Buyer, of all material that does not meet our specification.

Said refund or replacement is conditioned on Buyer giving written notice to Cayman within thirty (30) days after arrival of the material at its destination. Failure of Buyer to give said notice within thirty (30) days shall constitute a waiver of Buyer of all claims hereunder with respect to said material.

For further details, please refer to our Warranty and Limitations of Remedy located on our website and in our catalog.

This Certificate shall not be reproduced except in full, without written approval from the Cayman Chemical ISO Quality Manager.

ISO CRT SD02 v 4.0

CAYMAN CHEMICAL
1180 EAST ELLSWORTH RD
ANN ARBOR, MI 48108 - USA

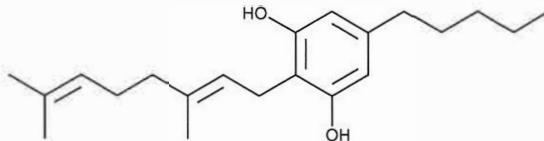
PHONE: [800] 364-9897
[734] 971-3335
FAX: [734] 971-3640

crmquality@caymancem.com
www.caymancem.com



CERTIFICATE of ANALYSIS

Cannabigerol (CRM)



ACCREDITED
ISO/IEC 17025 #AT-1773
ISO 17034 #AR-1774

<i>Item No.:</i>	20164
<i>Batch No.:</i>	0567652
<i>CAS Registry No.:</i>	25654-31-3
<i>Molecular Formula:</i>	C ₂₁ H ₃₂ O ₂
<i>Formula Weight:</i>	316.50 amu
<i>Expiry Date:</i>	01AUG2022 (valid from date of certification)
<i>Supplied as:</i>	A 1 mg/ml (nominal) solution in methanol
<i>Volume per Ampule:</i>	Not less than 1 ml. Ampules are overfilled.
<i>Storage:</i>	Unopened at -20°C.
<i>Safety:</i>	Refer to Safety Data Sheet
<i>Intended Use:</i>	For analytical testing purposes only, not intended for human or animal use.
<i>Instructions for Use:</i>	This product is designated for one-time use and should be used immediately after opening. It is advised that laboratories warm the vial to room temperature prior to opening and use measured volumes.

Certified Concentration · 1.000 mg/ml ± 0.008 mg/ml

Concentration is calculated based on product mass, solution mass, corrected purity, and density at 20°C. It is traceable to SI units through an unbroken chain of measurements. Uncertainty of concentration is expressed as an expanded uncertainty in accordance with ISO standards for Testing Laboratories and Reference Material Producers at the approximate 95% confidence interval using a coverage factor of k=2 and incorporates uncertainties from the corrected purity, solution preparation, homogeneity, and long- and short-term stability. Concentration was verified by comparison to an independently prepared calibration standard.

Corrected Purity · 99.70% ± 0.56%

Corrected purity is determined as follows: Corrected Purity = [(100 - % LOD - % ROI)*Chromatographic Purity/100] or [(100 - % KF - % RS - % ROI)*Chromatographic Purity/100]. All measurement uncertainties are expressed as expanded uncertainties in accordance with ISO standards for Testing Laboratories and Reference Material Producers at the approximate 95% confidence interval using an appropriate coverage factor. Where applicable, optical rotation, chiral purity, and/or isotopic purity testing are performed to support the identification of the reference material, therefore the uncertainty is considered null.

Approval:

Title: ISO Quality Manager

Certification Date: 01AUG2019

Cayman Chemical certifies that this standard meets the specifications stated in this certificate and warrants this product to meet the stated acceptance criteria through the expiration date when stored unopened as recommended.



CERTIFICATE of ANALYSIS

CRM Assay

Method Parameters

Cayman Method	TST SD151
Column	4.6 x150 mm, 5 µm Zorbax Bonus-RP
Mobile Phase	A: 01. % Trifluoroacetate B: Acetonitrile
Gradient	Time (min) %B 0-12 50-90% 12-20 90% 20.1-25 50%
Flow Rate	1 ml/min
Column Temp	30°C
Wavelength	UV monitored at 232 nm

Homogeneity

A minimum sample size of 1.0 µg was used to determine homogeneity. Homogeneity was determined by HPLC using ampules selected from a random sampling plan from early, middle, and late fill positions.

%RSD	Acceptance Criteria
0.65%	≤3%

The recommended minimum quantity for use is 1.0 µg. Quantities below this have not been evaluated.

Neat Material Quality Information (Item No.: 15293, Batch No.: 0542037)

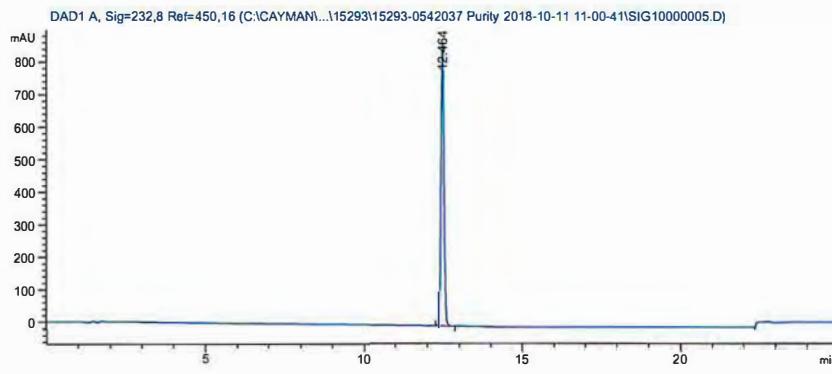
Qualifier	Method	Result
Chromatographic Purity, HPLC	Cayman Method TST SD151	≥99.90% ± 0.18%
Identity, LC-MS	Cayman Method TST SD13, +ESI	317.2 amu
Identity, GC-MS	Cayman Method TST SD12	Conforms
Identity, FTIR	USP<854> (diamond ATR)	Conforms
% LOD	Cayman Method TST SD24	<0.10% ± 0.48%
% ROI	Cayman Method TST SD06	<0.10% ± 0.21%
Identity, NMR	¹ H NMR	Conforms

NMR and optical rotation (if applicable) are provided as supplemental information but are not within scope of ISO accreditation.
Property values are traceable to SI units through an unbroken chain of measurements.

CERTIFICATE of ANALYSIS

Supplemental Data (Neat Material)

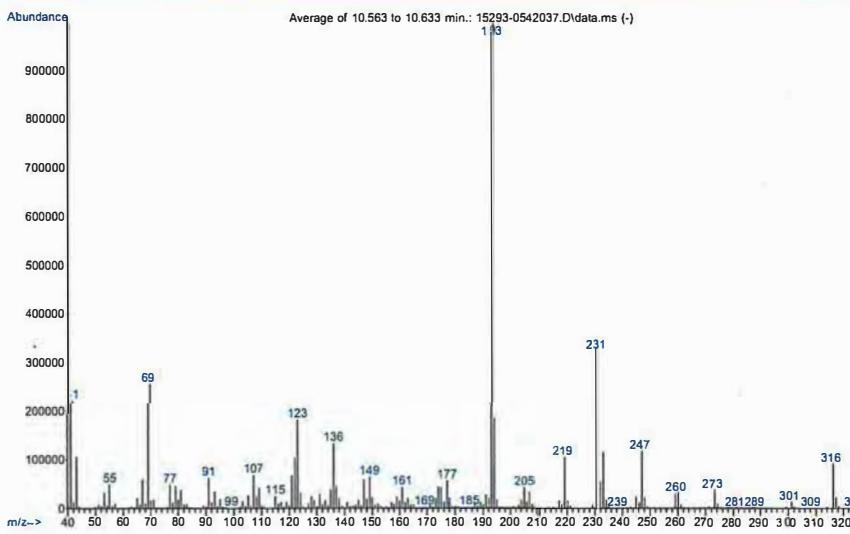
HPLC-UV



Conditions

Instrument	Agilent 1100/1200 Series	
Column	4.6 x 150 mm, 5 µm Zorbax Bonus-RP	
Mobile Phase	A: 01% Trifluoroacetate B: Acetonitrile	
Gradient	Time (min)	%B
	0-12	50-90%
	12-20	90%
	20.1-25	50%
Flow Rate	1 ml/min	
Column Temp	30°C	
Wavelength	UV monitored at 232 nm	

GC-MS



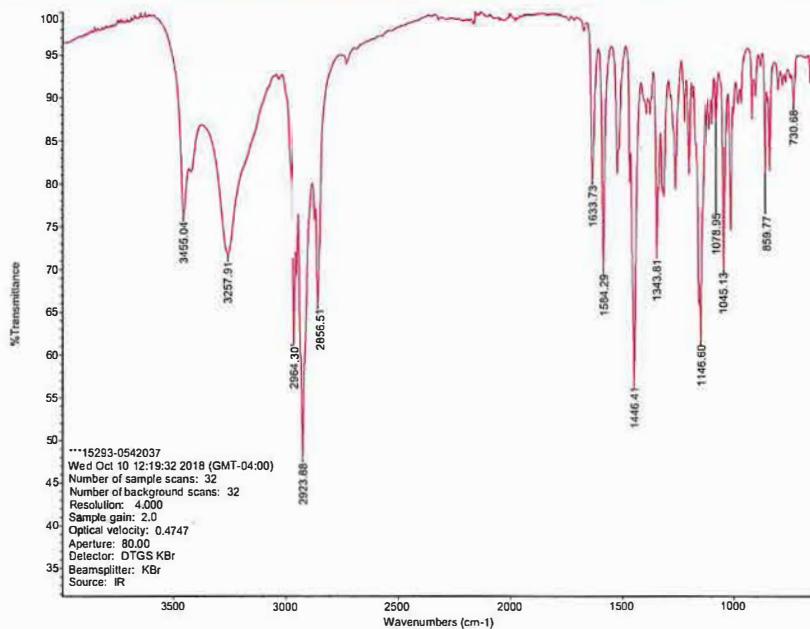
Conditions

Instrument	Agilent 6890 GC/5973 MSD	
Column	30 m x 0.32 mm, 0.5 µm Rtx-5MS	
Carrier Gas	He	
Flow Rate	2 ml/min	
Inlet Temp	300°C	
Split Ratio	15:1	
Oven Program	50°C hold for 1 min, ramp to 300°C at 30°C per min, hold at 300°C to 15 minutes	
Transfer Line Temp	300°C	
Voltage	70ev EI MS	
Scan Range	40-600 m/z	
Tune File	stune	

Apex spectrum – background (1 min window in front of peak)

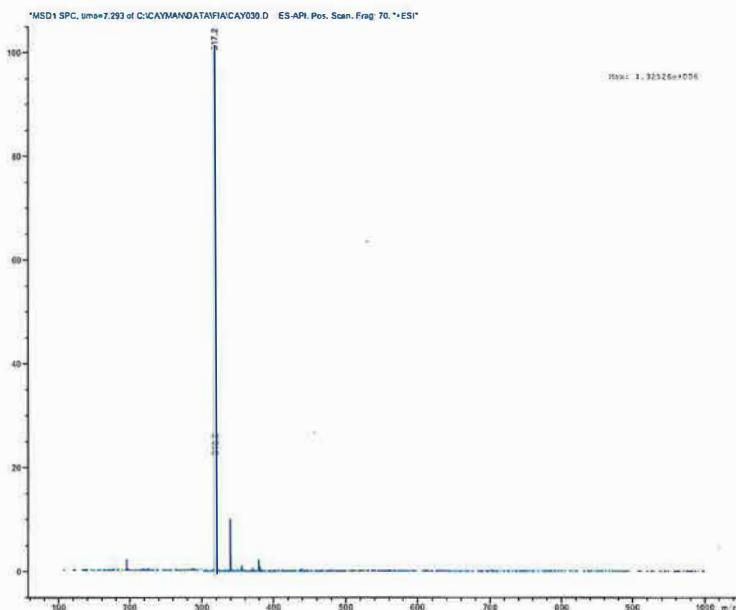
CERTIFICATE of ANALYSIS

FTIR



Conditions

ESI-MS

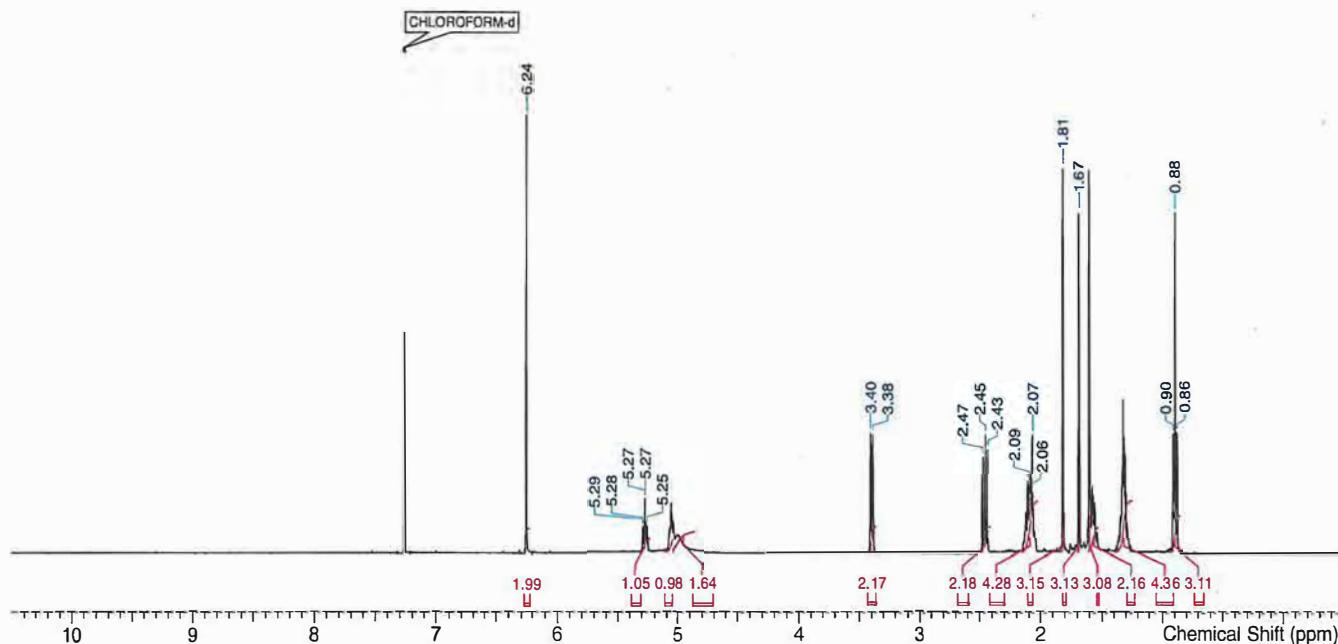


CERTIFICATE of ANALYSIS

NMR (*not within scope of ISO accreditation*)

Date	Oct 3 2018	
File Name	\sulfur\private\nmrdata_2018\YL-1756-082-3_20181003\YL-1756-082-3_20181003_01\YL-1756-082-3_20181003_001.fidfid	
Frequency (MHz)	399.9661	Nucleus 1H
Solvent	CHLOROFORM-d	Temperature (degree C) 25.000

¹H NMR (CHLOROFORM-d, 400 MHz) δ 6.24 (s, 2H), 5.2-5.3 (m, 1H), 5.0-5.1 (m, 1H), 4.95 (br s, 2H), 3.39 (d, 2H, J=7.0 Hz), 2.45 (t, 2H, J=7.8 Hz), 2.0-2.1 (m, 4H), 1.81 (d, 3H, J=0.8 Hz), 1.67 (d, 3H, J=0.8 Hz), 1.59 (s, 3H), 1.5-1.6 (m, 2H), 1.2-1.4 (m, 4H), 0.88 (s, 3H, J=8.2 Hz)



Conditions

Instrument	Varian Inova 400MHz NMR
Scans	64 scans

Stability

The effect of the components of stability on the combined standard uncertainty of the CRM property value are considered negligible unless indicated in stability studies.

Short-Term Stability

A decrease in property value was observed at 60°C during the two-week stability study. No decrease was observed at ambient temperature during the study. This data supports cold shipment of this product.

Long-Term Stability

Long-term stability data predicts 3 years stability at the -20°C storage temperature. Long-term stability studies are ongoing and the Certificate of Analysis will be updated upon study completion.



CERTIFICATE of ANALYSIS

Revision History

Revision No.	Date	Reason for Revision
01	01AUG2019	Initial version

Disclaimers

Material Safety Data

This material should be considered hazardous until information to the contrary becomes available. Do not ingest, swallow, or inhale. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. This information contains some but not all of the information required for the safe and proper use of this material. Before use, review the complete Safety Data Sheet, which has been sent via email to your institution.

Warranty and Limitation of Remedy

Cayman Chemical Company makes no warranty or guarantee of any kind, whether written or oral, expressed or implied, including without limitation, any warranty of fitness for a particular purpose, suitability and merchantability, which extends beyond the description of the chemicals hereof. Cayman warrants only to the original customer that the material will meet our specifications at the time of delivery.

Cayman will carry out its delivery obligations with due care and skill. Thus, in no event will Cayman have any obligation or liability, whether in tort (including negligence) or in contract, for any direct, indirect, incidental or consequential damages, even if Cayman is informed about their possible existence.

This limitation of liability does not apply in the case of intentional acts or negligence of Cayman, its directors or its employees.

Buyer's exclusive remedy and Cayman's sole liability hereunder shall be limited to a refund of the purchase price, or at Cayman's option, the replacement, at no cost to Buyer, of all material that does not meet our specification.

Said refund or replacement is conditioned on Buyer giving written notice to Cayman within thirty (30) days after arrival of the material at its destination. Failure of Buyer to give said notice within thirty (30) days shall constitute a waiver of Buyer of all claims hereunder with respect to said material.

For further details, please refer to our Warranty and Limitations of Remedy located on our website and in our catalog.

This Certificate shall not be reproduced except in full, without written approval from the Cayman Chemical ISO Quality Manager.

ISO CRT SD02 v 3.1

CAYMAN CHEMICAL
1180 EAST ELLSWORTH RD
ANN ARBOR MI 48108 - USA

PHONE: [800] 364-9897
[734] 971-3335
FAX: [734] 971-3640

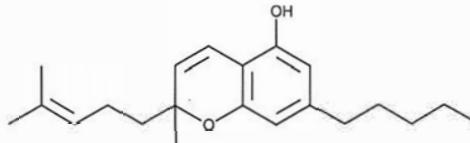
crmquality@caymancem.com
www.caymancem.com

CERTIFICATE of ANALYSIS



(±)-Cannabichromene (CRM)

Certified Reference Material



ACCREDITED
ISO/IEC 17025 #AT-1774
ISO 17034 #AR-1774

Item No.:	ISO60163
Batch No.:	0586327
CAS Registry No.:	20675-51-8
Molecular Formula:	C ₂₁ H ₃₀ O ₂
Formula Weight:	314.50 amu
Expiry Date:	29MAR2023 (valid from date of certification)
Supplied as:	A 1 mg/ml (nominal) solution in methanol
Volume per Ampule:	Not less than 1 ml. Ampules are overfilled.
Storage:	Unopened at -20°C.
Safety:	Refer to Safety Data Sheet
Intended Use:	For analytical testing purposes only, not intended for human or animal use.
Instructions for Use:	This product is designated for one-time use and should be used immediately after opening. It is advised that laboratories warm the vial to room temperature prior to opening and use measured volumes.

Certified Concentration · 1.000 mg/ml ± 0.013 mg/ml

Concentration is calculated based on product mass, solution mass, corrected purity, and density at 20°C. It is traceable to SI units through an unbroken chain of measurements. Uncertainty of concentration is expressed as an expanded uncertainty in accordance with ISO standards for Testing Laboratories and Reference Material Producers at the approximate 95% confidence interval using a coverage factor of k=2 and incorporates uncertainties from the corrected purity, solution preparation, homogeneity, and long- and short-term stability. Concentration was verified by comparison to an independently prepared calibration standard.

Corrected Purity · 94.75% ± 0.57%

Corrected purity is determined as follows: Corrected Purity = [(100 - % LOD - % ROI)*Chromatographic Purity/100] or [(100 - % KF - % RS - % ROI)*Chromatographic Purity/100]. All measurement uncertainties are expressed as expanded uncertainties in accordance with ISO standards for Testing Laboratories and Reference Material Producers at the approximate 95% confidence interval using an appropriate coverage factor. Where applicable, optical rotation, chiral purity, and/or isotopic purity testing are performed to support the identification of the reference material, therefore the uncertainty is considered null.

Approval:

Title: ISO Quality Manager

Certification Date: 29MAR2020

Cayman Chemical certifies that this standard meets the specifications stated in this certificate and warrants this product to meet the stated acceptance criteria through the expiration date when stored unopened as recommended.



CERTIFICATE of ANALYSIS



CRM Assay

Method Parameters

Cayman Method	TST SD151
Column	4.6 x150 mm, 5 µm Kinetex Biphenyl
Mobile Phase	A: 0.1% Trifluoroacetic acid in DI water B: Acetonitrile
Gradient	Time (min) %B 0-12 50-90% 12-17 90% 17.1-22 50%
Flow Rate	1 ml/min
Column Temp	30°C
Wavelength	UV monitored at 282 nm

Homogeneity

A minimum sample size of 2.0 µg was used to determine homogeneity. Homogeneity was determined by HPLC using ampules selected from a random sampling plan from early, middle, and late fill positions.

%RSD	Acceptance Criteria
1.47%	≤3%

The recommended minimum quantity for use is 2.0 µg. Quantities below this have not been evaluated.

Neat Material Quality Information (Item No.: 21721, Batch No.: 0522897)

Qualifier	Method	Result
Chromatographic Purity, HPLC	Cayman Method TST SD151	99.36% ± 0.18%
Identity, LC-MS	Cayman Method TST SD13, +ESI	315.4 amu
Identity, GC-MS	Cayman Method TST SD12	Conforms
Identity, FTIR	USP<854> (diamond ATR)	Conforms
% LOD	Cayman Method TST SD24	4.54% ± 0.49%
% ROI	Cayman Method TST SD06	<0.10% ± 0.21%
Identity, NMR	¹ H NMR	Conforms
Total THC ((THCA*0.877) + Δ ⁹ -THC)	Cayman Method TEST SD163	≤0.3%

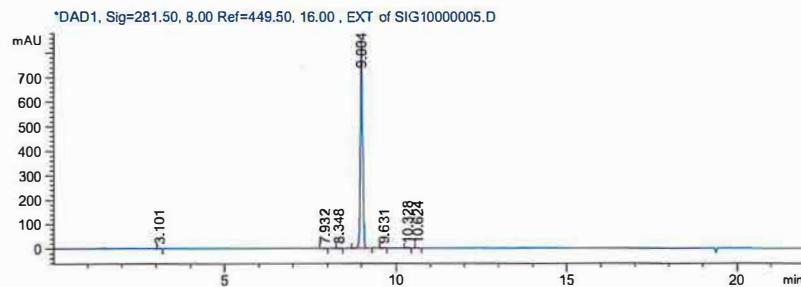
NMR, total THC, and optical rotation (if applicable) are provided as supplemental information but are not within scope of ISO accreditation.
Property values are traceable to SI units through an unbroken chain of measurements.

CERTIFICATE of ANALYSIS



Supplemental Data (Neat Material)

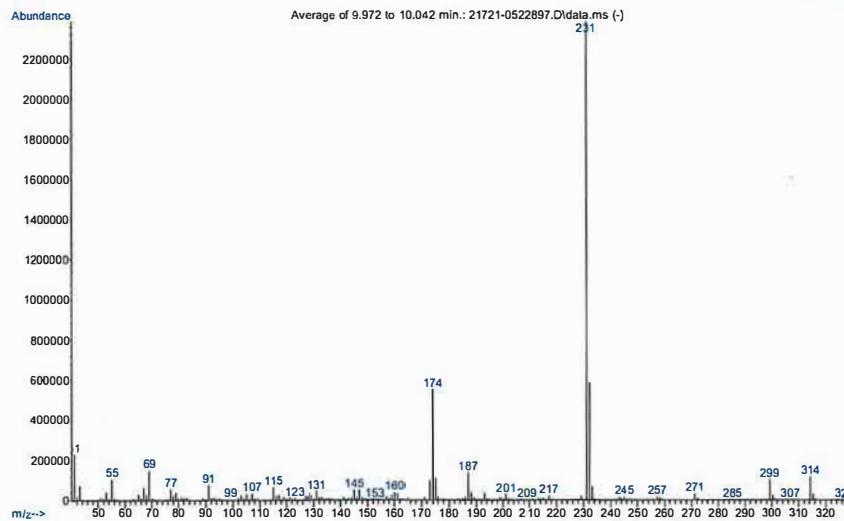
HPLC-UV



Conditions

Instrument	Agilent 1100/1200 Series	
Column	4.6 x 150 mm, 5 µm Kinetex Biphenyl	
Mobile Phase	A: 0.1% Trifluoroacetic acid in Water B: Acetonitrile	
Gradient	Time (min)	%B
	0-12	50-90%
	12-17	90%
	17.1-22	50%
Flow Rate	1 ml/min	
Column Temp	30°C	
Wavelength	UV monitored at 282 nm	

GC-MS



Conditions

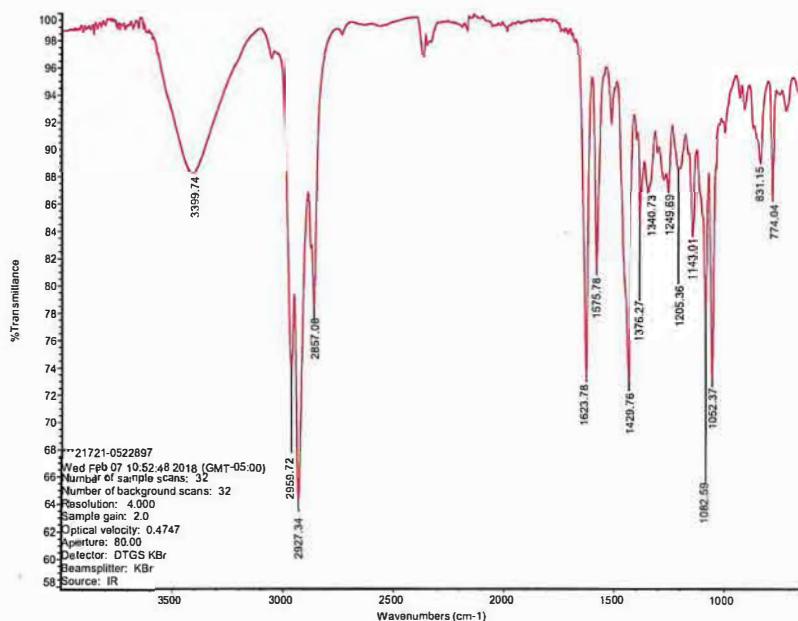
Instrument	Agilent GC MSD	
Column	30 m x 0.32 mm, 0.5 µm Rtx-5MS	
Carrier Gas	He	
Flow Rate	2 ml/min	
Inlet Temp	300°C	
Split Ratio	15:1	
Oven Program	50°C hold for 1 min, ramp to 300°C at 30°C per min, hold at 300°C to 15 minutes	
Transfer Line Temp	300°C	
Voltage	70ev EI MS	
Scan Range	40-600 m/z	
Tune File	stune	

Apex spectrum – background (1 min window in front of peak)

CERTIFICATE of ANALYSIS

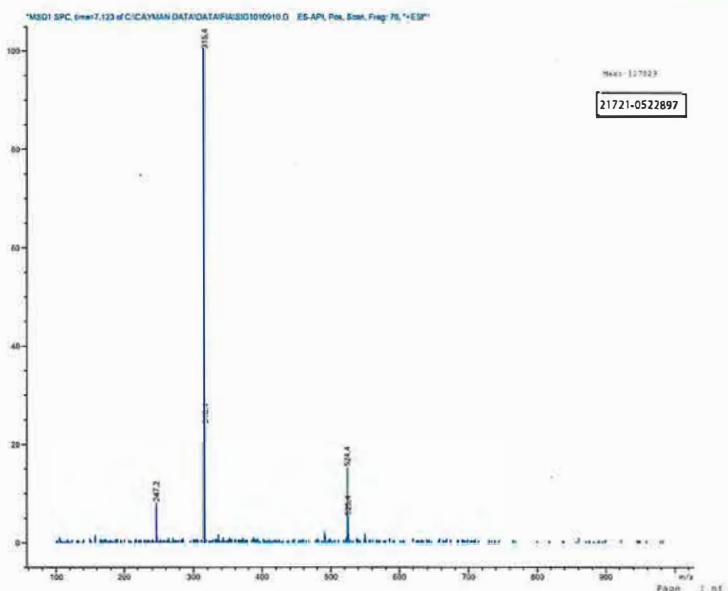


FTIR



Conditions

ESI-MS



Conditions

Instrument	Agilent HPLC MSD
Mobile Phase	50:50:0.1 methanol/water/acetic acid
Flow Rate	0.5 ml/min
Ionization Mode	+ESI
Mass Range	100-1,000 m/z
Nebulizer	60 psi
Desolvation Gas	13 L/min
Desolvation Temp	350°C
Electrospray Voltage	4kV

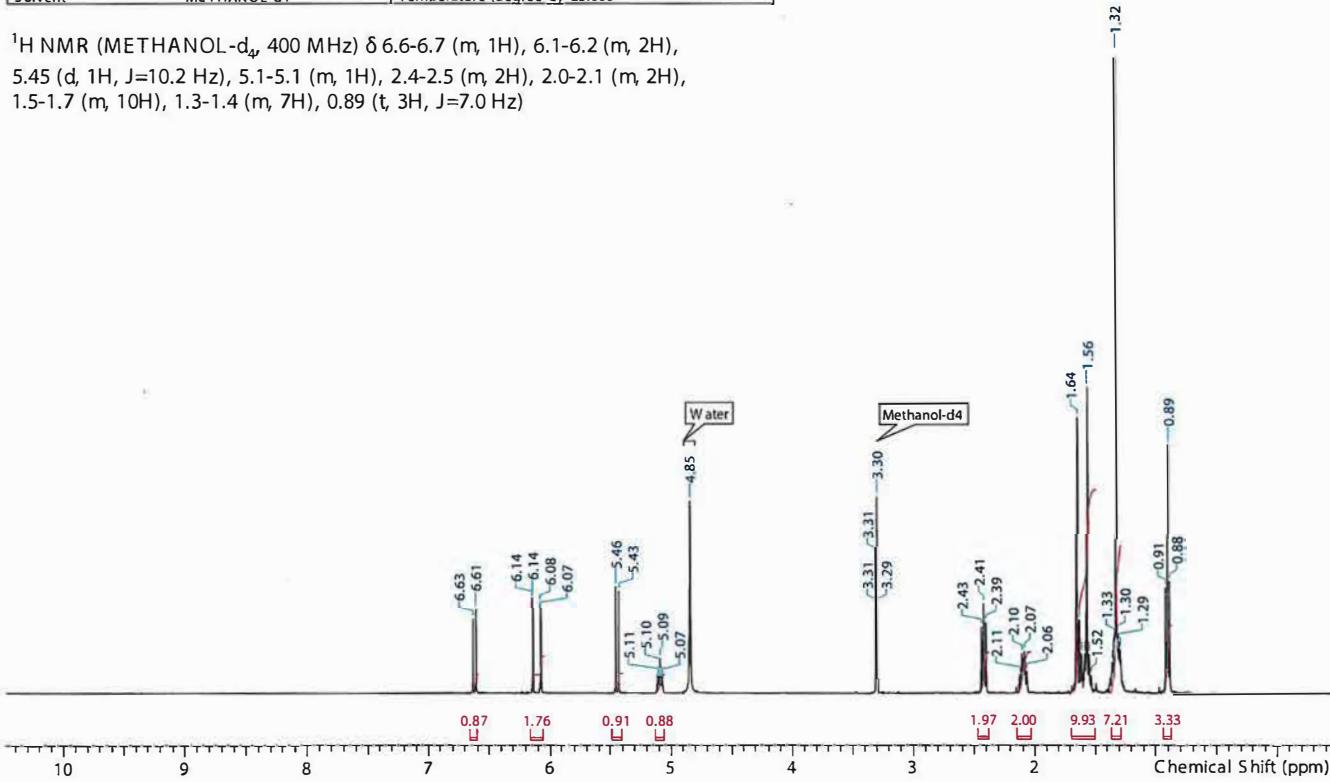
CERTIFICATE of ANALYSIS



NMR (not within scope of ISO accreditation)

Date	Jan 30 2018			
File Name	\E:\ufur\private\vmrdata_\2018\21721-0510968_20180130\21721-0510968_20180130_01\21721-0510968_20180130_001.fidfid			
Frequency (MHz)	399.9677	Nucleus	1H	Number of Transients
Solvent	METHANOL-d4	Temperature (degree C)	25.000	32

¹H NMR (METHANOL-d₄, 400 MHz) δ 6.6-6.7 (m, 1H), 6.1-6.2 (m, 2H), 5.45 (d, 1H, J=10.2 Hz), 5.1-5.1 (m, 1H), 2.4-2.5 (m, 2H), 2.0-2.1 (m, 2H), 1.5-1.7 (m, 10H), 1.3-1.4 (m, 7H), 0.89 (t, 3H, J=7.0 Hz)



Conditions

Instrument Varian Inova 400MHz NMR
Scans 64 scans

Stability

The effect of the components of stability on the combined standard uncertainty of the CRM property value are considered negligible unless indicated in stability studies.

Short-Term Stability

A decrease in property value was observed at 60°C during the two-week stability study. No decrease was observed at ambient temperature during the study. This data supports cold shipment of this product.

Long-Term Stability

Long-term stability data predicts three years stability at the -20°C storage temperature. Long-term stability studies are ongoing and the Certificate of Analysis will be updated upon study completion.

CERTIFICATE of ANALYSIS



Revision History

Revision No.	Date	Reason for Revision
01	29MAR2020	Initial version

Disclaimers

Material Safety Data

This material should be considered hazardous until information to the contrary becomes available. Do not ingest, swallow, or inhale. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. This information contains some but not all of the information required for the safe and proper use of this material. Before use, review the complete Safety Data Sheet, which has been sent via email to your institution.

Warranty and Limitation of Remedy

Cayman Chemical Company makes no warranty or guarantee of any kind, whether written or oral, expressed or implied, including without limitation, any warranty of fitness for a particular purpose, suitability and merchantability, which extends beyond the description of the chemicals hereof. Cayman warrants only to the original customer that the material will meet our specifications at the time of delivery.

Cayman will carry out its delivery obligations with due care and skill. Thus, in no event will Cayman have any obligation or liability, whether in tort (including negligence) or in contract, for any direct, indirect, incidental or consequential damages, even if Cayman is informed about their possible existence.

This limitation of liability does not apply in the case of intentional acts or negligence of Cayman, its directors or its employees.

Buyer's exclusive remedy and Cayman's sole liability hereunder shall be limited to a refund of the purchase price, or at Cayman's option, the replacement, at no cost to Buyer, of all material that does not meet our specification.

Said refund or replacement is conditioned on Buyer giving written notice to Cayman within thirty (30) days after arrival of the material at its destination. Failure of Buyer to give said notice within thirty (30) days shall constitute a waiver of Buyer of all claims hereunder with respect to said material.

For further details, please refer to our Warranty and Limitations of Remedy located on our website and in our catalog.

This Certificate shall not be reproduced except in full, without written approval from the Cayman Chemical ISO Quality Manager.

ISO CRT SD02 v 4.1

CAYMAN CHEMICAL
1180 EAST ELLSWORTH RD
ANN ARBOR, MI 48108 - USA

PHONE: [800] 364-9897
[734] 971-3335
FAX: [734] 971-3640

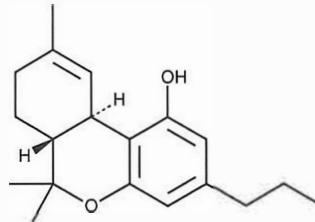
crmquality@caymancem.com
www.caymancem.com

CERTIFICATE of ANALYSIS



Tetrahydrocannabivarin (CRM)

Certified Reference Material



ACCREDITED
ISO/IEC 17025 #AT-1773
ISO 17034 #AR-1774

Item No.: 18091
Batch No.: 0606999
CAS Registry No.: 31262-37-0
Molecular Formula: C₁₉H₂₆O₂
Formula Weight: 286.40 amu

Expiry Date: 25JAN2024 (valid from date of certification)
Supplied as: A 1 mg/ml (nominal) solution in methanol
Volume per Ampule: Not less than 1 ml. Ampules are overfilled.

Storage: Unopened at -20°C.
Safety: Refer to Safety Data Sheet

Intended Use: For analytical testing purposes only, not intended for human or animal use.
Instructions for Use: This product is designated for one-time use and should be used immediately after opening.
It is advised that laboratories warm the vial to room temperature prior to opening and use measured volumes.

Certified Concentration · 1.000 mg/ml ± 0.013 mg/ml

Concentration is calculated based on product mass, solution mass, corrected purity, and density at 20°C. It is traceable to SI units through an unbroken chain of measurements. Uncertainty of concentration is expressed as an expanded uncertainty in accordance with ISO standards for Testing Laboratories and Reference Material Producers at the approximate 95% confidence interval using a coverage factor of k=2 and incorporates uncertainties from the corrected purity, solution preparation, homogeneity, and long- and short-term stability. Concentration was verified by comparison to an independently prepared calibration standard.

Corrected Purity · 94.47% ± 0.52%

Corrected purity is determined as follows: Corrected Purity = [(100 - % LOD - % ROI)*Chromatographic Purity/100] or [(100 - % KF - % RS - % ROI)*Chromatographic Purity/100]. All measurement uncertainties are expressed as expanded uncertainties in accordance with ISO standards for Testing Laboratories and Reference Material Producers at the approximate 95% confidence interval using an appropriate coverage factor. Where applicable, optical rotation, chiral purity, and/or isotopic purity testing are performed to support the identification of the reference material, therefore the uncertainty is considered null.

Approval:

Title: ISO Quality Manager

Certification Date: 25JAN2021

Cayman Chemical certifies that this standard meets the specifications stated in this certificate and warrants this product to meet the stated acceptance criteria through the expiration date when stored unopened as recommended.



CERTIFICATE of ANALYSIS



CRM Assay

Method Parameters

Cayman Method	TST SD173
Column	4.6 x150 mm, 2.7 µm NexLeaf CBX
Mobile Phase	A: 0.17% Phosphoric Acid in water B: 0.17% Phosphoric Acid in methanol
Gradient	Time (min) %B 0-3.3 65% 3.3-10.6 65-72% 10.6-14.6 72-95% 14.6-16.6 95% 16.6-17 95-65% 17-20 65%
Flow Rate	1.5 ml/min
Column Temp	50°C
Wavelength	UV monitored at 220 nm

Homogeneity

A minimum sample size of 1.0 µg was used to determine homogeneity. Homogeneity was determined by HPLC using ampules selected from a random sampling plan from early, middle, and late fill positions.

%RSD	Acceptance Criteria
0.96%	≤3%

The recommended minimum quantity for use is 1.0 µg. Quantities below this have not been evaluated.

Neat Material Quality Information (Item No.: 15538, Batch No.: 0602848)

Qualifier	Method	Result
Chromatographic Purity, HPLC	Cayman Method TST SD173	97.99% ± 0.18%
Identity, LC-MS	Cayman Method TST SD13, +ESI	287.2 amu
Identity, GC-MS	Cayman Method TST SD12	Conforms
Identity, FTIR	USP<854> (diamond ATR)	Conforms
% LOD	Cayman Method TST SD153	3.49% ± 0.45%
% ROI	Cayman Method TST SD06	<0.10% ± 0.19%
Identity, NMR	¹ H NMR	Conforms
Total THC ((THCA*0.877) + Δ ⁹ -THC)	Cayman Method TST SD163	<0.3%

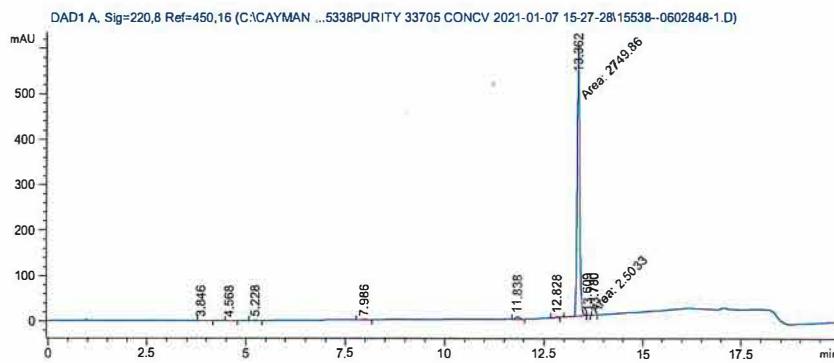
NMR, total THC, and optical rotation (if applicable) are provided as supplemental information but are not within scope of ISO accreditation.
Property values are traceable to SI units through an unbroken chain of measurements.

CERTIFICATE of ANALYSIS



Supplemental Data (Neat Material)

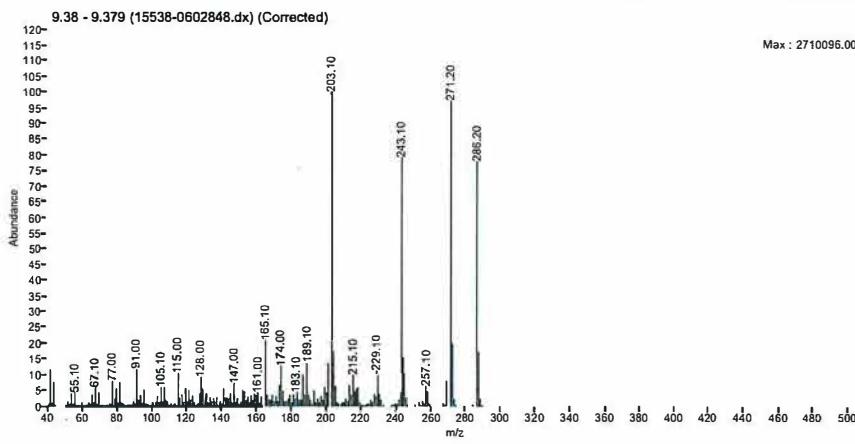
HPLC-UV



Conditions

Instrument	Agilent 1100/1200 Series	
Column	4.6 x150 mm, 2.7 μ m NexLeaf CBX	
Mobile Phase	A: 0.17% Phosphoric Acid in water B: 0.17% Phosphoric Acid in methanol	
Gradient	Time (min)	%B
	0-3.3	65%
	3.3-10.6	65-72%
	10.6-14.6	72-95%
	14.6-16.6	95%
	16.6-17	95-65%
	17-20	65%
Flow Rate	1.5 ml/min	
Column Temp	50°C	
Wavelength	UV monitored at 220 nm	

GC-MS



Conditions

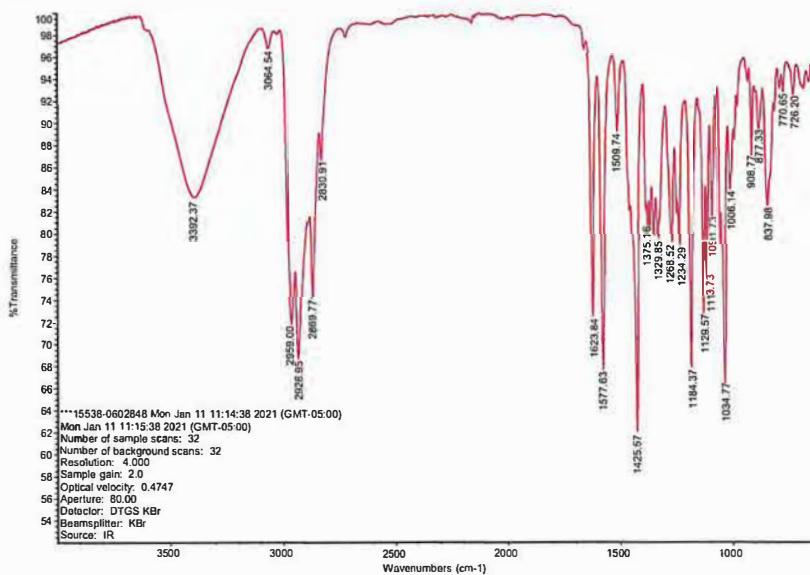
Instrument	Agilent GC MSD	
Column	30 m x 0.32 mm, 0.5 μ m Rtx-5MS	
Carrier Gas	He	
Flow Rate	2 ml/min	
Inlet Temp	300°C	
Split Ratio	15:1	
Oven Program	50°C hold for 1 min, ramp to 300°C at 30°C per min, hold at 300°C to 25 minutes	
Transfer Line Temp	300°C	
Voltage	70ev EI MS	
Scan Range	40-650 m/z	
Tune File	atune (custom)	

Apex spectrum – background (1 min window in front of peak)

CERTIFICATE of ANALYSIS

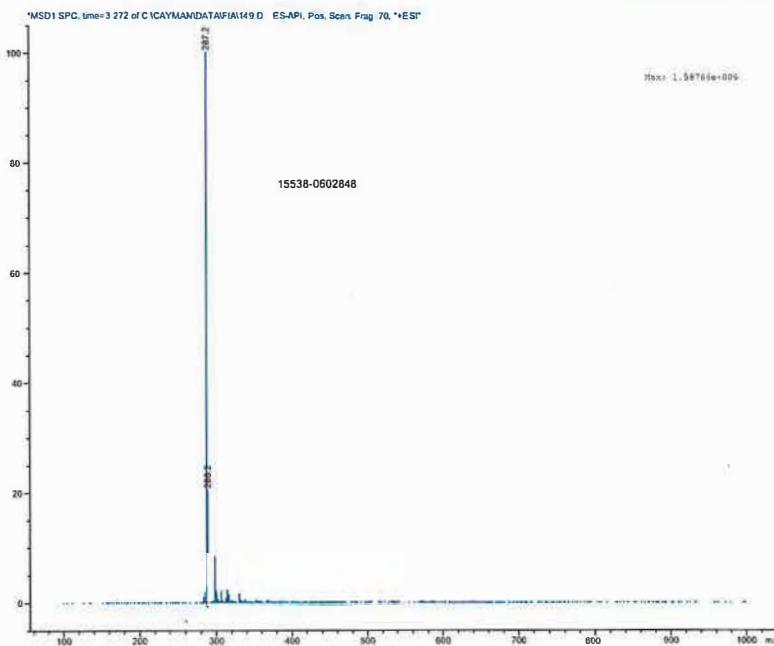


FTIR



Conditions

ESI-MS



Conditions

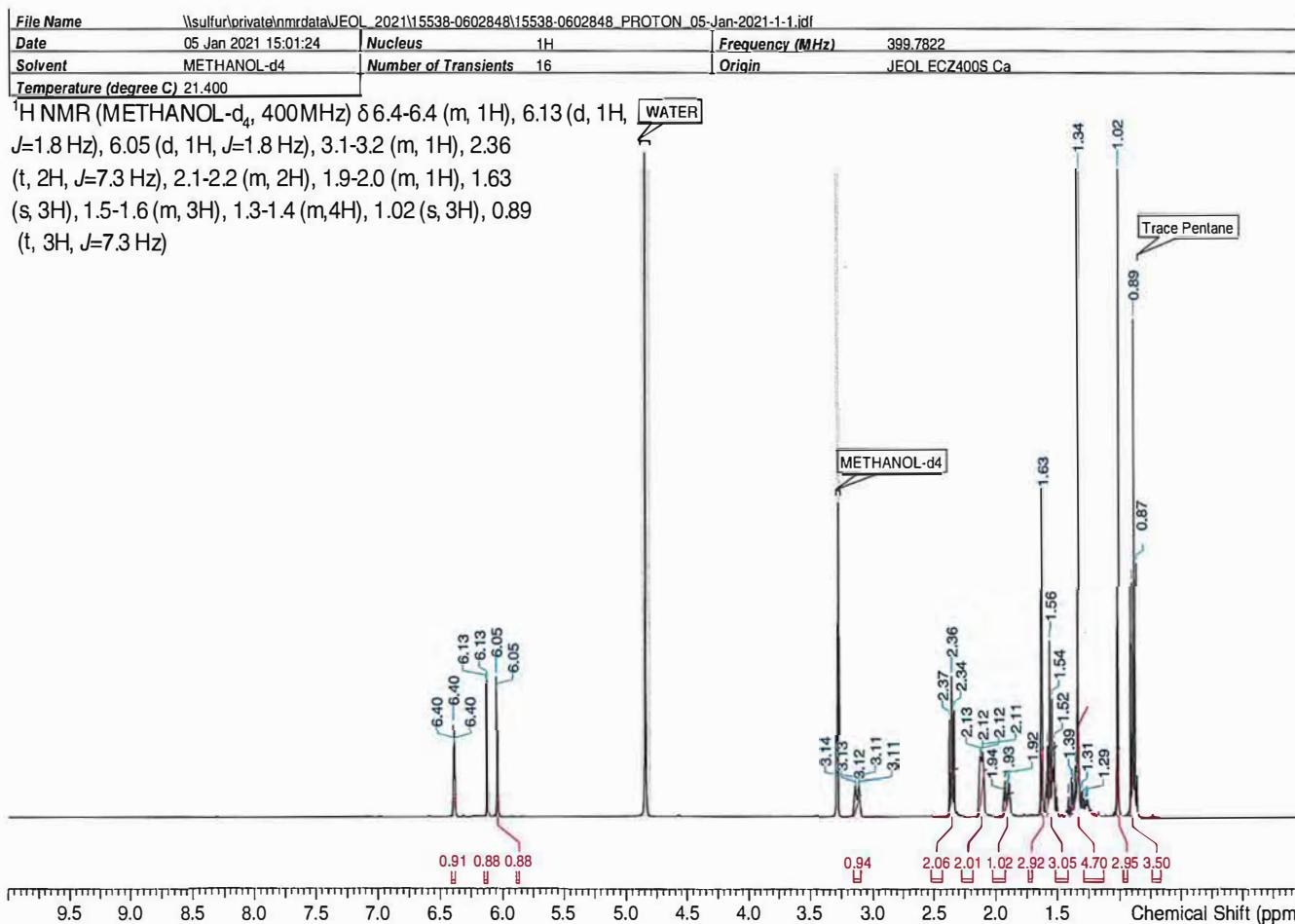
Instrument	Agilent HPLC MSD
Mobile Phase	50:50:0.1 methanol/water/acetic acid
Flow Rate	0.5 ml/min
Ionization Mode	+ESI
Mass Range	100-1,000 m/z
Nebulizer	60 psi
Desolvation Gas	13 L/min
Desolvation Temp	350°C
Electrospray Voltage	4kV

MS collected across peak width at half height

CERTIFICATE of ANALYSIS



NMR (not within scope of ISO accreditation)



Conditions

Instrument	JEOL ECZ 400S
Scans	16 scans

Stability

The effect of the components of stability on the combined standard uncertainty of the CRM property value are considered negligible unless indicated in stability studies.

Short-Term Stability

A decrease in property value was observed at 60°C during the two-week stability study. No decrease was observed at ambient temperature during the study. This data supports cold shipment of this product.

Long-Term Stability

Long-term stability data confirmed three years stability at the -20°C storage temperature.

CERTIFICATE of ANALYSIS



Revision History

Revision No.	Date	Reason for Revision
01	25JAN2021	Initial version

Disclaimers

Material Safety Data

This material should be considered hazardous until information to the contrary becomes available. Do not ingest, swallow, or inhale. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. This information contains some but not all of the information required for the safe and proper use of this material. Before use, review the complete Safety Data Sheet, which has been sent via email to your institution.

Warranty and Limitation of Remedy

Cayman Chemical Company makes no warranty or guarantee of any kind, whether written or oral, expressed or implied, including without limitation, any warranty of fitness for a particular purpose, suitability and merchantability, which extends beyond the description of the chemicals hereof. Cayman warrants only to the original customer that the material will meet our specifications at the time of delivery.

Cayman will carry out its delivery obligations with due care and skill. Thus, in no event will Cayman have any obligation or liability, whether in tort (including negligence) or in contract, for any direct, indirect, incidental or consequential damages, even if Cayman is informed about their possible existence.

This limitation of liability does not apply in the case of intentional acts or negligence of Cayman, its directors or its employees.

Buyer's exclusive remedy and Cayman's sole liability hereunder shall be limited to a refund of the purchase price, or at Cayman's option, the replacement, at no cost to Buyer, of all material that does not meet our specification.

Said refund or replacement is conditioned on Buyer giving written notice to Cayman within thirty (30) days after arrival of the material at its destination. Failure of Buyer to give said notice within thirty (30) days shall constitute a waiver of Buyer of all claims hereunder with respect to said material.

For further details, please refer to our Warranty and Limitations of Remedy located on our website and in our catalog.

This Certificate shall not be reproduced except in full, without written approval from the Cayman Chemical ISO Quality Manager.

ISO CRT SD02 v 4.1

CAYMAN CHEMICAL
1180 EAST ELLSWORTH RD
ANN ARBOR, MI 48108 - USA

PHONE: [800] 364-9897
[734] 971-3335
FAX: [734] 971-3640

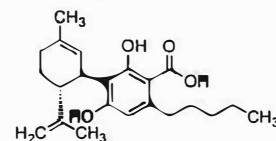
crmquality@caymancem.com
www.caymancem.com

Certified Reference Material - Certificate of Analysis

Cannabidiolic acid (CBDA), Primary Measurement Standard

2,4-Dihydroxy-3-[(1R,6R)-3-methyl-6-(1-methylethenyl)-2-cyclohexen-1-yl]-6-pentyl-benzoic acid

Product No.:	C-144-1ML
Lot No.:	FE02202007
Description of CRM:	Cannabidiolic acid (CBDA) in Acetonitrile (Solution)
Expiration Date:	February 2023 See Section "Stability Assessment".
Storage:	Store unopened and upright in sub-freezer (-60 °C to -80 °C).
Shipping:	Ship cold. See Section "Stability Assessment".
Chemical formula:	$C_{22}H_{30}O_4$
CAS No.:	1244-58-2
Regulatory:	USDEA Exempt Canadian TK # 61-1103



Analyte	Certified Concentration ± associated uncertainty U, $u=k^*u$ ($k=2$)
Cannabidiolic acid (CBDA)	1.000 ± 0.006 mg/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 certified value is calculated from high precision weighing of thoroughly characterized starting material. See "Details about certification process" on page 2.

Intended use: This Certified Reference Material is suitable for the in vitro identification, calibration, and quantification of the analyte(s) in analytical and R&D applications. 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.

Accreditation: Cerilliant Corp. is accredited by the US accreditation authority ANAB as registered reference material producer AR-1353 in accordance with ISO 17034 and registered testing laboratory AT-1352 according to ISO/IEC 17025.



Darron Ellsworth, Quality Assurance Manager

May 12, 2020

Issue Date

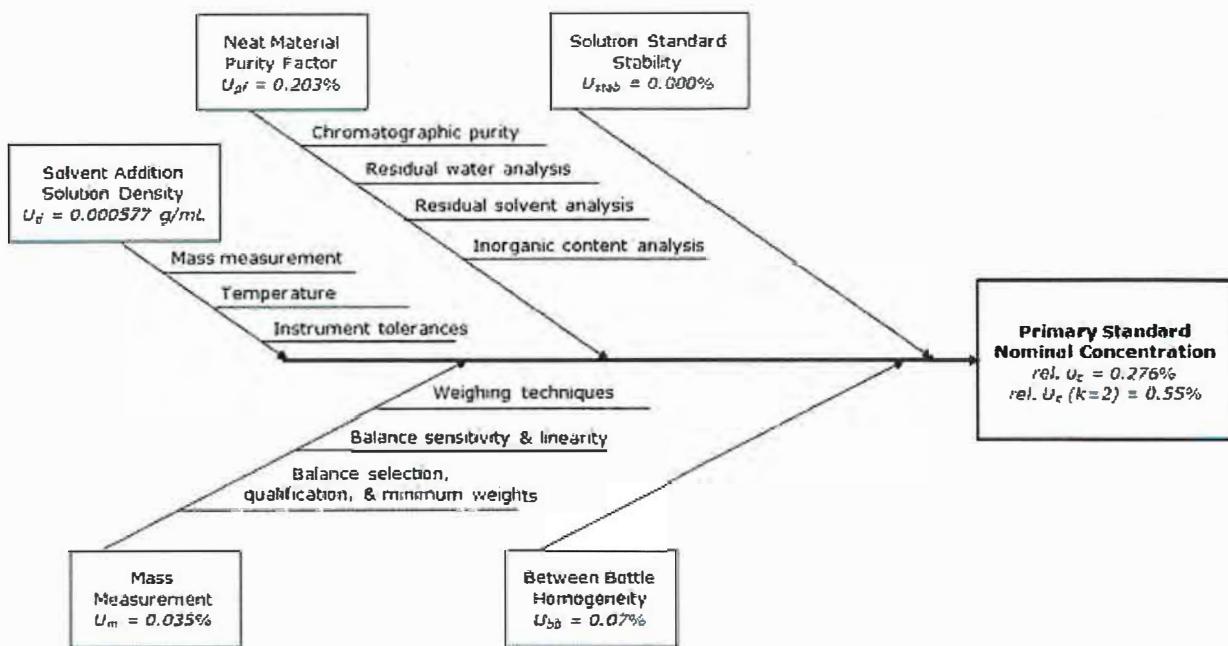
Cerilliant Corporation, 811 Paloma Drive, Suite A Round Rock, TX 78665, USA, Tel: 800-848-7837 / 512-238-9974; www.cerilliant.com
Sigma-Aldrich Production GmbH is a subsidiary of Merck KGaA, Darmstadt, Germany.



Packaging:	2 mL amber USP Type 1 glass ampoule containing not less than 1 mL of certified solution. Ampoules are overfilled to ensure a minimum of 1 mL volume can be transferred when using a 1mL 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 Mass Balance 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 was manufactured in the USA.

Associated uncertainty:

The uncertainty has been calculated by statistical analysis of all aspects of our production system and incorporated uncertainty of the mass balance purity factor, material density, balance, weighing technique, and homogeneity. Uncertainty components of the gravimetrically prepared Primary Standard concentration are shown in the figure below. Uncertainty is expressed as an expanded uncertainty in accordance with ISO 17034 at the approximate 95% confidence interval using a coverage factor of $k=2$. Uncertainty contribution from neat material homogeneity was established to be negligible through establishment of process controls and verification of the control process. Stability uncertainty was determined to be negligible by regression analysis.



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 Mass Balance Purity Factor of each raw material is traceable to the SI and higher order reference materials through mass measurement and instrument qualification and calibrations.

Details about certification process:

This standard has been prepared and certified under the ISO 17034, ISO/IEC 17025, ISO 9001 and ISO 13485 standards. This standard meets the requirements of a Certified Reference Material and a Primary Standard as defined by ISO and is traceable to the SI and higher order standards through an unbroken chain of comparisons.

- ◆ Nominal concentration is calculated based on: the actual mass; Mass balance purity factor of the analyte(s); measured mass of the solution; and the density of the pure diluent at 20°C.
- ◆ Fill volume is gravimetrically verified throughout the dispensing process using qualified and calibrated balances.
- ◆ Concentration is verified against an independently prepared calibration solution gravimetrically prepared.
- ◆ Additional certification information available upon request.

Solution Standard Verification

Concentration accuracy and within- and between-bottle homogeneity are analytically verified against an independently prepared calibration solution and to the prior lot.

Solution standard verification demonstrates confirmation that the specified requirements for the Primary Measurement Standard have been fulfilled and validated under ISO 13485.

Standard Solution Assay Parameters		Calibration Curve
Analysis Method:	HPLC/UV	Calibration Curve: Linear Regression
Column:	Ascentis Express C18, 2.7 µm, 3.0 x 100 mm	Number of Points: 4
Mobile Phase:	Acetonitrile:0.1% Phosphoric acid in Water (80:20)	Linearity (r) : 0.998
Flow Rate:	0.9 mL/min	
Wavelength:	225 nm	
		Verified Concentration (mg/mL)
Standard Solution	Lot Number	Actual Results
New Lot	FE02202007	1.007
Previous Lot	FE04301903	1.001
		%RSD - Homogeneity
		Actual Results
New Lot		0.6
Previous Lot		0.5

♦ Concentration is verified through multiple analyses and is calculated as the average of multiple analyses compared to an independently prepared calibration solution.

♦ Within-sample and between-sample homogeneity of the New Lot is ensured through rigorous production process controls statistically analyzed to evaluate risk and verified by analysis. Multiple samples pulled from across the lot using a random stratified sampling plan were analyzed to verify homogeneity. % RSD results shown above for the New Lot demonstrate ampoule-to-ampoule homogeneity.

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 is utilized to calculate the weighing adjustment necessary to ensure accuracy of the solution standard concentration.

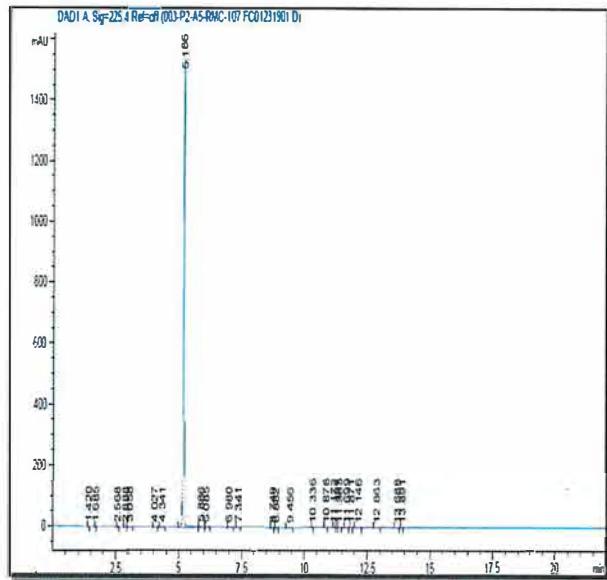
Material Name:	Cannabidiolic acid (CBDA)	Chemical Formula:	C ₂₂ H ₃₀ O ₄
Material Lot:	FC01231901	CAS Number:	1244-58-2
Molecular Weight: 358.47			
Material Characterization Summary			
Analytical Test		Method	Results
Primary Chromatographic Purity by HPLC/UV Analysis		SP10-0102	99.5% ¹
Secondary Chromatographic Purity by LC/MS Analysis		SP10-0107	> 99.9%
Identity by LC/MS Analysis		SP10-0107	Consistent with Structure
Identity by ¹ H-NMR Analysis		USP <761>, SP10-0116	Consistent with Structure
Residual Solvent Analysis by GC/FID Headspace		AM1087 ²	0.54%
Residual Water Analysis by Karl Fischer Coulometry		AM1346 ²	None Detected
Inorganic Content by Microash Analysis		SP10-0135	< 0.2%
Mass Balance Purity Factor			98.97%

¹ 0.10% Cannabidiol (CBD) detected by HPLC/UV analysis.
² Validated analytical method

- ♦ The primary chromatographic purity is calculated as the average of two independently performed analyses utilizing two different methods. Acceptance criteria requires the purity values to be within 0.5% of each other.
- ♦ The primary purity method was selected to optimize resolution of impurities while minimizing degradation of the analyte. Secondary purity methods with orthogonal detector capabilities from the primary purity method are used as controls to confirm an accurate purity value.
- ♦ The primary chromatographic purity value is used to calculate the Mass Balance Purity Factor.
- ♦ A secondary chromatographic purity method is utilized as a control.
- ♦ Mass Balance Purity Factor = [(100 - wt% residual solvent - wt% residual water - wt% residual inorganics) x Chromatographic Purity/100].
- ♦ Mass Balance Purity Factor does not include adjustment for chiral and/or isotopic purity.

Spectral and Physical Data

HPLC/UV



Column: Ascentis Express C18, 2.7 μ m,

3.0 x 100 mm

Mobile Phase: A: Acetonitrile

B: 0.1% Phosphoric acid in Water

Gradient:

Time (min)	% A	% B
0.0	55	45
7.0	80	20
9.0	95	5
20.0	95	5
21.0	55	45

Flow Rate: 0.7 mL/min

Wavelength: 225 nm

Sample Name: FC01231901

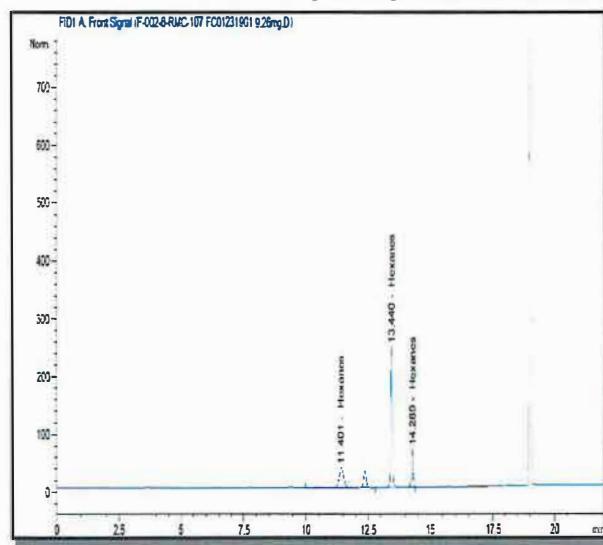
Acquired: July 18, 2019

Peak #	Ret Time	Area %
1	1.42	0.00
2	1.69	0.00
3	2.57	0.00
4	2.89	0.01
5	3.06	0.01
6	4.03	0.02
7	4.34	0.04
8	5.19	99.58
9	5.89	0.10
10	6.09	0.02
11	6.98	0.02
12	7.34	0.00
13	8.75	0.01
14	8.88	0.01
15	9.46	0.01
16	10.34	0.00
17	10.88	0.01
18	11.17	0.00
19	11.31	0.01
20	11.38	0.01
21	11.70	0.03
22	11.87	0.00
23	12.15	0.01
24	12.86	0.04
25	13.69	0.03
26	13.89	0.00

Peak 9 has been identified as CBD

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: FC01231901

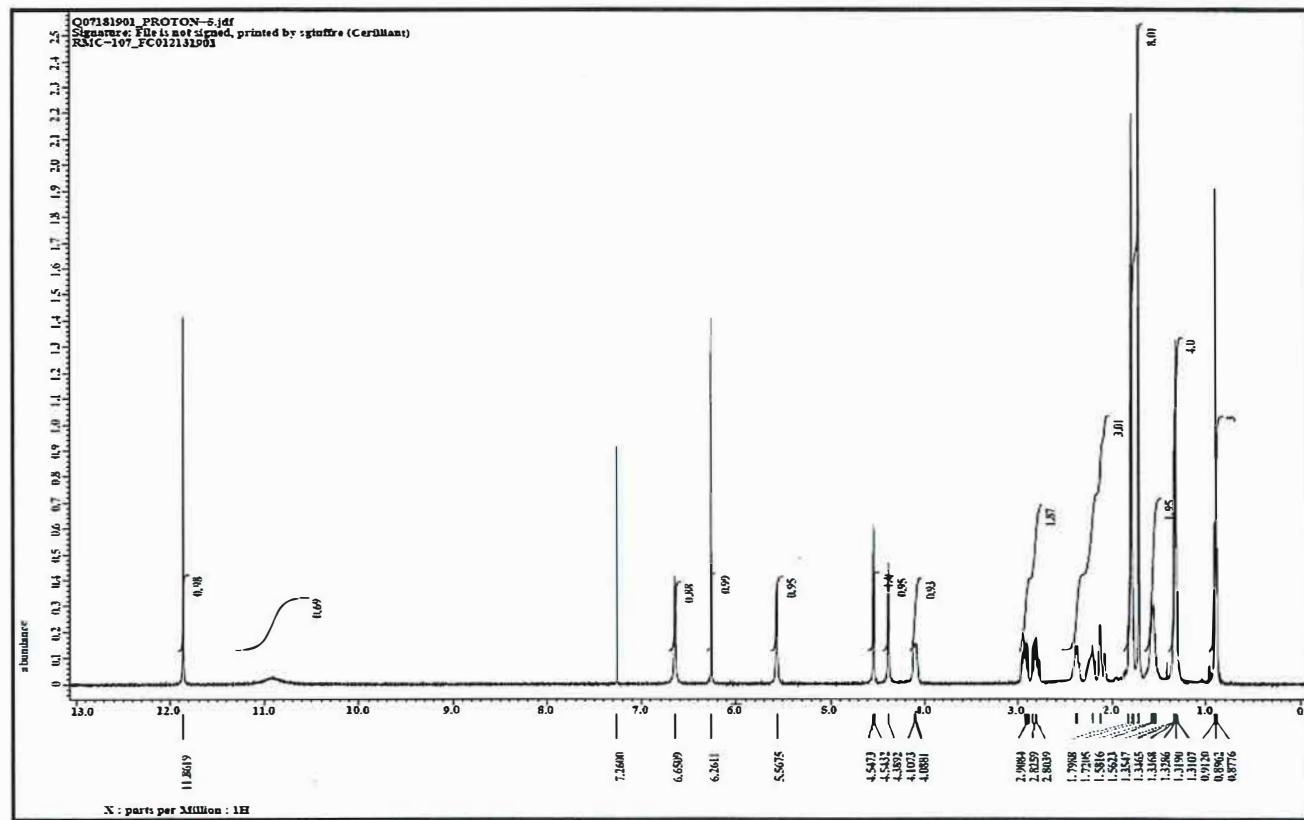
Acquired: July 19, 2019

Peak	Compound	Area	Weight %
1	Hexanes	2033.31	0.54
2	NMP	NA	NA
Total			0.54

¹H NMR

Instrument: JEOL ECS 400

Solvent: Chloroform-D



Spectral and Physical Data (cont.)

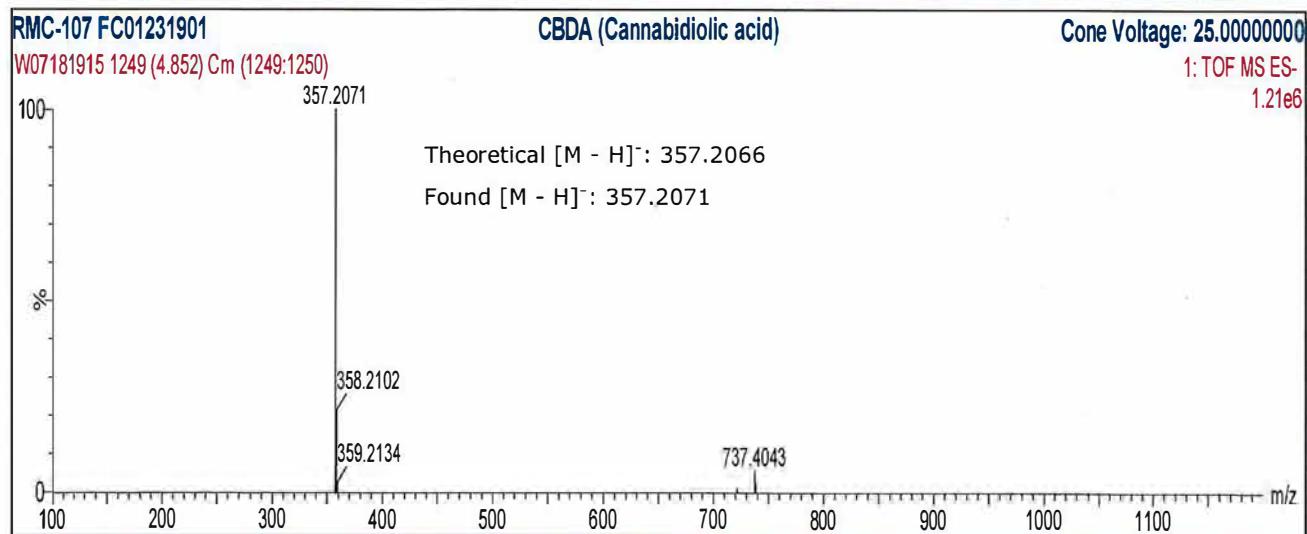
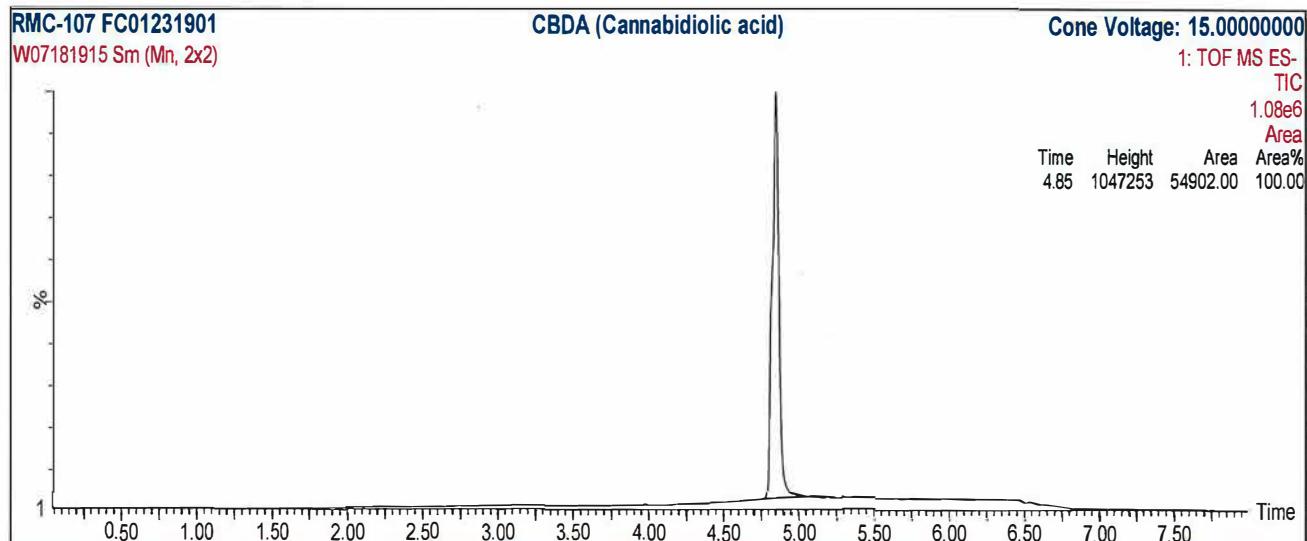
LC/MS

Column: Ascentis Express C18, 2.7 μ m,
3.0 x 50 mm

Mobile Phase: A: 0.1% Formic acid in Water
B: Acetonitrile

Gradient:	Time (min)	% A	% B
	0.0	95	5
	0.5	95	5
	4.0	20	80
	5.8	20	80
	6.0	95	5
	8.0	95	5

Flow Rate: 0.4 mL/min
Scan Range: 100-1200 amu
Ionization: Electrospray, Negative Ion
Instrument: Waters XEVO G2 QTOF
Acquired: July 18, 2019



Stability

Short term stability studies have been performed in multiple storage conditions for a period of up to four weeks. Short term data is utilized 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 stability findings for this product is listed below.

Storage Condition	Mean Kinetic Temperature (MKT)	Time Period/Result
Sub-Freezer	-70°C	No decrease in purity was noted after four weeks.
Freezer	-15°C	
Refrigerator	4°C	
Room Temperature	21°C	No decrease in purity was noted after 48 hours.
Room Temperature	21°C	0.80% decrease in purity was noted after one week.
Room Temperature	21°C	6.25% decrease in purity was noted after four weeks.
40°C	40°C	14.80% decrease in purity was noted after one week.
40°C	40°C	69.82% decrease in purity was noted after four weeks.

Transport/Shipping: Ship cold.

Short Term Storage: Stability data supports short term storage for no more than 12 months at Freezer conditions.

Long Term Stability: Long term stability has been assessed for Sub-freezer storage (-60 °C to -80 °C) conditions. Stability of a minimum of 56 months has been established through real-time stability studies.

Commutability

This standard is a solution of a pure substance in an organic solvent and is a Primary Standard. This Primary Standard is suitable for use in the preparation of calibrators and/or controls in any biological matrix. This standard is not in a biological matrix and therefore commutability to methods or standards in biological matrices does not apply.

COA Revision History

Revision No.	Date	Reason for Revision
00	May 12, 2020	Initial version.

The vibrant M, Supelco, TraceCERT and Sigma-Aldrich are trademarks of Merck KGaA, Darmstadt, Germany or its affiliates. All other trademarks are the property of their respective owners. Detailed information on trademarks is available via publicly accessible resources. © 2018 Merck KGaA, Darmstadt, Germany and/or its affiliates. All Rights Reserved.

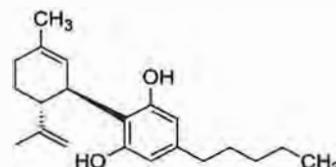
The life science business of Merck KGaA, Darmstadt, Germany operates as MilliporeSigma in the US and Canada.



Certified Reference Material - Certificate of Analysis

Cannabidiol, Primary Measurement Standard

		Cerilliant Quality
Product No.:	C-045-1ML	ISO 17034
Lot No.:	FE10071912	ISO/IEC 17025
Description of CRM:	Cannabidiol in Methanol (Solution)	ISO 13485
Expiration Date:	November 2024	ISO 14001
Storage:	Store unopened in freezer (-10 °C to -25 °C).	ISO 9001
Shipping:	Ship cold. See Stability Section	
Chemical formula:	C ₂₁ H ₃₀ O ₂	
CAS No.:	13956-29-1	
Regulatory:	USDEA Exempt Canadian TK # 61-1088	



Analyte	Certified Concentration ± associated uncertainty U, $u=k^*u$ ($k=2$)
Cannabidiol	1.000 ± 0.006 mg/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 3.

Measurement method: The certified value is calculated from high precision weighing of thoroughly characterized starting material. See "Details about certification process" on page 3.

Intended use: This Certified Reference Material is suitable for the in vitro identification, calibration, and quantification of the analyte(s) in analytical and R&D applications. 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.

Accreditation: Cerilliant Corp. is accredited by the US accreditation authority ANAB as registered reference material producer AR-1353 in accordance with ISO 17034 and registered testing laboratory AT-1352 according to ISO/IEC 17025.



Darron Ellsworth, Quality Assurance Manager

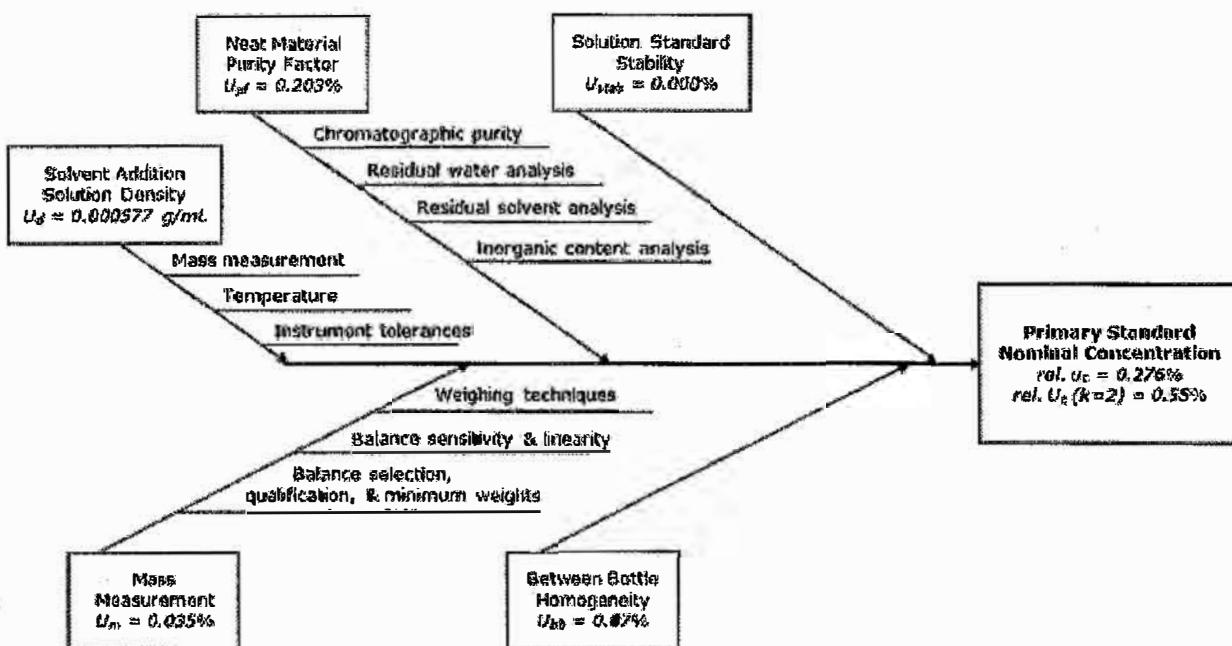
May 25, 2021

Issue Date

Packaging:	2 mL amber USP Type 1 glass ampoule containing not less than 1 mL of certified solution. Ampoules are overfilled to ensure a minimum of 1 mL volume can be transferred when using a 1mL 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 Mass Balance 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 was manufactured in the USA.

Associated uncertainty:

The uncertainty has been calculated by statistical analysis of all aspects of our production system and Incorporated uncertainty of the mass balance purity factor, material density, balance, weighing technique, and homogeneity. Uncertainty components of the gravimetrically prepared Primary Standard concentration are shown in the figure below. Uncertainty is expressed as an expanded uncertainty in accordance with ISO 17034 at the approximate 95% confidence Interval using a coverage factor of $k=2$. Uncertainty contribution from neat material homogeneity was established to be negligible through establishment of process controls and verification of the control process. Stability uncertainty was determined to be negligible by regression analysis.



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 Mass Balance Purity Factor of each raw material is traceable to the SI and higher order reference materials through mass measurement and instrument qualification and calibrations.

Details about certification process:

This standard has been prepared and certified under the ISO 17034, ISO/IEC 17025, ISO 9001 and ISO 13485 standards. This standard meets the requirements of a Certified Reference Material and a Primary Standard as defined by ISO and is traceable to the SI and higher order standards through an unbroken chain of comparisons.

- ♦ Nominal concentration is calculated based on: the actual mass; Mass balance purity factor of the analyte(s); measured mass of the solution; and the density of the pure diluent at 20°C.
- ♦ Fill volume is gravimetrically verified throughout the dispensing process using qualified and calibrated balances.
- ♦ Concentration is verified against an independently prepared calibration solution gravimetrically prepared.
- ♦ Additional certification information available upon request.

Solution Standard Verification

Concentration accuracy and within- and between-bottle homogeneity are analytically verified against an independently prepared calibration solution and to the prior lot.

Solution standard verification demonstrates confirmation that the specified requirements for the Primary Measurement Standard have been fulfilled and validated under ISO 13485.

Standard Solution Assay Parameters		Calibration Curve	
Analysis Method:	HPLC/UV	Calibration Curve:	Linear Regression
Column:	Ascentis Express C18, 2.7 µm, 3.0 x 100 mm	Number of Points:	4
Mobile Phase:	Acetonitrile:0.1% Phosphoric acid In Water (80:20)	Linearity (r) :	1.000
Flow Rate:	1.5 mL/min		
Wavelength:	228 nm		
		Verified Concentration (mg/mL)	%RSD - Homogeneity
Standard Solution	Lot Number	Actual Results	Actual Results
New Lot	FE10071912	1.001	0.3
Previous Lot	FE12271801	1.004	0.2
<ul style="list-style-type: none">Concentration is verified through multiple analyses and is calculated as the average of multiple analyses compared to an independently prepared calibration solution.Within-sample and between-sample homogeneity of the New Lot is ensured through rigorous production process controls statistically analyzed to evaluate risk and verified by analysis. Multiple samples pulled from across the lot using a random stratified sampling plan were analyzed to verify homogeneity. % RSD results shown above for the New Lot demonstrate ampoule-to-ampoule homogeneity.			

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 is utilized to calculate the weighing adjustment necessary to ensure accuracy of the solution standard concentration.

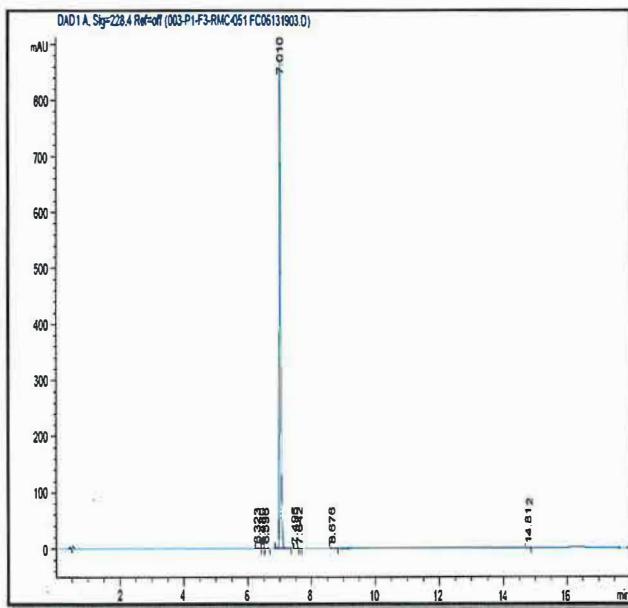
Material Name:	Cannabidiol	Chemical Formula:	C ₂₁ H ₃₀ O ₂
Material Lot:	FC06131903	CAS Number:	13956-29-1
Material Characterization Summary			
Analytical Test	Method	Results	
Primary Chromatographic Purity by HPLC/UV Analysis	SP10-0102	99.8%	
Secondary Chromatographic Purity by GC/FID Analysis	SP10-0101	99.3%	
Identity by GC/MS Analysis	SP10-0105	Consistent with Structure	
Identity by ¹ H-NMR Analysis	USP <761>, SP10-0116	Consistent with Structure	
Residual Solvent Analysis by GC/FID Headspace	AM1087 ¹	0.06%	
Residual Water Analysis by Karl Fischer Coulometry	AM1346 ¹	None Detected	
Inorganic Content by Microash Analysis	SP10-0135	< 0.2%	
Mass Balance Purity Factor		99.72%	

¹ Validated analytical method

- ♦ The primary chromatographic purity is calculated as the average of two independently performed analyses utilizing two different methods. Acceptance criteria requires the purity values to be within 0.5% of each other.
- ♦ The primary purity method was selected to optimize resolution of impurities while minimizing degradation of the analyte. Secondary purity methods with orthogonal detector capabilities from the primary purity method are used as controls to confirm an accurate purity value.
- ♦ The primary chromatographic purity value is used to calculate the Mass Balance Purity Factor.
- ♦ A secondary chromatographic purity method is utilized as a control.
- ♦ Mass Balance Purity Factor = [(100 - wt% residual solvent - wt% residual water - wt% residual Inorganics) x Chromatographic Purity/100].
- ♦ Mass Balance Purity Factor does not include adjustment for chiral and/or isotopic purity.

Spectral and Physical Data

HPLC/UV



Column: Ascentis Express C18, 2.7 μ m, 3.0 x 100 mm
Mobile Phase: A: Acetonitrile
Gradient: B: 0.1% Phosphoric acid in Water

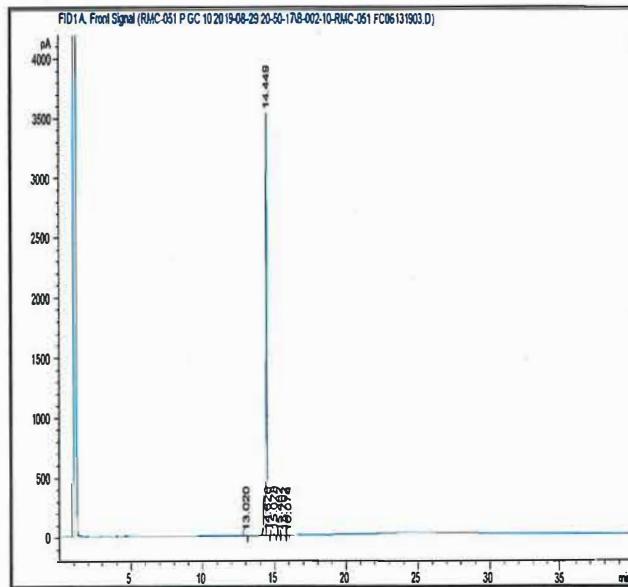
Time (min)	% A	% B
0.0	40	60
5.0	70	30
10.0	90	10
15.0	90	10
15.1	40	60

Flow Rate: 0.8 mL/min
Wavelength: 228 nm

Sample Name: FC06131903
Acquired: September 11, 2019

Peak #	Ret Time	Area %
1	6.32	0.08
2	6.48	0.00
3	6.60	0.03
4	7.01	99.77
5	7.50	0.01
6	7.64	0.01
7	8.68	0.09
8	14.81	0.01

GC/FID



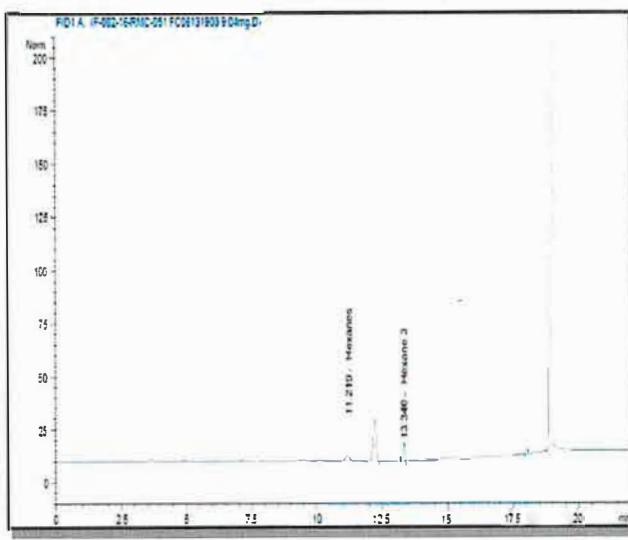
Column: DB-5ms, 30 m x 0.53 mm ID, 1.5 μ m film thickness
Temp Program: 40°C to 200°C at 40°C/min
Injector Temp: 200°C to 300°C at 5°C/min hold 16 min
Detector Temp: Cool-on-Column
Detector Temp: 325°C

Sample Name: FC06131903
Acquired: August 29, 2019

Peak #	Ret Time	Area %
1	13.02	0.05
2	14.45	99.32
3	14.63	0.15
4	15.08	0.40
5	15.46	0.01
6	15.79	0.05
7	16.07	0.01

Spectral and Physical Data (cont.)

Residual Solvent Analysis by GC/FID Headspace



Column:

DB-ALC1 30 m x 0.53 mm,

3 μ m film thickness

40°C hold 12 min to 220°C at

40°C/min hold 5.5 min

Helium

2.0 mL/min

250°C

Headspace Sampler

60°C

Vial Equilibration:

10 minutes

Temp Program:

Carrier Gas:

Flow Rate:

Detector Heater Temp:

Injector:

HS Oven Temp:

Sample Name:

FC06131903

Acquired:

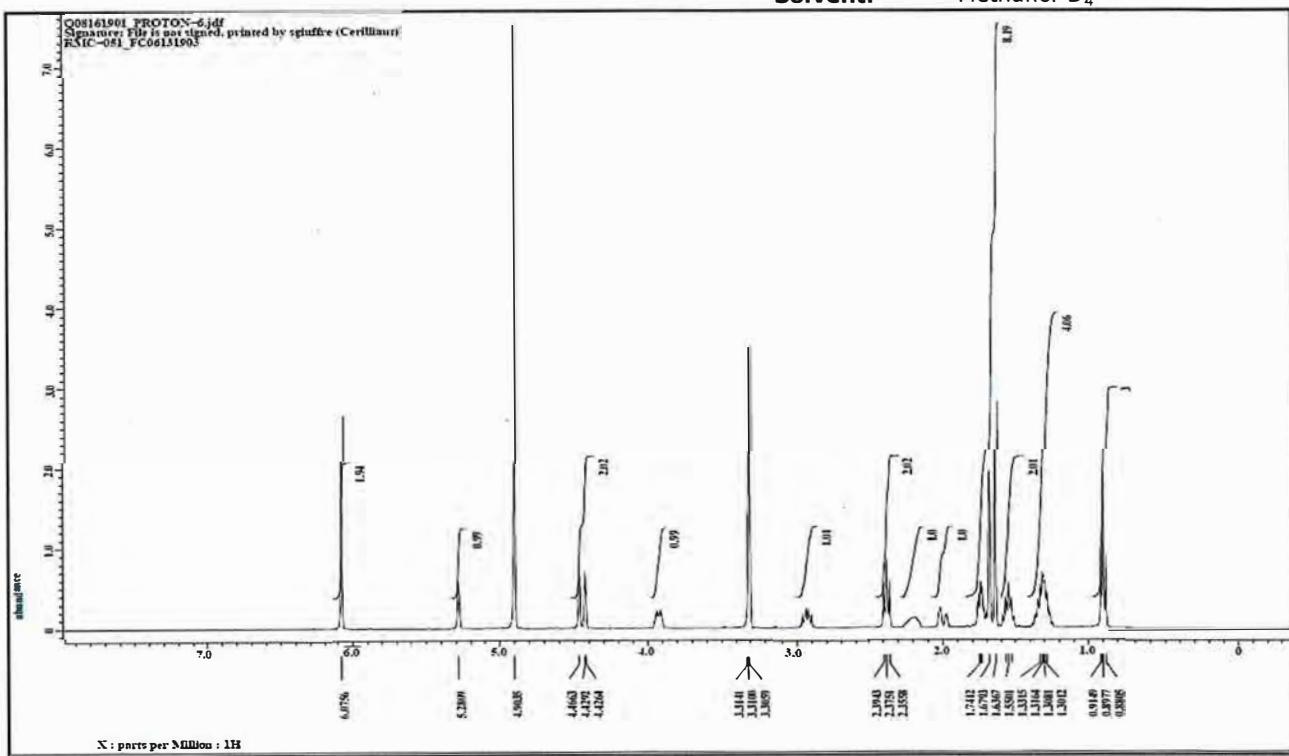
August 16, 2019

Peak	Compound	Area	Weight %
1	Hexanes	229.05	0.06
2	NMP	NA	NA
Total			0.06

^1H NMR

Instrument: JEOL ECS 400

Solvent: Methanol-D₄

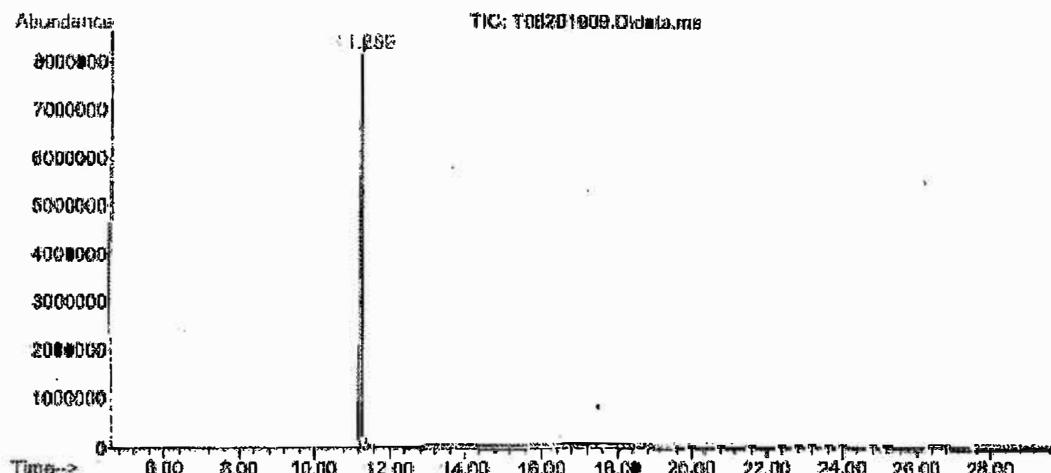


Spectral and Physical Data (cont.)

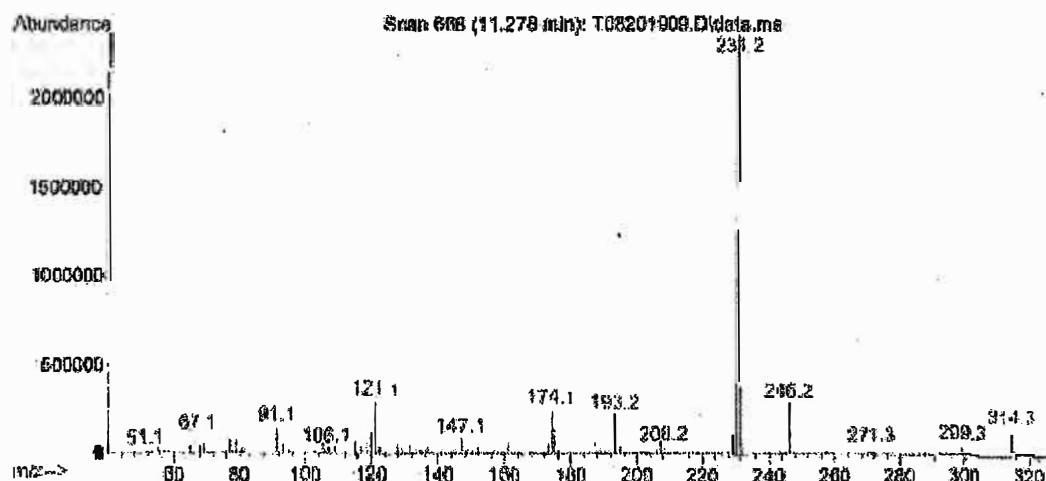
GC/MS

Compound Name	:	Cannabidiol
Lot Number	:	FCD61319#3
Instrument	:	Agilent GCMS
Operator	:	ECM (SGTUFFRE)
Date Reported	:	Wed Aug 21 06:16:35 2019
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, 10min hold
Injector Temp.	:	Cool on-column
Carrier Gas	:	Helium
Flow Rate (mL/min)	:	0.80 mL/min
Transfer Line Temp.	:	280°C
Scan Range	:	50-500

Total Ion Chromatogram



Mass Spectrum



Stability

Short term stability studies have been performed in multiple storage conditions for a period of up to four weeks. Short term data is utilized 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 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: Ship cold.

Long Term Stability: Long term stability has been assessed for Freezer storage (-10 °C to -25 °C) conditions. Stability of a minimum of 60 months has been established through real-time stability studies.

Commutability

This standard is a solution of a pure substance in an organic solvent and is a Primary Standard. This Primary Standard is suitable for use in the preparation of calibrators and/or controls in any biological matrix. This standard is not in a biological matrix and therefore commutability to methods or standards in biological matrices does not apply.

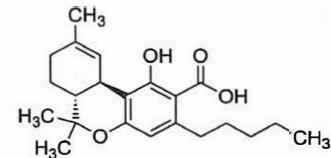
COA Revision History

Revision No.	Date	Reason for Revision
00	December 17, 2019	Initial version.
01	April 23, 2021	Corrected NMR trace.
02	May 25, 2021	Revised long chemical name.

Certified Reference Material - Certificate of Analysis

 Δ^9 -Tetrahydrocannabinolic acid A (THCA-A), Primary Measurement Standard

Product No.:	T-093-1ML
Lot No.:	FE11102003
Description of CRM:	Δ^9 -Tetrahydrocannabinolic acid A (THCA-A) in Acetonitrile (Solution)
Expiration Date:	December 2024 See Section "Stability Assessment".
Storage:	Store unopened and upright in sub-freezer (-60 °C to -80 °C).
Shipping:	Ship cold. See Section "Stability Assessment".
Chemical formula:	C ₂₂ H ₃₀ O ₄
CAS No.:	23978-85-0
Regulatory:	USDEA Exempt Canadian TK # 61-1570



Analyte	Certified Concentration ± associated uncertainty U , $u = k * u$ ($k = 2$)
Δ^9 -Tetrahydrocannabinolic acid A (THCA-A)	1.000 ± 0.006 mg/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 certified value is calculated from high precision weighing of thoroughly characterized starting material. See "Details about certification process" on page 2.
Intended use:	This Certified Reference Material is suitable for the <i>in vitro</i> identification, calibration, and quantification of the analyte(s) in analytical and R&D applications. 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.
Accreditation:	Cerilliant Corp. is accredited by the US accreditation authority ANAB as registered reference material producer AR-1353 in accordance with ISO 17034 and registered testing laboratory AT-1352 according to ISO/IEC 17025.



A handwritten signature in black ink, appearing to read 'Darron Ellsworth'.

Darron Ellsworth, Quality Assurance Manager

December 18, 2020

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 1 glass ampoule containing not less than 1 mL of certified solution. Ampoules are overfilled to ensure a minimum of 1 mL volume can be transferred when using a 1mL Class A volumetric pipette.

Details on starting materials:

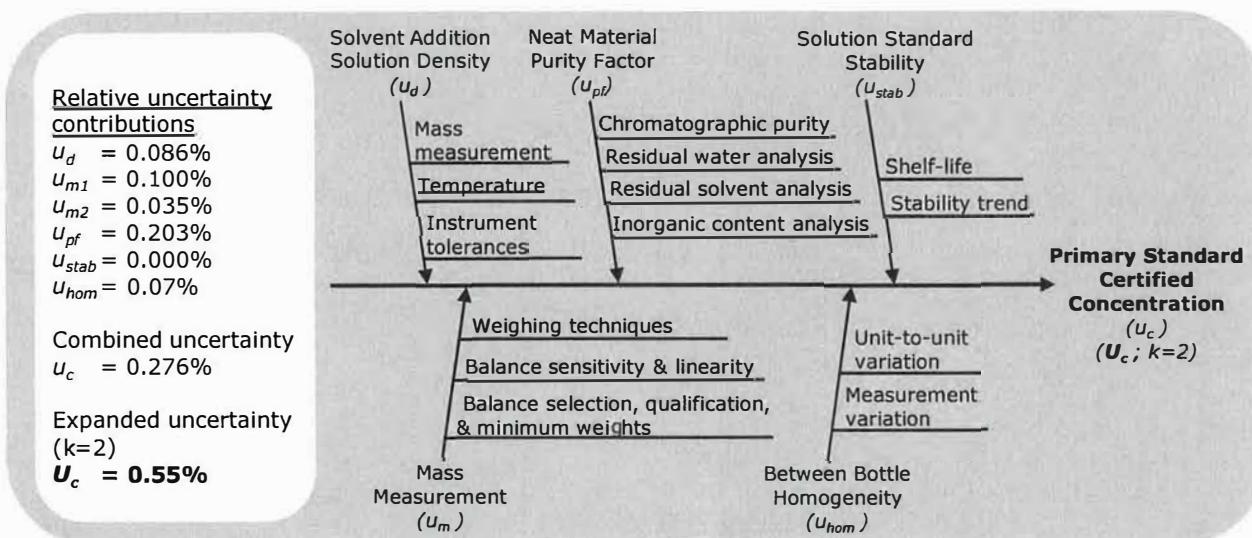
Each raw material utilized has been identified and thoroughly characterized through the use of multiple analytical techniques and is assigned a Mass Balance Purity Factor. Spectral data is provided on subsequent pages of this CoA.

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.

Associated uncertainty:

The uncertainty has been calculated by statistical analysis of all aspects of our production system and incorporated uncertainty of the mass balance purity factor, material density, balance, weighing technique, and homogeneity. Uncertainty components of the gravimetrically prepared Primary Standard concentration are shown in the figure below. Uncertainty is expressed as an expanded uncertainty in accordance with ISO 17034 at the approximate 95% confidence interval using a coverage factor of $k=2$. Uncertainty contribution from neat material homogeneity was established to be negligible through establishment of process controls and verification of the control process. Stability uncertainty was determined to be negligible by regression analysis.



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 Mass Balance Purity Factor of each raw material is traceable to the SI and higher order reference materials through mass measurement and instrument qualification and calibrations.

Details about certification process:

This standard has been prepared and certified under the ISO 17034, ISO/IEC 17025, and ISO 9001 standards. This standard meets the requirements of a Certified Reference Material and a Primary Standard as defined by ISO and is traceable to the SI and higher order standards through an unbroken chain of comparisons.

- ♦ Nominal concentration is calculated based on: the actual mass; Mass balance purity factor of the analyte(s); measured mass of the solution; and the density of the pure diluent at 20°C.
- ♦ Fill volume is gravimetrically verified throughout the dispensing process using qualified and calibrated balances.
- ♦ Concentration is verified against an independently prepared calibration solution gravimetrically prepared.
- ♦ Additional certification information available upon request.

Solution Standard Verification

Concentration accuracy and within- and between-bottle homogeneity are analytically verified against an independently prepared calibration solution and to the prior lot.

Standard Solution Assay Parameters		Calibration Curve	
Analysis Method:	HPLC/UV	Calibration Curve:	Linear Regression
Column:	Ascentis Express C8, 2.7 µm, 3.0 x 100 mm	Number of Points:	4
Mobile Phase:	Acetonitrile:0.1% Phosphoric acid in Water (80:20)	Linearity (r) :	1.000
Flow Rate:	1.5 mL/min		
Wavelength:	225 nm		
		Verified Concentration (mg/mL)	%RSD - Homogeneity
Standard Solution	Lot Number	Actual Results	Actual Results
New Lot	FE11102003	1.001	0.3
Previous Lot	FE09271901	1.035	0.1
<ul style="list-style-type: none">• Concentration is verified through multiple analyses and is calculated as the average of multiple analyses compared to an independently prepared calibration solution.• Within-sample and between-sample homogeneity of the New Lot is ensured through rigorous production process controls statistically analyzed to evaluate risk and verified by analysis. Multiple samples pulled from across the lot using a random stratified sampling plan were analyzed to verify homogeneity. % RSD results shown above for the New Lot demonstrate ampoule-to-ampoule homogeneity.			

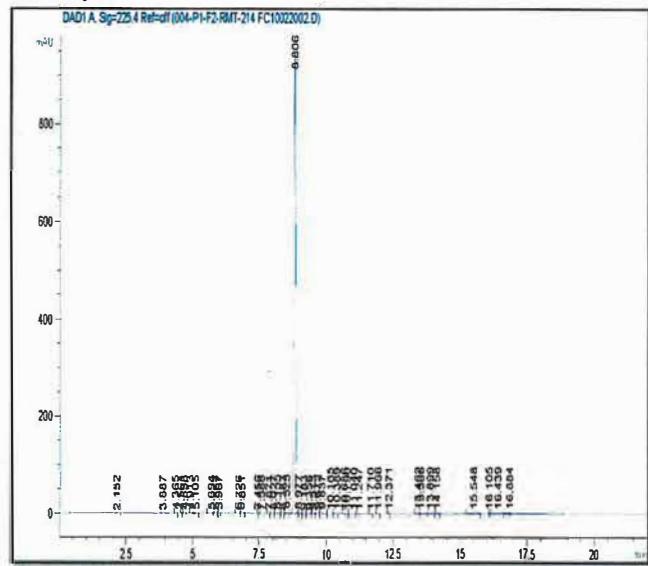
Analyte Certification - Mass Balance Purity Factor

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 is utilized to calculate the weighing adjustment necessary to ensure accuracy of the solution standard concentration.

Material Name: Δ^9 -Tetrahydrocannabinolic acid A (THCA-A)	Chemical Formula: C ₂₂ H ₃₀ O ₄	
Material Lot: FC10012002	CAS Number: 23978-85-0	
	Molecular Weight: 358.48	
Material Characterization Summary		
Analytical Test	Method	Results
Primary Chromatographic Purity by HPLC/UV Analysis	20384348	99.3%
Secondary Chromatographic Purity by LC/MS Analysis	20384217	99.5%
Identity by LC/MS Analysis	20384217	Consistent with Structure
Identity by ¹ H-NMR Analysis	20384224	Consistent with Structure
Residual Solvent Analysis by GC/FID Headspace	20397799 ¹	0.08%
Residual Water Analysis by Karl Fischer Coulometry	20398075 ¹	Below Quantitation Limit
Inorganic Content by Microash Analysis	20384350	Below Quantitation Limit
Mass Balance Purity Factor		99.19%
¹ Validated analytical method • The primary chromatographic purity is calculated as the average of two independently performed analyses utilizing two different methods. Acceptance criteria requires the purity values to be within 0.5% of each other. • The primary purity method was selected to optimize resolution of impurities while minimizing degradation of the analyte. Secondary purity methods with orthogonal detector capabilities from the primary purity method are used as controls to confirm an accurate purity value. • The primary chromatographic purity value is used to calculate the Mass Balance Purity Factor. • A secondary chromatographic purity method is utilized as a control. • Mass Balance Purity Factor = [(100 - wt% residual solvent - wt% residual water - wt% residual inorganics) x Chromatographic Purity/100]. • Mass Balance Purity Factor does not include adjustment for chiral and/or isotopic purity.		

Spectral and Physical Data

HPLC/UV



Column: Ascentis Express C18, 2.7 µm,
3.0 x 100 mm

Mobile Phase: A: Acetonitrile
B: Water

C: 0.1% Phosphoric acid in Water

Gradient:	Time (min)	% A	% B	% C
	0.0	40.0	30.0	30.0
	5.0	70.0	15.0	15.0
	10.0	95.0	2.5	2.5
	20.0	95.0	2.5	2.5
	20.1	60.0	30.0	10.0

Flow Rate: 0.9 mL/min

Wavelength: 225 nm

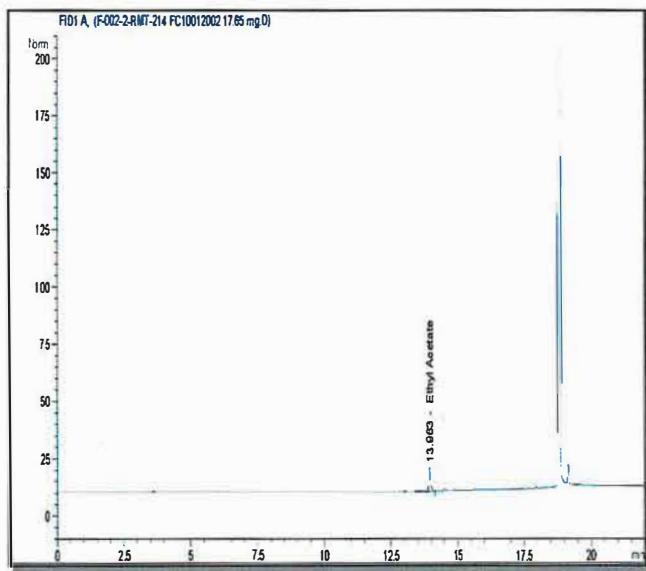
Sample Name: FC10012002
Acquired: November 13, 2020

Peak #	Ret Time	Area %
1	2.15	0.01
2	3.89	0.01
3	4.37	0.00
4	4.56	0.00
5	4.70	0.00
6	4.91	0.01
7	5.11	0.01
8	5.69	0.01
9	5.87	0.00
10	5.97	0.00
11	6.73	0.06
12	6.85	0.04
13	7.46	0.00
14	7.59	0.02
15	7.87	0.00
16	8.03	0.00
17	8.16	0.10
18	8.38	0.00
19	8.53	0.15
20	8.81	99.22
21	8.98	0.06
22	9.18	0.00

Peak #	Ret Time	Area %
23	9.36	0.00
24	9.51	0.00
25	9.67	0.11
26	9.84	0.07
27	10.17	0.01
28	10.39	0.00
29	10.69	0.00
30	10.79	0.00
31	11.04	0.00
32	11.25	0.00
33	11.71	0.00
34	11.97	0.00
35	12.37	0.00
36	13.46	0.01
37	13.57	0.01
38	13.90	0.00
39	14.16	0.00
40	15.55	0.02
41	16.11	0.00
42	16.44	0.03
43	16.88	0.00

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: FC10012002

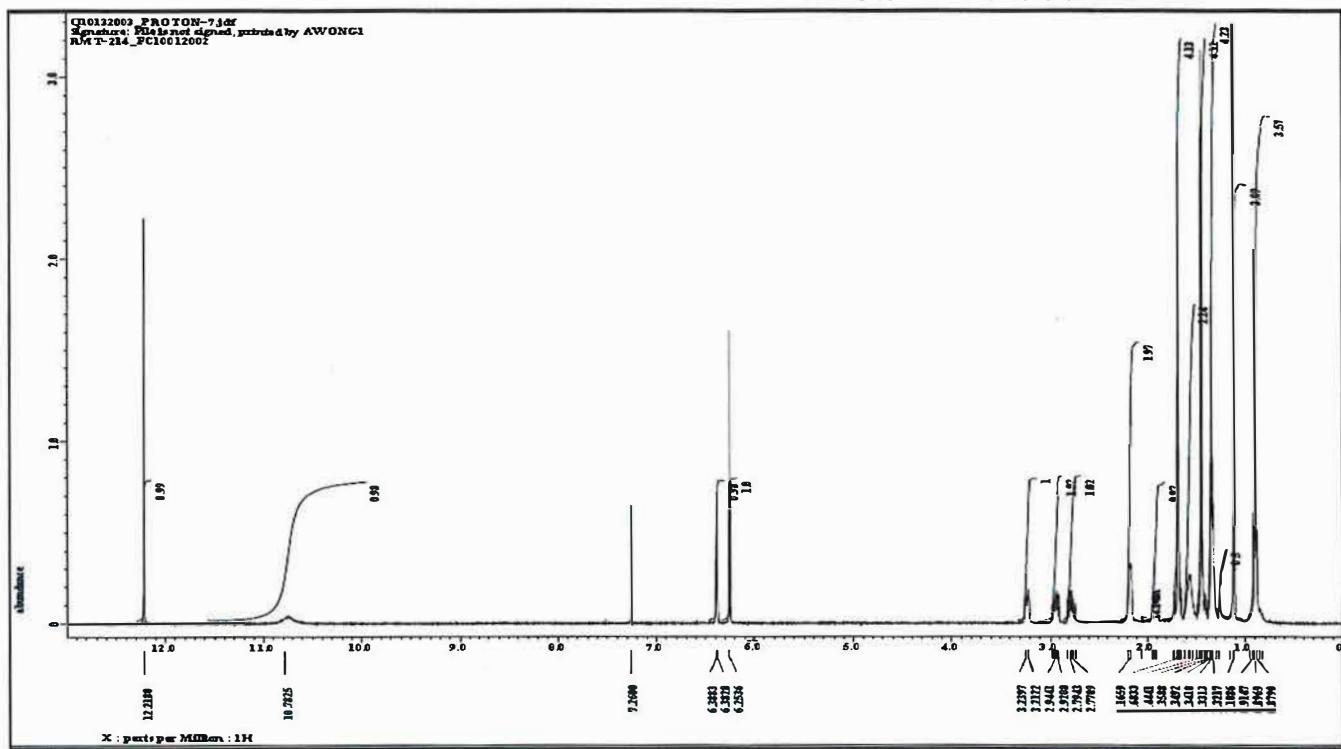
Acquired: October 14, 2020

Peak	Compound	Area	Weight %
1	Ethyl acetate	41.88	0.08
2	NMP	NA	NA
Total			0.08

¹H NMR

Instrument: JEOL ECS 400

Solvent: Chloroform-D



Spectral and Physical Data (cont.)

LC/MS

Column: Ascentis Express Phenyl-Hexyl,
2.7 μ m, 3.0 x 50 mm

Mobile Phase: A: 0.1% Formic acid in Water
B: Acetonitrile

Gradient:	Time (min)	% A	% B
	0.0	50	50
	0.5	50	50
	4.0	2	98
	5.8	2	98
	6.0	50	50
	8.0	50	50

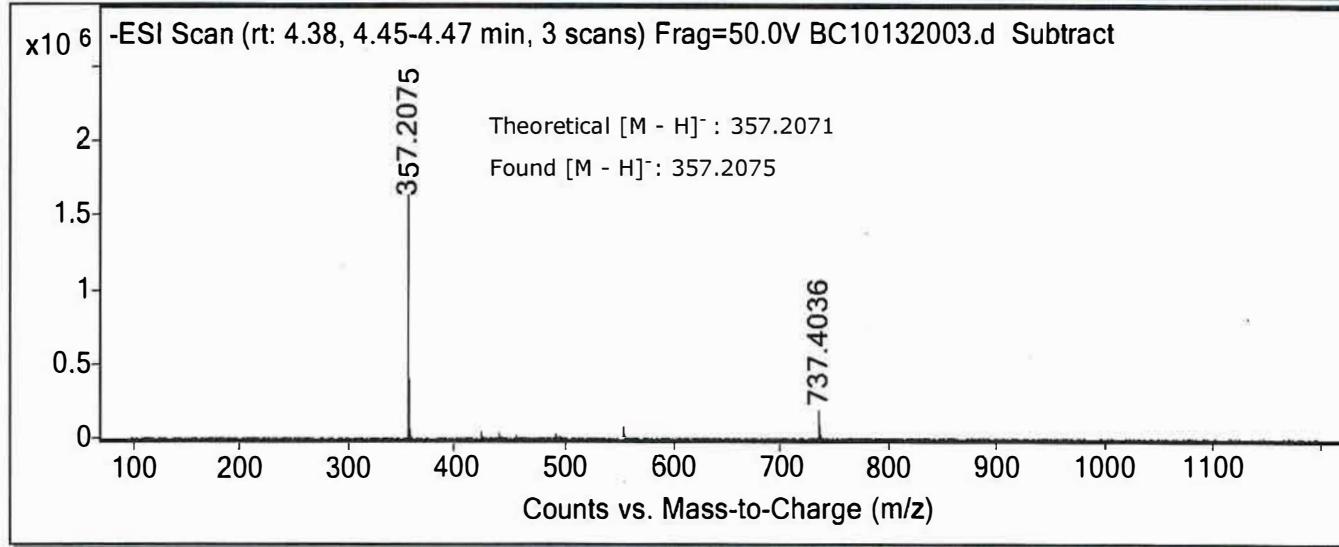
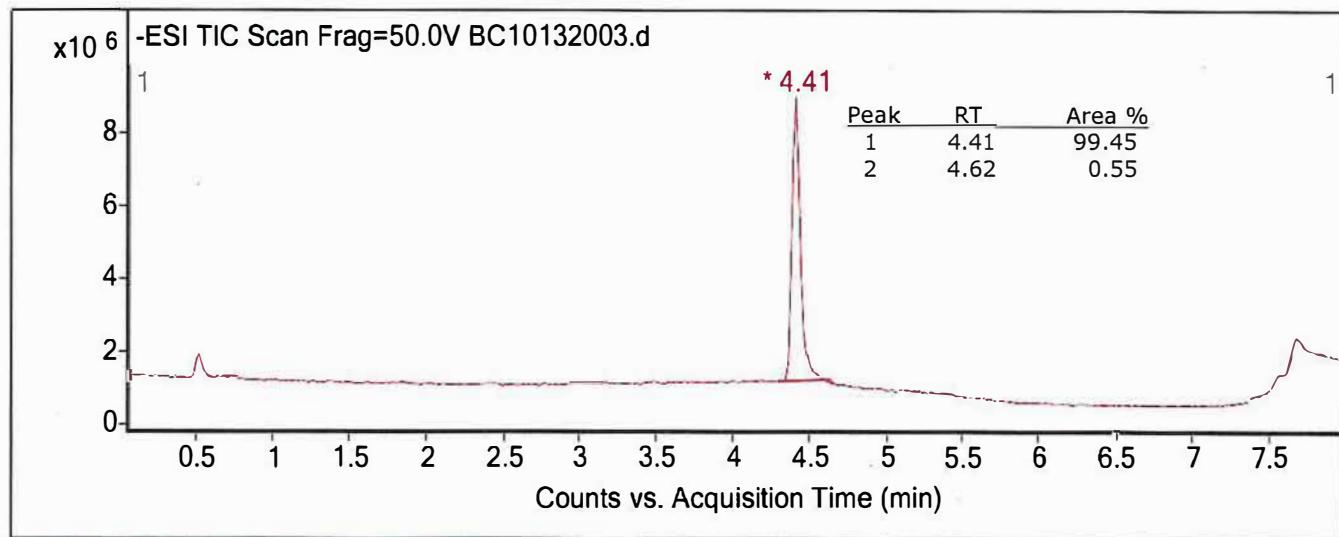
Flow Rate: 0.4 mL/min

Scan Range: 100-1200 amu

Ionization: Electrospray, Negative Ion

Instrument: Agilent 6545XT QTOF

Acquired: October 13, 2020



Stability

Short term stability studies have been performed in multiple storage conditions for a period of up to four weeks. Short term data is utilized 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 stability findings for this product is listed below.

Storage Condition	Mean Kinetic Temperature (MKT)	Time Period/Result
Sub-Freezer	-70°C	No decrease in purity was noted after four weeks.
Freezer	-15°C	
Refrigerator	4°C	No decrease in purity was noted after one week.
		No decrease in purity was noted after four weeks.
Room Temperature	21°C	No decrease in purity was noted after one week.
		5.41% decrease in purity was noted after four weeks.
40°C	40°C	4.28% decrease in purity was noted after one week.
		24.57% decrease in purity was noted after four weeks.

Transport/Shipping: Ship cold.

Short Term Storage: Stability data supports short term storage for no more than 12 months at Freezer conditions.

Long Term Stability: Long term stability has been assessed for Sub-freezer storage (-60 °C to -80 °C) conditions. Stability of a minimum of 51 months has been established through real-time stability studies.

Commutability

This standard is a solution of a pure substance in an organic solvent and is a Primary Standard. This Primary Standard is suitable for use in the preparation of calibrators and/or controls in any biological matrix. This standard is not in a biological matrix and therefore commutability to methods or standards in biological matrices does not apply.

COA Revision History

Revision No.	Date	Reason for Revision
00	December 18, 2020	Initial version.

The vibrant M, Supelco, TraceCERT and Sigma-Aldrich are trademarks of Merck KGaA, Darmstadt, Germany or its affiliates. All other trademarks are the property of their respective owners.

Detailed information on trademarks is available via publicly accessible resources.
© 2018 Merck KGaA, Darmstadt, Germany and/or its affiliates. All Rights Reserved.

The life science business of Merck KGaA, Darmstadt,
Germany operates as MilliporeSigma in the US and Canada.

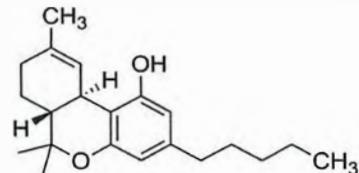


Certified Reference Material - Certificate of Analysis

(-)- Δ^9 -THC, Primary Measurement Standard

(6aR,10aR)-6a,7,8,10a-tetrahydro-6,6,9-trimethyl-3-pentyl-6H-dibenzo[b,d]pyran-1-ol

Product No.:	T-005-1ML
Lot No.:	FE02072001
Description of CRM:	(-)- Δ^9 -THC in Methanol (Solution)
Expiration Date:	February 2025 See Section "Stability Assessment".
Storage:	Store unopened in freezer (-10 °C to -25 °C).
Shipping:	Ambient. See Section "Stability Assessment".
Chemical formula:	C ₂₁ H ₃₀ O ₂
CAS No.:	1972-08-3
Regulatory:	USDEA Exempt Canadian TK # 61-1540



Analyte	Certified Concentration ± associated uncertainty U, $u=k^*u$ ($k=2$)
(-)- Δ^9 -THC	1.000 ± 0.018 mg/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 certified value is calculated from high precision weighing of thoroughly characterized starting material. See "Details about certification process" on page 2.

Intended use: This Certified Reference Material is suitable for the in vitro identification, calibration, and quantification of the analyte(s) in analytical and R&D applications. 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.

Accreditation: Cerilliant Corp. is accredited by the US accreditation authority ANAB as registered reference material producer AR-1353 in accordance with ISO 17034 and registered testing laboratory AT-1352 according to ISO/IEC 17025.



A handwritten signature in black ink, appearing to read "Darron Ellsworth".

Darron Ellsworth, Quality Assurance Manager

December 29, 2020

Issue Date

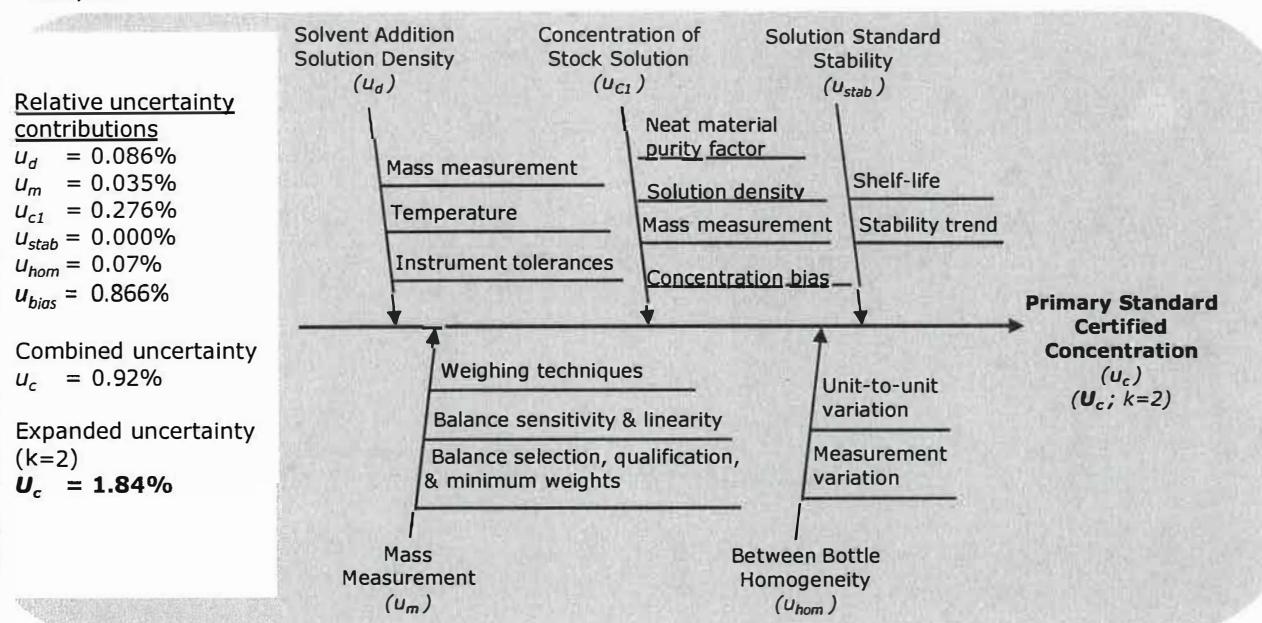
Cerilliant Corporation, 811 Paloma Drive, Suite A Round Rock, TX 78665, USA, Tel: 800-848-7837 / 512-238-9974; www.cerilliant.com
Sigma-Aldrich Production GmbH is a subsidiary of Merck KGaA, Darmstadt, Germany.



Packaging:	2 mL amber USP Type 1 glass ampoule containing not less than 1 mL of certified solution. Ampoules are overfilled to ensure a minimum of 1 mL volume can be transferred when using a 1mL 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 Mass Balance 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 was manufactured in the USA.

Associated uncertainty:

The uncertainty has been calculated by statistical analysis of all aspects of our production system and incorporated uncertainty of the mass balance purity factor, material density, balance, weighing technique, and homogeneity. Uncertainty components of the gravimetrically prepared Primary Standard concentration are shown in the figure below. Uncertainty is expressed as an expanded uncertainty in accordance with ISO 17034 at the approximate 95% confidence interval using a coverage factor of $k=2$. Uncertainty contribution from neat material homogeneity was established to be negligible through establishment of process controls and verification of the control process. Stability uncertainty was determined to be negligible by regression analysis.



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 Mass Balance Purity Factor of each raw material is traceable to the SI and higher order reference materials through mass measurement and instrument qualification and calibrations.

Details about certification process:

This standard has been prepared and certified under the ISO 17034, ISO/IEC 17025, ISO 9001 and ISO 13485 standards. This standard meets the requirements of a Certified Reference Material and a Primary Standard as defined by ISO and is traceable to the SI and higher order standards through an unbroken chain of comparisons.

- Nominal concentration is calculated based on: the actual mass; Mass balance purity factor of the analyte(s); measured mass of the solution; and the density of the pure diluent at 20°C.
- Fill volume is gravimetrically verified throughout the dispensing process using qualified and calibrated balances.
- Concentration is verified against an independently prepared calibration solution gravimetrically prepared.
- Additional certification information available upon request.

Solution Standard Verification

Concentration accuracy and within- and between-bottle homogeneity are analytically verified against an independently prepared calibration solution and to the prior lot.

Solution standard verification demonstrates confirmation that the specified requirements for the Primary Measurement Standard have been fulfilled and validated under ISO 13485.

Standard Solution Assay Parameters		Calibration Curve	
Analysis Method:	HPLC/UV	Calibration Curve:	Linear Regression
Column:	Luna C18 (2), 3 µm, 4.6 x 150 mm	Number of Points:	4
Mobile Phase:	Methanol:Water:Tetrahydrofuran (71:24:5)	Linearity (r) :	1.000
Flow Rate:	1.0 mL/min		
Wavelength:	228 nm		
		Verified Concentration (mg/mL)	%RSD - Homogeneity
Standard Solution	Lot Number	Actual Results	Actual Results
New Lot	FE02072001	0.985	0.4
Previous Lot	FE08221804	0.943	0.3
<ul style="list-style-type: none">• Concentration is verified through multiple analyses and is calculated as the average of multiple analyses compared to an independently prepared calibration solution.• Within-sample and between-sample homogeneity of the New Lot is ensured through rigorous production process controls statistically analyzed to evaluate risk and verified by analysis. Multiple samples pulled from across the lot using a random stratified sampling plan were analyzed to verify homogeneity. % RSD results shown above for the New Lot demonstrate ampoule-to-ampoule homogeneity.			
Standard Solution	Lot Number	Verified Concentration against USP Standard HPLC Analysis	
New Lot	FE02072001	1.026	
<ul style="list-style-type: none">• Concentration is verified against an independently prepared calibration solution using USP Standard 1651621 Lot R045H0			

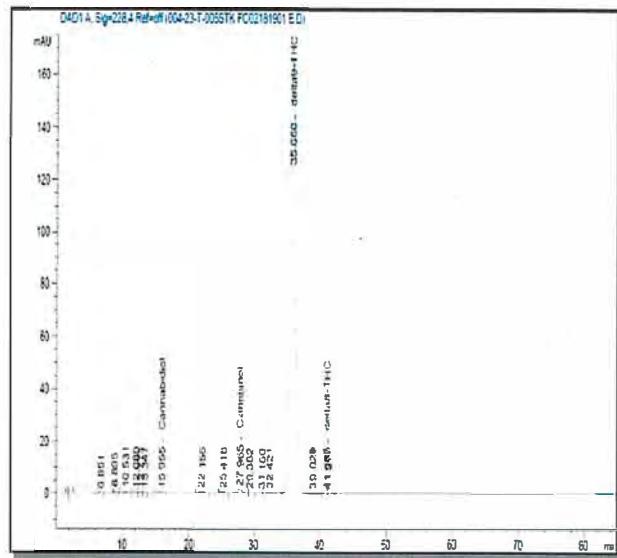
Analyte Certification - Mass Balance Purity Factor

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 is 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:	FC02181901	CAS Number:	1972-08-3		
Molecular Weight: 314.46					
Material Characterization Summary					
Analytical Test	Method	Results			
Chromatographic Purity by HPLC/UV Analysis	AM1280	99.0% ¹			
exo-THC Determination by GC/FID Analysis	AM1266	0.1%			
Identity by GC/MS Analysis	SP10-0105	Consistent with Structure			
Identity by ¹ H-NMR Analysis	USP <761>, SP10-0116	Consistent with Structure			
Residual Solvent Analysis by GC/FID Headspace	AM1087 ²	0.22%			
Residual Water Analysis by Karl Fischer Coulometry	AM1346 ²	0.32%			
Mass Balance Purity Factor		98.51%			
¹ Purity value adjusted for known impurities as shown on the trace below. ² Validated analytical method					
<ul style="list-style-type: none">♦ The chromatographic purity value is used to calculate the Mass Balance Purity Factor.♦ Mass Balance Purity Factor = [(100 - wt% residual solvent - wt% residual water - wt% residual inorganics) x Chromatographic Purity/100].♦ Mass Balance Purity Factor does not include adjustment for chiral and/or isotopic purity.					

Spectral and Physical Data

HPLC/UV



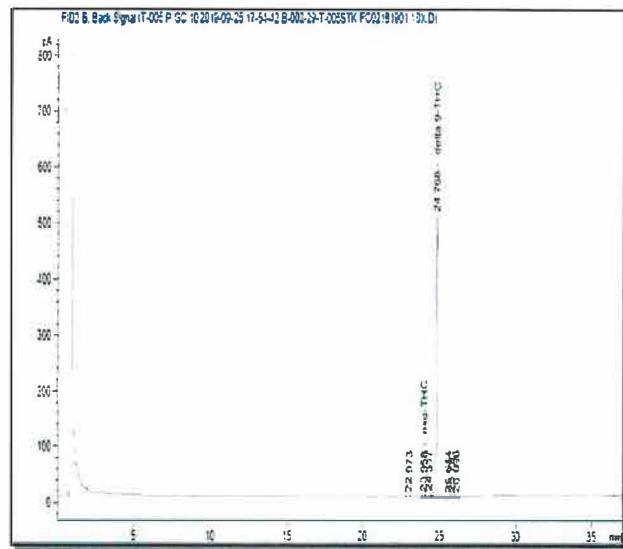
Column: Luna C18, 3 μ m, 4.6 x 150 mm
Mobile Phase: Methanol:Water:Tetrahydrofuran (71:24:5)
Flow Rate: 1.0 mL/min
Wavelength: 228 nm

Sample Name: FC02181901
Acquired: September 23, 2019

Peak #	Ret Time	Area %	
1	6.85	0.02	
2	8.90	0.14	
3	10.53	0.13	
4	12.08	0.01	
5	12.77	0.02	
6	13.35	0.02	
7	15.96	0.05	Cannabidiol
8	22.16	0.09	
9	25.42	0.04	
10	27.97	0.51	Cannabinol
11	29.36	0.00	
12	31.16	0.00	
13	32.42	0.10	
14	35.66	98.72	(-)- Δ^9 -THC
15	39.03	0.09	
16	41.09	0.02	(-)- Δ^8 -THC
17	41.27	0.02	

Spectral and Physical Data (cont.)

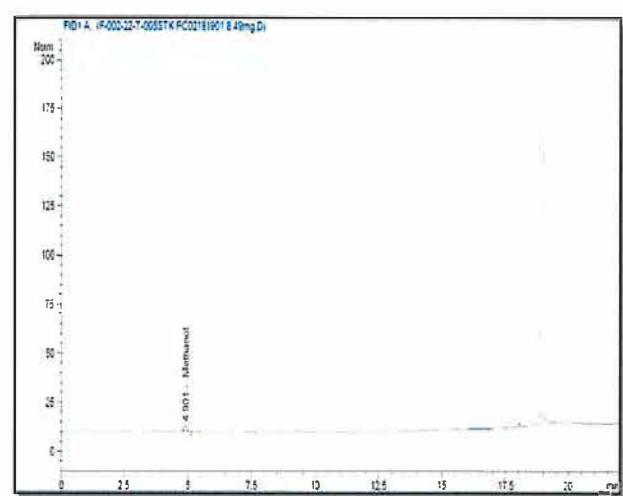
exo-THC by GC/FID



Column: DB-35ms, 30 m x 0.53 mm ID, 1.0 μ m 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: FC02181901
Acquired: September 25, 2019

Peak #	Ret Time	Area %	
1	22.97	0.03	
2	23.96	0.05	exo-THC
3	24.32	0.20	
4	24.77	99.44	(-)- Δ^9 -THC
5	25.61	0.04	
6	25.79	0.20	
7	26.10	0.03	

Residual Solvent Analysis by GC/FID Headspace



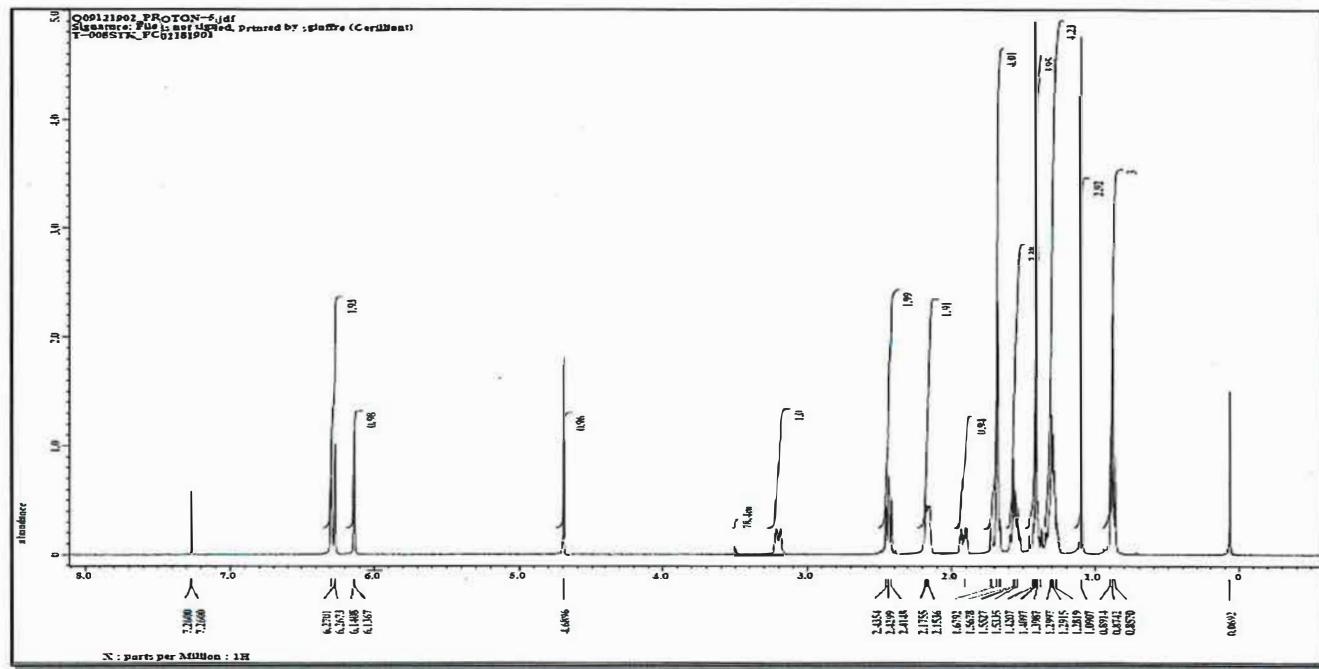
Column: DB-ALC1 30 m x 0.53 mm, 3 μ m film thickness
Temp Program: 40°C hold 12 min to 220°C at 40°C/min hold 5.5 min
Carrier Gas: Helium
Flow Rate: 2.0 mL/min
Detector Heater Temp: 250°C
Injector: Headspace Sampler
HS Oven Temp: 60°C
Vial Equilibration: 10 minutes
Sample Name: FC02181901
Acquired: September 13, 2019

Peak	Compound	Area	Weight %
1	Methanol	20.94	0.22
2	NMP	NA	NA
Total			0.22

Spectral and Physical Data (cont.)

¹H NMR

Instrument: JEOL ECS 400
Solvent: Chloroform-D

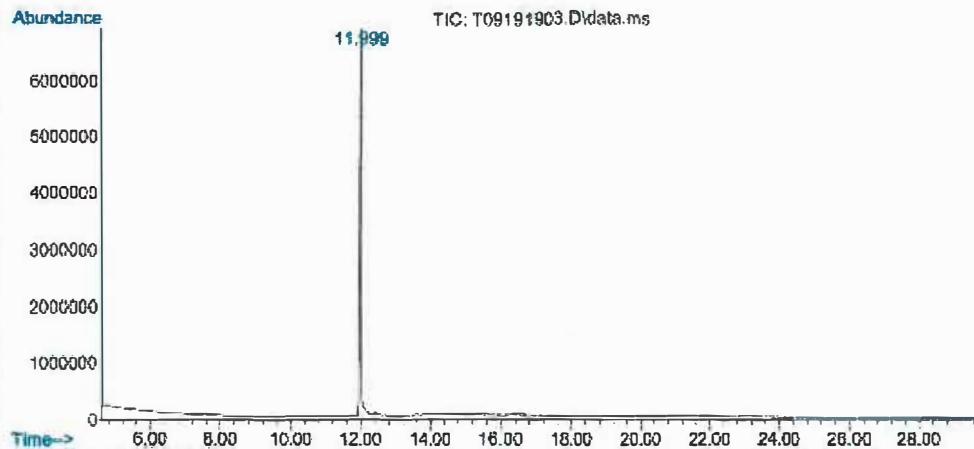


Spectral and Physical Data (cont.)

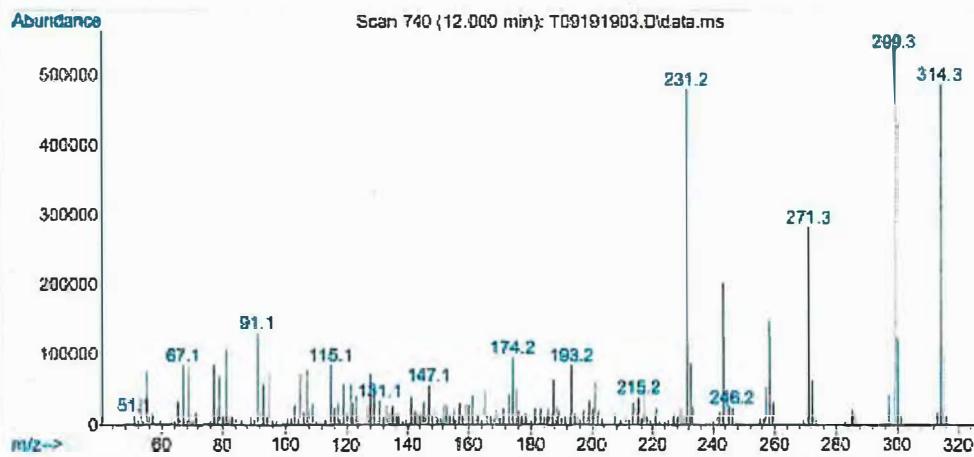
GC/MS

Compound Name	: (-)-delta9-THC
Lot Number	: FC02181901
Instrument	: Agilent GCMS
Operator	: ECM(SGIUFFRE)
Date Reported	: Thu Sep 19 09:33:31 2019
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, 1min hold
Injector Temp.	: Cool on-column
Carrier Gas	: Helium
Flow Rate (mL/min)	: 0.80 mL/min
Transfer Line Temp.	: 280°C
Scan Range	: 50-500

Total Ion Chromatogram



Mass Spectrum



Stability

Short term stability studies have been performed in multiple storage conditions for a period of up to four weeks. Short term data is utilized 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 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.

Long Term Stability: Long term stability has been assessed for Freezer storage (-10 °C to -25 °C) conditions. Stability of a minimum of 60 months has been established through real-time stability studies.

Commutability

This standard is a solution of a pure substance in an organic solvent and is a Primary Standard. This Primary Standard is suitable for use in the preparation of calibrators and/or controls in any biological matrix. This standard is not in a biological matrix and therefore commutability to methods or standards in biological matrices does not apply.

COA Revision History

Revision No.	Date	Reason for Revision
00	April 03, 2020	Initial version.
01	May 01, 2020	Corrected CAS Number.
02	December 29, 2020	Updated expanded uncertainty from ± 0.006 to ± 0.018 mg/mL. Updated uncertainty fishbone diagram.

The vibrant M, Supelco, TraceCERT and Sigma-Aldrich are trademarks of Merck KGaA, Darmstadt, Germany or its affiliates. All other trademarks are the property of their respective owners.

Detailed information on trademarks is available via publicly accessible resources.

© 2018 Merck KGaA, Darmstadt, Germany and/or its affiliates. All Rights Reserved.

**The life science business of Merck KGaA, Darmstadt, Germany
operates as MilliporeSigma in the US and Canada.**

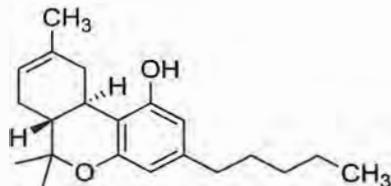


Certified Reference Material - Certificate of Analysis

(-)- Δ^8 -THC, Primary Measurement Standard

(6aR,10aR)-6a,7,10,10a-tetrahydro-6,6-9-trimethyl-3-pentyl-6H-dibenzo[b,d]pyran-1-ol

Product No.:	T-032-1ML
Lot No.:	FE04282108
Description of CRM:	(-)- Δ^8 -THC in Methanol (Solution)
Expiration Date:	May 2026 See Stability Section
Storage:	Store unopened in freezer (-10 °C to -25 °C).
Shipping:	Ambient. See Stability Section
Chemical formula:	C ₂₁ H ₃₀ O ₂
CAS No.:	5957-75-5
Regulatory:	USDEA Exempt Canadian TK # 61-1550



Analyte	Certified Concentration ± associated uncertainty U , $u = k * u$ ($k = 2$)
(-)- Δ^8 -THC	1.000 ± 0.009 mg/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 3.
Measurement method:	The certified value is calculated from high precision weighing of thoroughly characterized starting material. See "Details about certification process" on page 3.
Intended use:	This Certified Reference Material is suitable for the in vitro identification, calibration, and quantification of the analyte(s) in analytical and R&D applications. 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.
Accreditation:	Cerilliant Corp. is accredited by the US accreditation authority ANAB as registered reference material producer AR-1353 in accordance with ISO 17034 and registered testing laboratory AT-1352 according to ISO/IEC 17025.



A handwritten signature in black ink, appearing to read 'Darron Ellsworth'.

Darron Ellsworth, Quality Assurance Manager

January 20, 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.

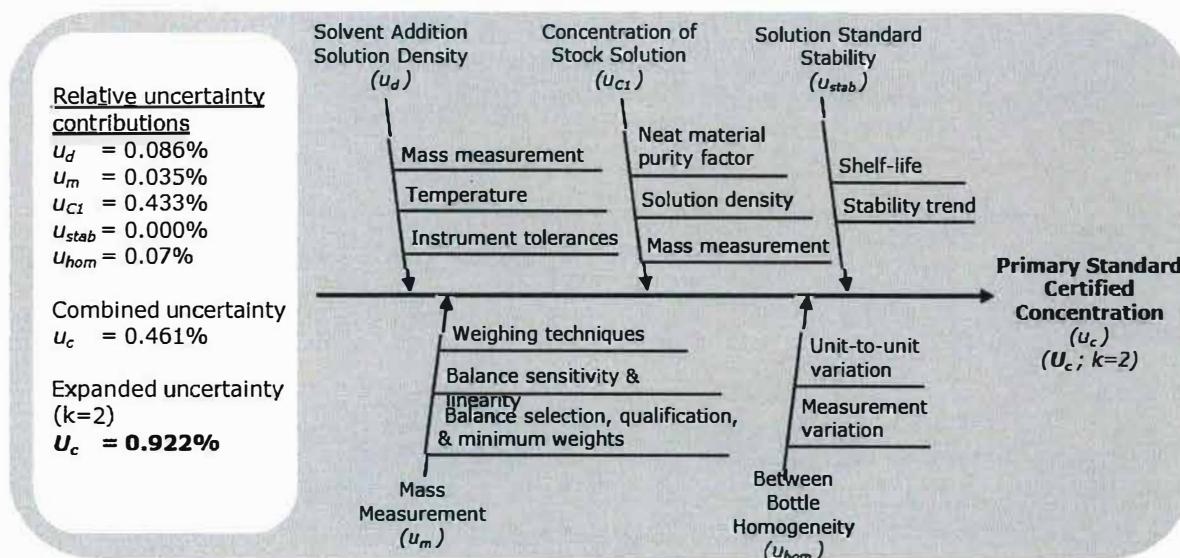
Packaging: 2 mL amber USP Type 1 glass ampoule containing not less than 1 mL of certified solution. Ampoules are overfilled to ensure a minimum of 1 mL volume can be transferred when using a 1mL Class A volumetric pipette.

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 Mass Balance 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.

Associated uncertainty:

The uncertainty has been calculated by statistical analysis of all aspects of our production system and incorporated uncertainty of the mass balance purity factor, material density, balance, weighing technique, and homogeneity. Uncertainty components of the gravimetrically prepared Primary Standard concentration are shown in the figure below. Uncertainty is expressed as an expanded uncertainty in accordance with ISO 17034 at the approximate 95% confidence interval using a coverage factor of $k=2$. Uncertainty contribution from neat material homogeneity was established to be negligible through establishment of process controls and verification of the control process. Stability uncertainty was determined to be negligible by regression analysis.



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 Mass Balance Purity Factor of each raw material is traceable to the SI and higher order reference materials through mass measurement and instrument qualification and calibrations.

Details about certification process:

This standard has been prepared and certified under the ISO 17034, ISO/IEC 17025, and ISO 9001 standards. This standard meets the requirements of a Certified Reference Material and a Primary Standard as defined by ISO and is traceable to the SI and higher order standards through an unbroken chain of comparisons.

- ◆ Nominal concentration is calculated based on: the actual mass; Mass balance purity factor of the analyte(s); measured mass of the solution; and the density of the pure diluent at 20°C.
- ◆ Fill volume is gravimetrically verified throughout the dispensing process using qualified and calibrated balances.
- ◆ Concentration is verified against an independently prepared calibration solution gravimetrically prepared.
- ◆ Additional certification information available upon request.

Solution Standard Verification

Concentration accuracy and within- and between-bottle homogeneity are analytically verified against an independently prepared calibration solution and to the prior lot.

Standard Solution Assay Parameters		Calibration Curve	
Analysis Method:	HPLC/UV	Calibration Curve:	Linear Regression
Column:	Ascentis Express C18, 2.7 µm, 3.0 x 50 mm	Number of Points:	4
Mobile Phase:	Acetonitrile:[Methanol:Water:Tetrahydrofuran (62:33:5)] (30:70)	Linearity (r) :	1.000
Flow Rate:	1.5 mL/min		
Wavelength:	228 nm		
		Verified Concentration (mg/mL)	%RSD - Homogeneity
Standard Solution	Lot Number	Actual Results	Actual Results
New Lot	FE04282108	0.992	0.3
Previous Lot	FE12271903	0.990	0.2
<ul style="list-style-type: none">♦ Concentration is verified through multiple analyses and is calculated as the average of multiple analyses compared to an independently prepared calibration solution.♦ Within-sample and between-sample homogeneity of the New Lot is ensured through rigorous production process controls statistically analyzed to evaluate risk and verified by analysis. Multiple samples pulled from across the lot using a random stratified sampling plan were analyzed to verify homogeneity. % RSD results shown above for the New Lot demonstrate ampoule-to-ampoule homogeneity.			

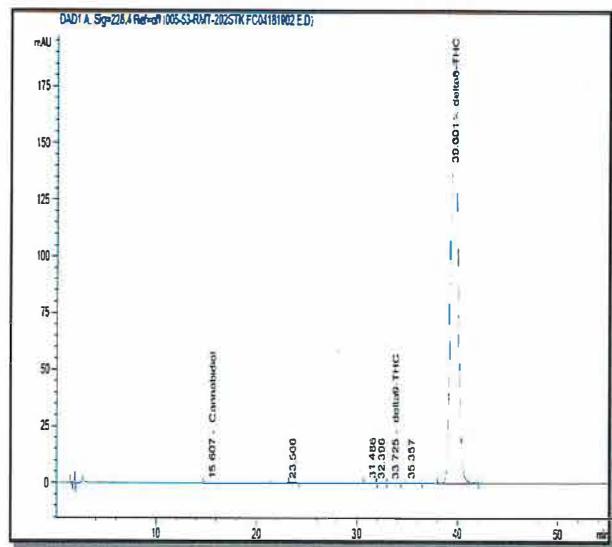
Analyte Certification - Mass Balance Purity Factor

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 is utilized to calculate the weighing adjustment necessary to ensure accuracy of the solution standard concentration.

Material Name:	(-)-Δ ⁸ -THC	Chemical Formula:	C ₂₁ H ₃₀ O ₂		
Material Lot:	FC04181902	CAS Number:	5957-75-5		
		Molecular Weight:	314.46		
Material Characterization Summary					
Analytical Test	Method	Results			
Primary Chromatographic Purity by HPLC/UV Analysis	AM1280	99.7% ¹			
Secondary Chromatographic Purity by GC/FID Analysis	AM1266	99.4%			
Chiral Purity by HPLC/UV Analysis	AM1319	97.8% ee			
Identity by GC/MS Analysis	SP10-0105	Consistent with Structure			
Identity by ¹ H-NMR Analysis	USP <761>, SP10-0116	Consistent with Structure			
Residual Water Analysis by Karl Fischer Coulometry	AM1346 ²	Not Detected			
Purity Factor Based on Assay Value		100.8%			
¹ 0.03% Cannabidiol and 0.07% (-)-Δ ⁹ -THC detected by HPLC/UV analysis. No Cannabinol detected.					
² Validated analytical method					
<ul style="list-style-type: none">♦ The primary chromatographic purity is calculated as the average of two independently performed analyses utilizing two different methods. Acceptance criteria requires the purity values to be within 0.5% of each other.♦ The primary purity method was selected to optimize resolution of impurities while minimizing degradation of the analyte. Secondary purity methods with orthogonal detector capabilities from the primary purity method are used as controls to confirm an accurate purity value.♦ A secondary chromatographic purity method is utilized as a control.♦ The Mass Balance Purity Factor is based on Assay by HPLC/UV.					

Spectral and Physical Data

HPLC/UV

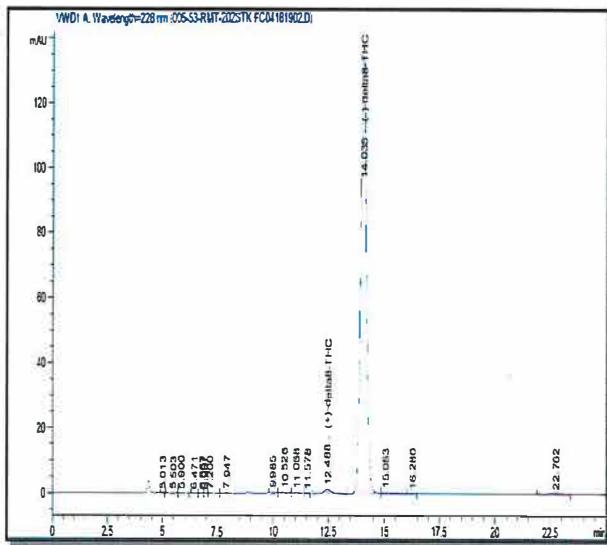


Column: Luna C18, 3 μ m, 4.6 x 150 mm
Mobile Phase: Methanol:Water:Tetrahydrofuran (71:24:5)
Flow Rate: 1.0 mL/min
Wavelength: 228 nm

Sample Name: FC04181902
Acquired: June 04, 2019

Peak #	Ret Time	Area %	
1	15.61	0.03	Cannabidiol
2	23.57	0.02	
3	31.49	0.08	
4	32.40	0.05	
5	33.73	0.07	(-)- Δ^9 -THC
6	35.36	0.04	
7	39.60	99.71	(-)- Δ^8 -THC

Chiral HPLC/UV



Column: Chiraldak AD-H, 5 μ m, 4.6 x 250 mm
Mobile Phase: Isopropanol:Methanol:Heptane (31:9:950)
Flow Rate: 0.7 mL/min
Wavelength: 228 nm

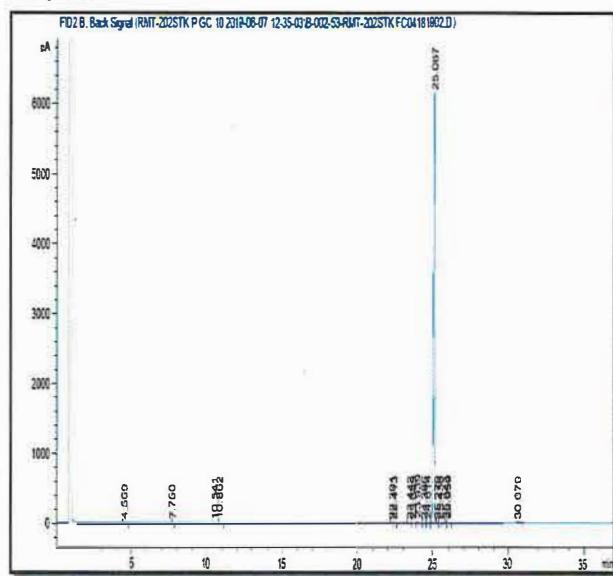
Sample Name: FC04181902
Acquired: June 13, 2019

Peak #	Ret Time	Area %	
1	5.01	0.00	
2	5.50	0.02	
3	5.90	0.01	
4	6.47	0.00	
5	6.87	0.00	
6	6.97	0.00	
7	7.20	0.01	
8	7.95	0.02	
9	9.99	0.01	
10	10.53	0.05	
11	11.07	0.01	
12	11.58	0.00	
13	12.49	1.11	(+)- Δ^8 -THC
14	14.04	98.34	(-)- Δ^8 -THC
15	15.05	0.15	
16	16.28	0.01	
17	22.76	0.26	

%ee = 97.77

Spectral and Physical Data (cont.)

GC/FID



Column: DB-35ms, 30 m x 0.53 mm ID,
1.0 μ m 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: FC04181902

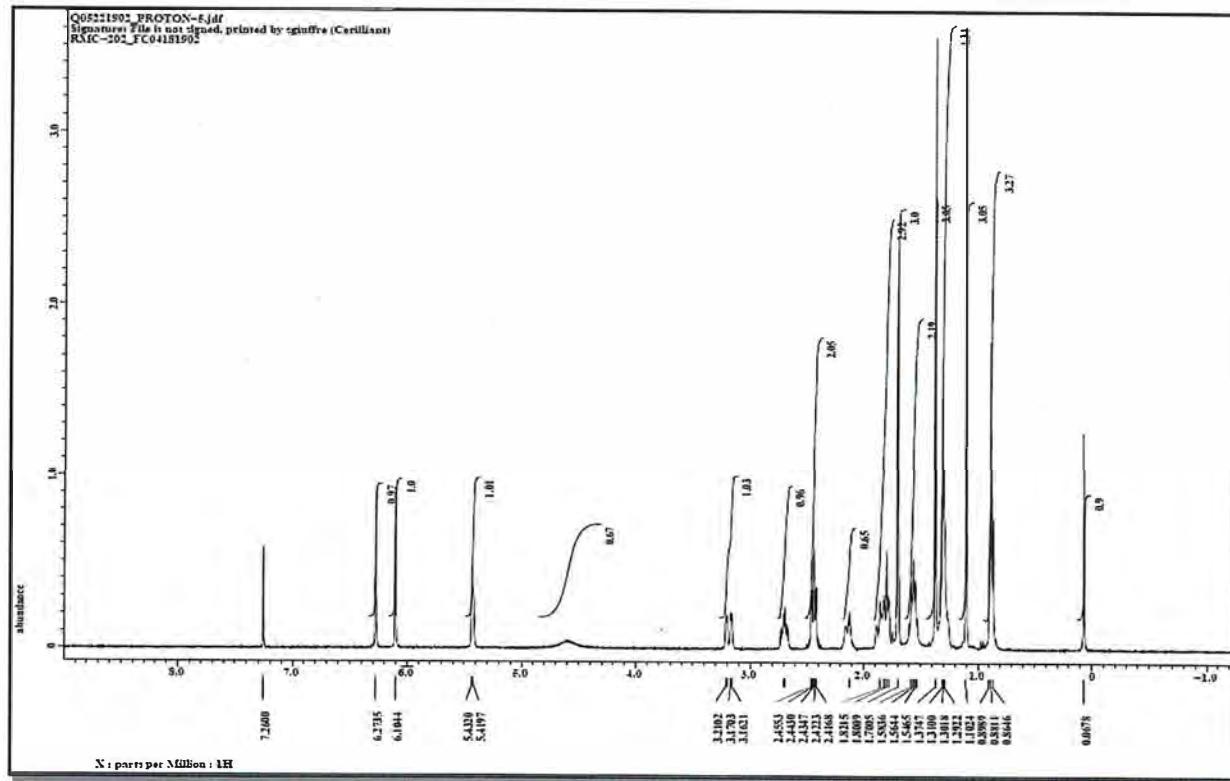
Acquired: June 07, 2019

Peak #	Ret Time	Area %
1	4.57	0.02
2	7.75	0.01
3	10.54	0.01
4	10.86	0.06
5	22.30	0.02
6	22.41	0.01
7	23.44	0.01
8	23.65	0.02
9	23.94	0.27
10	24.39	0.01
11	24.61	0.05
12	25.07	99.40
13	25.28	0.04
14	25.44	0.01
15	25.84	0.02
16	25.96	0.04
17	30.68	0.01

Spectral and Physical Data (cont.)

¹H NMR

Instrument: JEOL ECS 400
Solvent: Chloroform-D

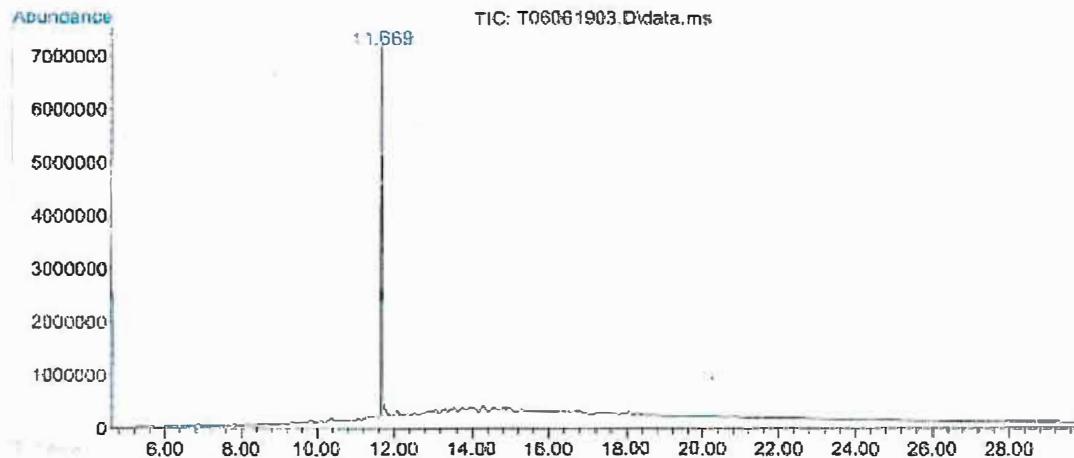


Spectral and Physical Data (cont.)

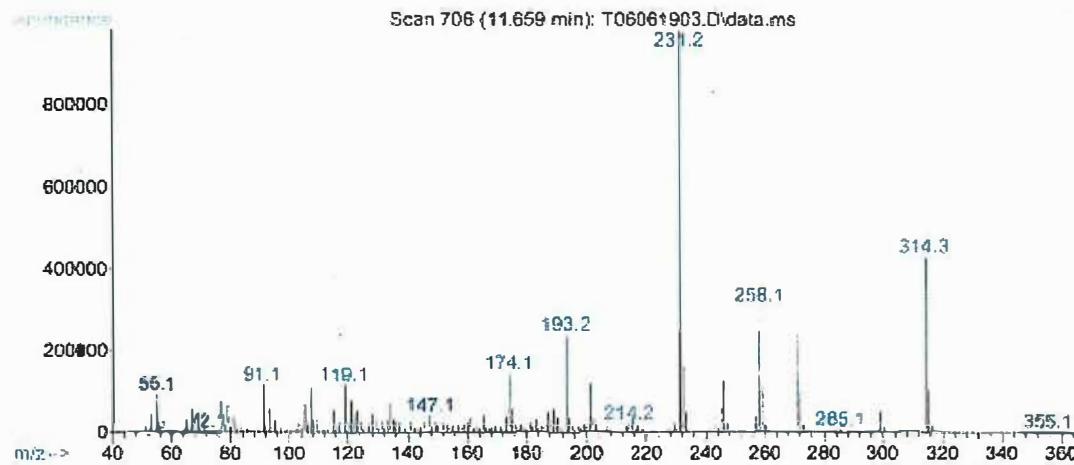
GC/MS

Compound Name : (-)-delta⁸-THC
Lot Number : FC#4181902
Instrument : Agilent GCMS
Operator : ECM(SGIUFFRE)
Date Reported : Thu Jun 06 10:44:24 2019
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 : 50-500

Total Ion Chromatogram



Mass Spectrum



Stability

Short term stability studies have been performed in multiple storage conditions for a period of up to four weeks. Short term data is utilized 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 stability findings for this product is listed below.

Storage Condition	Targeted Mean Kinetic Temperature (MKT)	Time Period/Result
Freezer	-20°C	No decrease in purity was noted after four weeks.
Refrigerator	5°C	
Room Temperature	20°C	
40°C	40°C	

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

Long Term Stability: Long term stability has been assessed for Freezer storage (-10 °C to -25 °C) conditions. Stability of a minimum of 60 months has been established through real-time stability studies.

Commutability

This standard is a solution of a pure substance in an organic solvent and is a Primary Standard. This Primary Standard is suitable for use in the preparation of calibrators and/or controls in any biological matrix. This standard is not in a biological matrix and therefore commutability to methods or standards in biological matrices does not apply.

COA Revision History

Revision No.	Date	Reason for Revision
00	January 20, 2022	Initial version.

The vibrant M, Supelco, TraceCERT and Sigma-Aldrich are trademarks of Merck KGaA, Darmstadt, Germany or its affiliates. All other trademarks are the property of their respective owners. Detailed information on trademarks is available via publicly accessible resources. © 2018 Merck KGaA, Darmstadt, Germany and/or its affiliates. All Rights Reserved.

The life science business of Merck KGaA, Darmstadt, Germany operates as MilliporeSigma in the US and Canada.



Certified Reference Material - Certificate of Analysis

Cannabinol, Primary Measurement Standard

6,6,9-Trimethyl-3-penty-6H-dibenzo[b,d]pyran-1-ol

Cerilliant Quality

ISO 17034

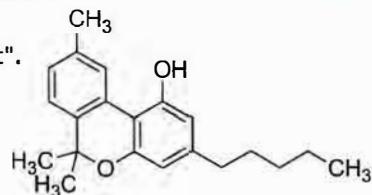
ISO/IEC 17025

ISO 13485

ISO 14001

ISO 9001

Product No.:	C-046-1ML
Lot No.:	FE11211801
Description of CRM:	Cannabinol in Methanol (Solution)
Expiration Date:	February 2023 See Section "Stability Assessment".
Storage:	Store unopened in freezer (-10 °C to -25 °C).
Shipping:	Ambient. See Section "Stability Assessment".
Chemical formula:	C ₂₁ H ₂₆ O ₂
CAS No.:	521-35-7
Regulatory:	USDEA Exempt Canadian TK # 61-1089



Analyte	Certified Concentration ± associated uncertainty U, $u=k^*u$ ($k=2$)
Cannabinol	1.000 ± 0.006 mg/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 certified value is calculated from high precision weighing of thoroughly characterized starting material. See "Details about certification process" on page 2.

Intended use: This Certified Reference Material is suitable for the in vitro identification, calibration, and quantification of the analyte(s) in analytical and R&D applications. 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 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.

Accreditation: Cerilliant Corp. is accredited by the US accreditation authority ANAB as registered reference material producer AR-1353 in accordance with ISO 17034 and registered testing laboratory AT-1352 according to ISO/IEC 17025.




Darron Ellsworth, Quality Assurance Manager

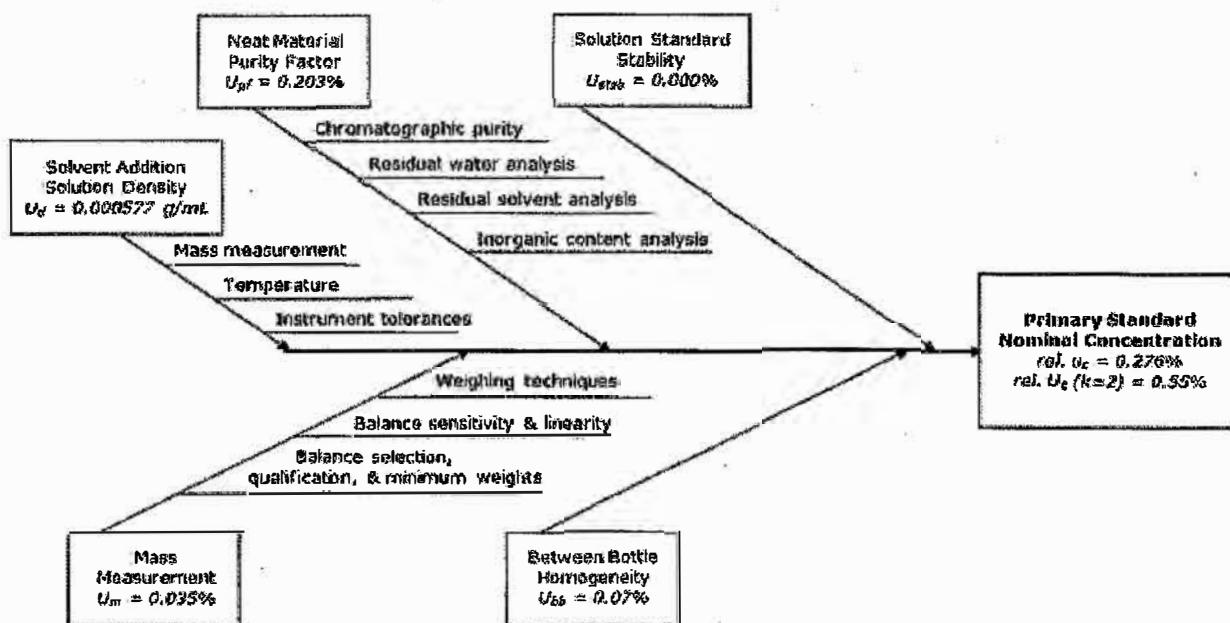
March 06, 2019

Issue Date

- Packaging:** 2 mL amber USP Type 1 glass ampoule containing not less than 1 mL of certified solution. Ampoules are overfilled to ensure a minimum of 1 mL volume can be transferred when using a 1mL 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 Mass Balance 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 was manufactured in the USA.

Associated uncertainty:

The uncertainty has been calculated by statistical analysis of all aspects of our production system and incorporated uncertainty of the mass balance purity factor, material density, balance, weighing technique, and homogeneity. Uncertainty components of the gravimetrically prepared Primary Standard concentration are shown in the figure below. Uncertainty is expressed as an expanded uncertainty in accordance with ISO 17034 at the approximate 95% confidence interval using a coverage factor of $k=2$. Uncertainty contribution from neat material homogeneity was established to be negligible through establishment of process controls and verification of the control process. Stability uncertainty was determined to be negligible by regression analysis.



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 Mass Balance Purity Factor of each raw material is traceable to the SI and higher order reference materials through mass measurement and instrument qualification and calibrations.

Details about certification process:

This standard has been prepared and certified under the ISO 17034, ISO/IEC 17025, ISO 9001 and ISO 13485 standards. This standard meets the requirements of a Certified Reference Material and a Primary Standard as defined by ISO and is traceable to the SI and higher order standards through an unbroken chain of comparisons.

- ◆ Nominal concentration is calculated based on: the actual mass; Mass balance purity factor of the analyte(s); measured mass of the solution; and the density of the pure diluent at 20°C.
- ◆ Fill volume is gravimetrically verified throughout the dispensing process using qualified and calibrated balances.
- ◆ Concentration is verified against an independently prepared calibration solution gravimetrically prepared.
- ◆ Additional certification information available upon request.

Solution Standard Verification

Concentration accuracy and within- and between-bottle homogeneity are analytically verified against an independently prepared calibration solution and to the prior lot.

Solution standard verification demonstrates confirmation that the specified requirements for the Primary Measurement Standard have been fulfilled and validated under ISO 13485.

Standard Solution Assay Parameters		Calibration Curve	
Analysis Method:	HPLC/UV	Calibration Curve:	Linear Regression
Column:	Ascentis Express C18, 2.7 µm, 3.0 x 50 mm	Number of Points:	4
Mobile Phase:	Acetonitrile:[Methanol:Water:Tetrahydrofuran (62:33:5)](25:75)	Linearity (r):	1.000
Flow Rate:	1.5 mL/min		
Wavelength:	228 nm		
		Verified Concentration (mg/mL)	%RSD - Homogeneity
Standard Solution	Lot Number	Actual Results	Actual Results
New Lot	FE11211801	0.998	0.4
Previous Lot	FE06131701	0.991	0.3

• Concentration is verified through multiple analyses and is calculated as the average of multiple analyses compared to an independently prepared calibration solution.

• Within-sample and between-sample homogeneity of the New Lot is ensured through rigorous production process controls statistically analyzed to evaluate risk and verified by analysis. Multiple samples pulled from across the lot using a random stratified sampling plan were analyzed to verify homogeneity. % RSD results shown above for the New Lot demonstrate ampoule-to-ampoule homogeneity.

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 is utilized to calculate the weighing adjustment necessary to ensure accuracy of the solution standard concentration.

Material Name:	Cannabinol	Chemical Formula:	C ₂₁ H ₂₆ O ₂
Material Lot:	FC06161701	CAS Number:	521-35-7
Material Characterization Summary			
Analytical Test		Method	Results
Primary Chromatographic Purity by HPLC/UV Analysis		SP10-0102	99.6% ¹
Secondary Chromatographic Purity by GC/FID Analysis		SP10-0106	99.9%
Identity by GC/MS Analysis		SP10-0107	Consistent with Structure
Identity by ¹ H-NMR Analysis		USP <761>, SP10-0116	Consistent with Structure
Residual Solvent Analysis by GC/FID Headspace		AM1087 ²	0.11%
Residual Water Analysis by Karl Fischer Coulometry		AM1346 ²	Below Quantitation Limit
Inorganic Content by Microash Analysis		SP10-0135	< 0.2%
Mass Balance Purity Factor			99.50%

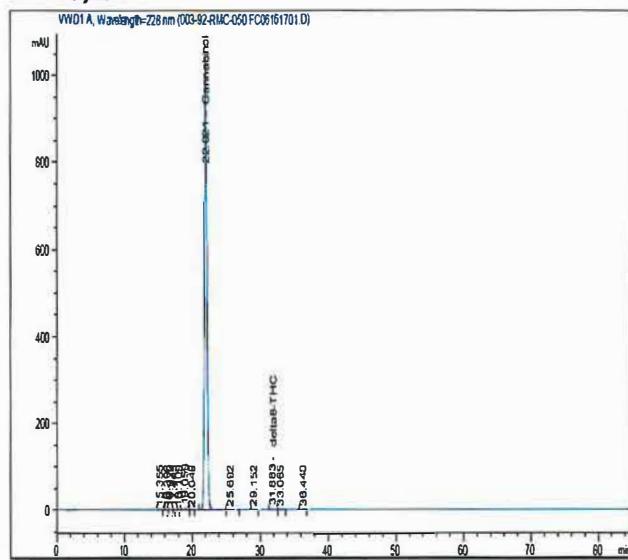
¹ 0.10% (-)-Δ⁸-THC detected by HPLC/UV analysis. No Cannabidiol or (-)-Δ⁹-THC detected.

² Validated analytical method.

- ♦ The primary chromatographic purity is calculated as the average of two independently performed analyses utilizing two different methods. Acceptance criteria requires the purity values to be within 0.5% of each other.
- ♦ The primary purity method was selected to optimize resolution of impurities while minimizing degradation of the analyte. Secondary purity methods with orthogonal detector capabilities from the primary purity method are used as controls to confirm an accurate purity value.
- ♦ The primary chromatographic purity value is used to calculate the Mass Balance Purity Factor.
- ♦ A secondary chromatographic purity method is utilized as a control.
- ♦ Mass Balance Purity Factor = [(100 - wt% residual solvent - wt% residual water - wt% residual inorganics) x Chromatographic Purity/100].
- ♦ Mass Balance Purity Factor does not include adjustment for chiral and/or isotopic purity.

Spectral and Physical Data

HPLC/UV

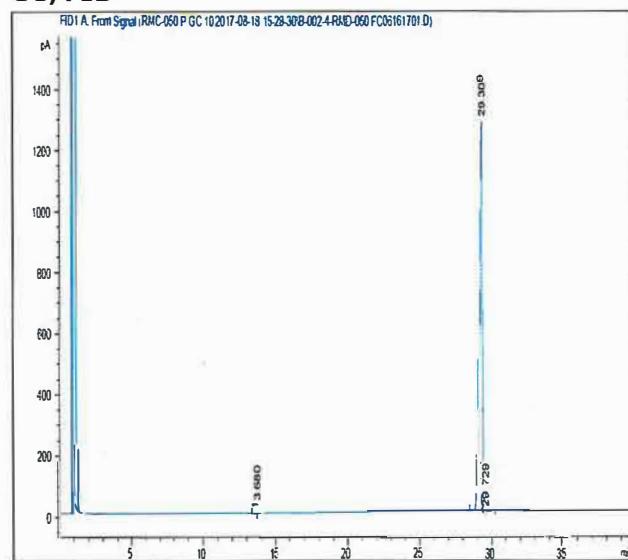


Column: Luna C18, 3 μ m, 4.6 x 150
Mobile Phase: Methanol:Water:Tetrahydrofuran (71:24:5)
Flow Rate: 1.0 mL/min
Wavelength: 228 nm

Sample Name: FC06161701
Acquired: August 31, 2017

Peak #	Ret Time	Area %
1	15.36	0.01
2	16.40	0.01
3	16.92	0.02
4	17.45	0.00
5	18.11	0.00
6	19.06	0.21
7	20.05	0.01
8	22.02	99.61 Cannabinol
9	25.69	0.02
10	29.15	0.01
11	31.88	0.10 (-)- Δ^8 -THC
12	33.07	0.01
13	36.44	0.01

GC/FID



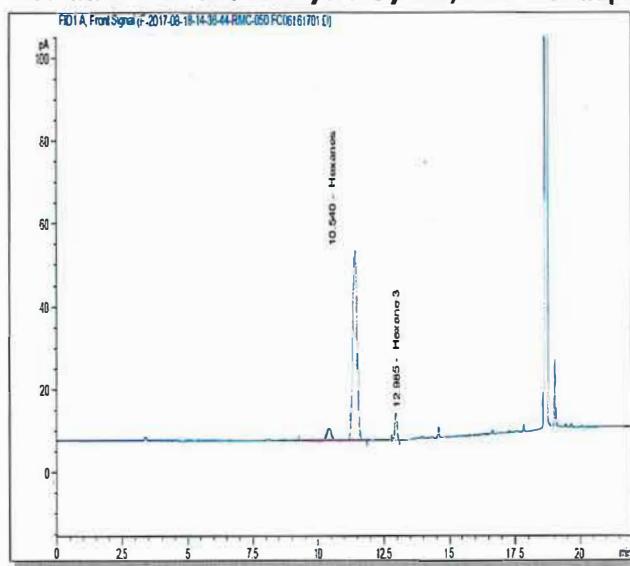
Column: DB-5ms, 30 m x 0.53 mm ID, 1.5 μ m film thickness
Temp Program: 40°C to 200°C at 40°C/min
200°C to 300°C at 5°C/min hold 16 min
Injector Temp: Cool-on-Column
Detector Temp: 325°C

Sample Name: FC06161701
Acquired: August 18, 2017

Peak #	Ret Time	Area %
1	13.68	0.07
2	29.31	99.88
3	29.73	0.05

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 (12 min) to 220°C at
40°C/min (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:

FC06161701

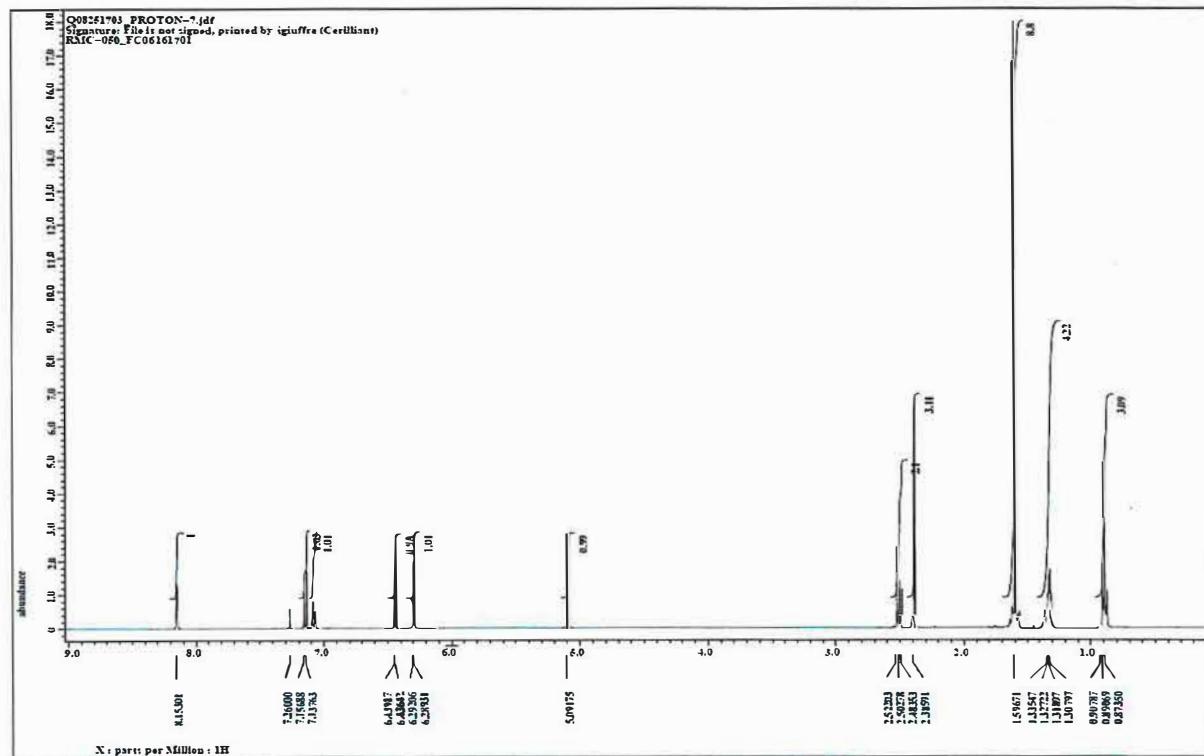
Acquired:

August 18, 2017

Peak	Compound	Area	Weight %
1	Hexanes	612.31	0.11
2	NMP	NA	NA
Total			0.11

¹H NMR

Instrument: JEOL ECS 400
Solvent: Chloroform-D

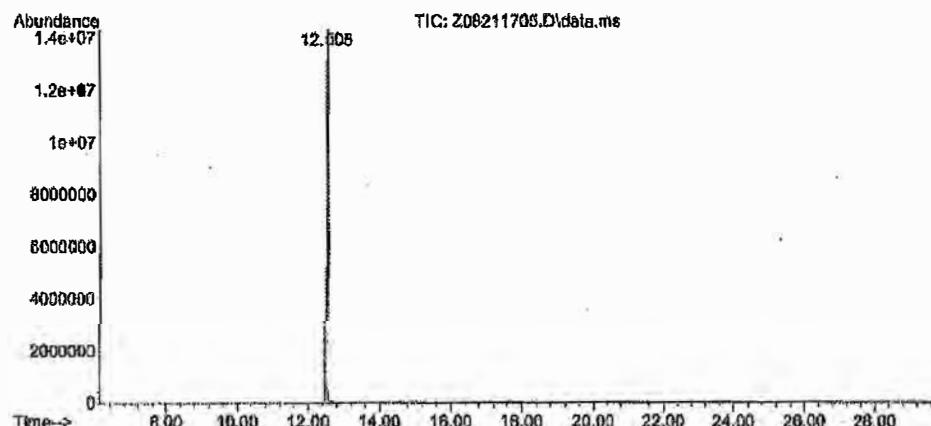


Spectral and Physical Data (cont.)

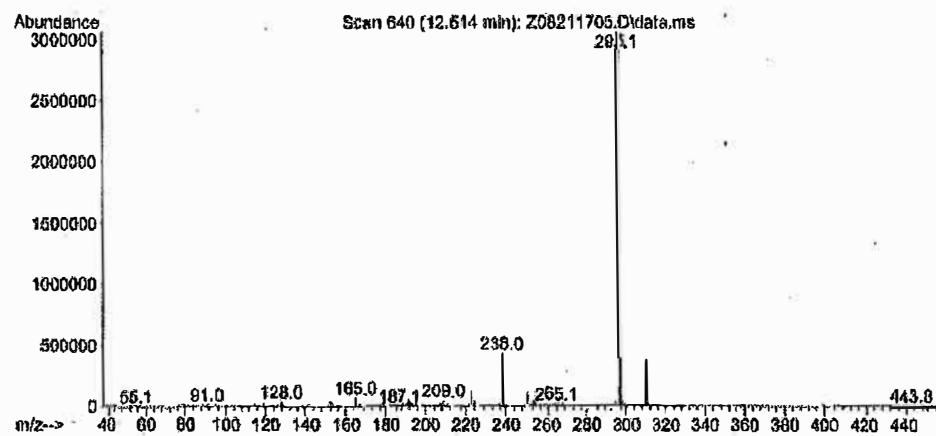
GC/MS

Compound Name	:	Cannabidiol
Lot Number	:	FC06161701
Instrument	:	Agilent GCMS
Operator	:	ECM (SGIUFFRE)
Date Reported	:	Mon Aug 21 12:48:11 2017
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	:	50-500

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.

Long Term Stability: Long term stability has been assessed for Freezer storage (-10 °C to -25 °C) conditions. Stability of a minimum of 60 months has been established through real-time stability studies.

Commutability

This standard is a solution of a pure substance in an organic solvent and is a Primary Standard. This Primary Standard is suitable for use in the preparation of calibrators and/or controls in any biological matrix. This standard is not in a biological matrix and therefore commutability to methods or standards in biological matrices does not apply.

COA Revision History

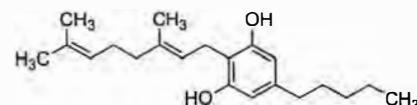
Revision No.	Date	Reason for Revision
00	March 06, 2019	Initial version.

Certified Reference Material - Certificate of Analysis

Cannabigerol (CBG), Primary Measurement Standard

2-[(2E)-3,7-Dimethyl-2,6-octadien-1-yl]-5-pentyl-1,3-Benzenediol

Product No.:	C-141-1ML
Lot No.:	FN03072001
Description of CRM:	Cannabigerol (CBG) in Methanol (Solution)
Expiration Date:	March 2024 See Section "Stability Assessment".
Storage:	Store unopened in freezer (-10 °C to -25 °C).
Shipping:	Ship cold. See Section "Stability Assessment".
Chemical formula:	$C_{21}H_{32}O_2$
CAS No.:	25654-31-3
Regulatory:	USDEA Exempt Canadian TK # 61-1100



Analyte	Certified Concentration ± associated uncertainty U, $u=k^*u$ ($k=2$)
Cannabigerol (CBG)	1.000 ± 0.006 mg/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 certified value is calculated from high precision weighing of thoroughly characterized starting material. See "Details about certification process" on page 2.

Intended use: This Certified Reference Material is suitable for the *in vitro* identification, calibration, and quantification of the analyte(s) in analytical and R&D applications. 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.

Accreditation: Cerilliant Corp. is accredited by the US accreditation authority ANAB as registered reference material producer AR-1353 in accordance with ISO 17034 and registered testing laboratory AT-1352 according to ISO/IEC 17025.



Darron Ellsworth, Quality Assurance Manager

April 02, 2020

Issue Date

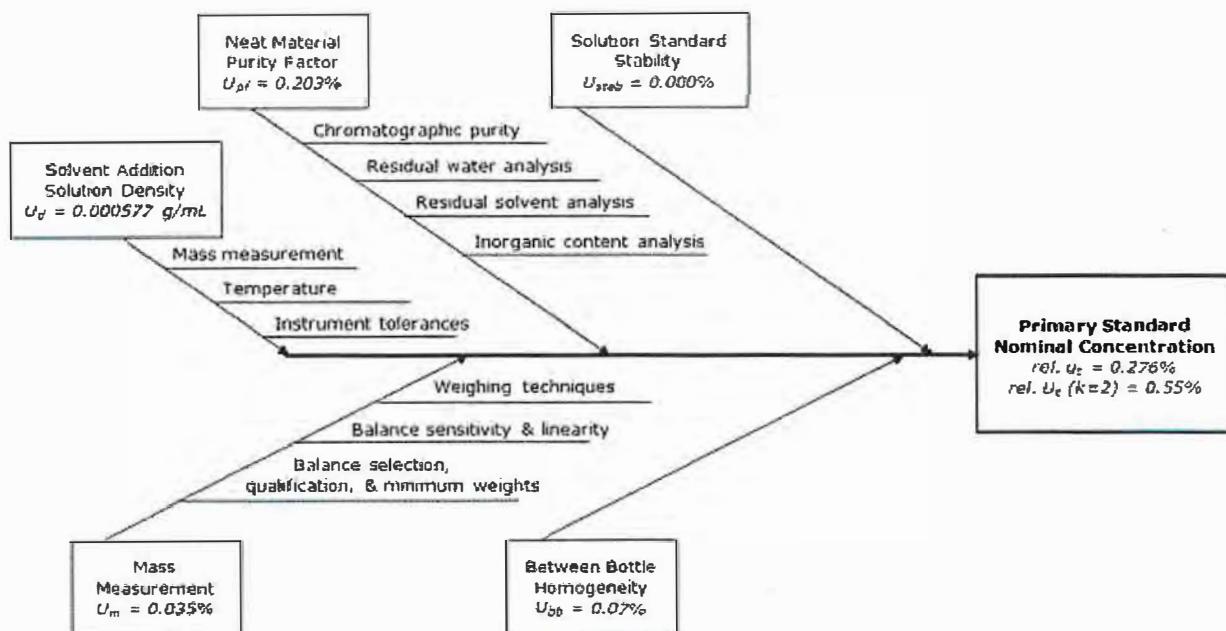
Cerilliant Corporation, 811 Paloma Drive, Suite A Round Rock, TX 78665, USA, Tel: 800-848-7837 / 512-238-9974; www.cerilliant.com
Sigma-Aldrich Production GmbH is a subsidiary of Merck KGaA, Darmstadt, Germany.



Packaging:	2 mL amber USP Type 1 glass ampoule containing not less than 1 mL of certified solution. Ampoules are overfilled to ensure a minimum of 1 mL volume can be transferred when using a 1mL 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 Mass Balance 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 was manufactured in the USA.

Associated uncertainty:

The uncertainty has been calculated by statistical analysis of all aspects of our production system and incorporated uncertainty of the mass balance purity factor, material density, balance, weighing technique, and homogeneity. Uncertainty components of the gravimetrically prepared Primary Standard concentration are shown in the figure below. Uncertainty is expressed as an expanded uncertainty in accordance with ISO 17034 at the approximate 95% confidence interval using a coverage factor of $k=2$. Uncertainty contribution from neat material homogeneity was established to be negligible through establishment of process controls and verification of the control process. Stability uncertainty was determined to be negligible by regression analysis.



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 Mass Balance Purity Factor of each raw material is traceable to the SI and higher order reference materials through mass measurement and instrument qualification and calibrations.

Details about certification process:

This standard has been prepared and certified under the ISO 17034, ISO/IEC 17025, ISO 9001 and ISO 13485 standards. This standard meets the requirements of a Certified Reference Material and a Primary Standard as defined by ISO and is traceable to the SI and higher order standards through an unbroken chain of comparisons.

- ♦ Nominal concentration is calculated based on: the actual mass; Mass balance purity factor of the analyte(s); measured mass of the solution; and the density of the pure diluent at 20°C.
- ♦ Fill volume is gravimetrically verified throughout the dispensing process using qualified and calibrated balances.
- ♦ Concentration is verified against an independently prepared calibration solution gravimetrically prepared.
- ♦ Additional certification information available upon request.

Solution Standard Verification

Concentration accuracy and within- and between-bottle homogeneity are analytically verified against an independently prepared calibration solution and to the prior lot.

Solution standard verification demonstrates confirmation that the specified requirements for the Primary Measurement Standard have been fulfilled and validated under ISO 13485.

Standard Solution Assay Parameters		Calibration Curve	
Analysis Method:	HPLC/UV	Calibration Curve:	Linear Regression
Column:	Ascentis Express C18, 2.7 µm, 3.0 x 50 mm	Number of Points:	4
Mobile Phase:	Acetonitrile:0.1% Phosphoric acid in Water (75:25)	Linearity (r) :	1.000
Flow Rate:	1.2 mL/min		
Wavelength:	225 nm		
		Verified Concentration (mg/mL)	%RSD - Homogeneity
Standard Solution	Lot Number	Actual Results	Actual Results
New Lot	FN03072001	1.009	0.7
Previous Lot	FE01181901	1.008	1.0
♦ Concentration is verified through multiple analyses and is calculated as the average of multiple analyses compared to an independently prepared calibration solution.			
♦ Within-sample and between-sample homogeneity of the New Lot is ensured through rigorous production process controls statistically analyzed to evaluate risk and verified by analysis. Multiple samples pulled from across the lot using a random stratified sampling plan were analyzed to verify homogeneity. % RSD results shown above for the New Lot demonstrate ampoule-to-ampoule homogeneity.			

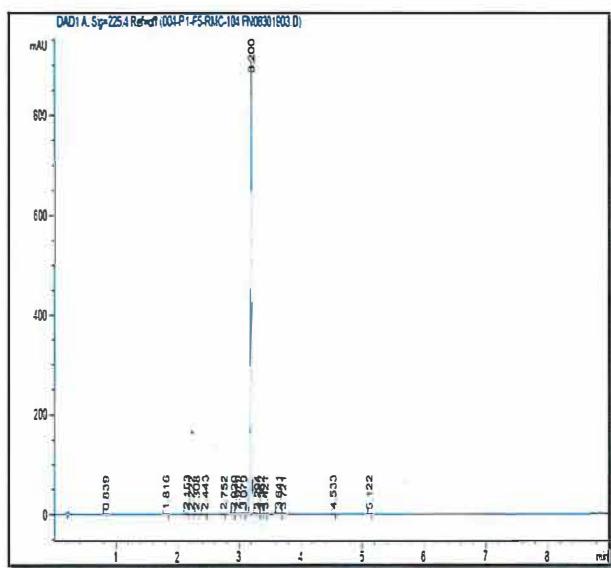
Analyte Certification - Mass Balance Purity Factor

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 is utilized to calculate the weighing adjustment necessary to ensure accuracy of the solution standard concentration.

Material Name:	Cannabigerol (CBG)	Chemical Formula:	C ₂₁ H ₃₂ O ₂		
Material Lot:	FN08301903	CAS Number:	25654-31-3		
Material Characterization Summary					
Analytical Test	Method	Results			
Primary Chromatographic Purity by HPLC/UV Analysis	20384348	99.2% ¹			
Secondary Chromatographic Purity by LC/MS Analysis	20384217	> 99.9%			
Identity by LC/MS Analysis	20384217	Consistent with Structure			
Identity by ¹ H-NMR Analysis	20384224	Consistent with Structure			
Residual Solvent Analysis by GC/FID Headspace	20397799 ²	None Detected			
Residual Water Analysis by Karl Fischer Coulometry	20398075 ²	Below Quantitation Limit			
Inorganic Content by Microash Analysis	20384350	< 0.2%			
Mass Balance Purity Factor		99.20%			
¹ No Δ ⁹ -THC detected by HPLC/UV analysis.					
² Validated analytical method					
<ul style="list-style-type: none">◆ The primary chromatographic purity is calculated as the average of two independently performed analyses utilizing two different methods. Acceptance criteria requires the purity values to be within 0.5% of each other.◆ The primary purity method was selected to optimize resolution of impurities while minimizing degradation of the analyte. Secondary purity methods with orthogonal detector capabilities from the primary purity method are used as controls to confirm an accurate purity value.◆ The primary chromatographic purity value is used to calculate the Mass Balance Purity Factor.◆ A secondary chromatographic purity method is utilized as a control.◆ Mass Balance Purity Factor = [(100 - wt% residual solvent - wt% residual water - wt% residual inorganics) x Chromatographic Purity/100].◆ Mass Balance Purity Factor does not include adjustment for chiral and/or isotopic purity.					

Spectral and Physical Data

HPLC/UV



Column: Ascentis Express C18, 2.7 µm, 3.0 x 50 mm

Mobile Phase: A: Acetonitrile
B: 0.1% Phosphoric acid in Water

Gradient:

Time (min)	% A	% B
0.0	40	60
0.2	40	60
3.5	95	5
8.0	95	5
8.1	40	60

Flow Rate: 1.0 mL/min

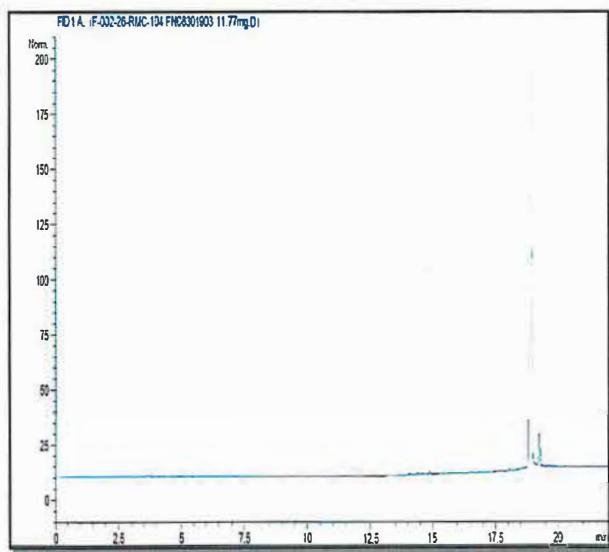
Wavelength: 225 nm

Sample Name: FN08301903
Acquired: November 19, 2019

Peak #	Ret Time	Area %
1	0.84	0.01
2	1.82	0.01
3	2.15	0.18
4	2.22	0.08
5	2.31	0.01
6	2.44	0.04
7	2.75	0.01
8	2.92	0.01
9	2.98	0.08
10	3.08	0.04
11	3.20	99.21
12	3.29	0.04
13	3.36	0.02
14	3.42	0.01
15	3.64	0.17
16	3.72	0.01
17	4.53	0.05
18	5.12	0.02

Spectral and Physical Data (cont.)

Residual Solvent Analysis by GC/FID Headspace



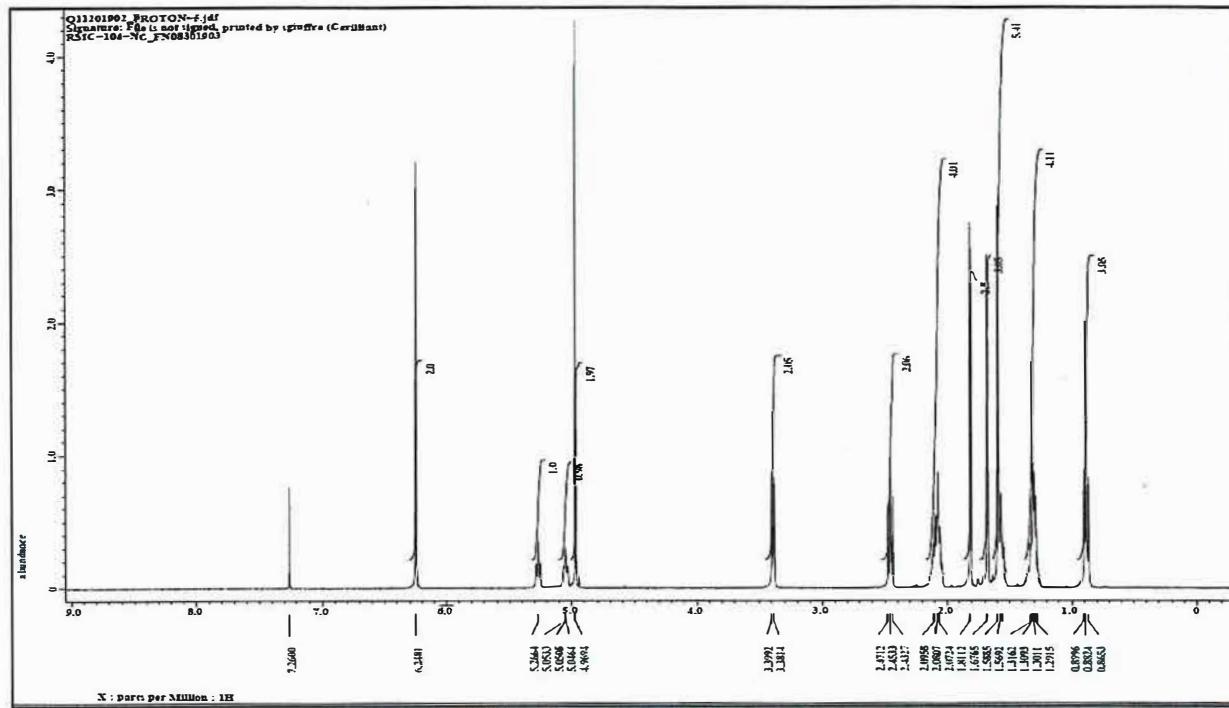
Column: DB-ALC1 30 m x 0.53 mm,
3 μ m film thickness
Temp Program: 40°C hold 12 min to
220°C at 40°C/min
hold 5.5 min
Carrier Gas: Helium
Flow Rate: 2.0 mL/min
Detector Heater Temp: 250°C
Injector: Headspace Sampler
HS Oven Temp: 60°C
Vial Equilibration: 10 minutes
Sample Name: FN08301903
Acquired: December 05, 2019

Peak	Compound	Area	Weight %
1	NMP	NA	NA
Total		ND	ND

ND- None Detected

^1H NMR

Instrument: JEOL ECS 400
Solvent: Chloroform-D



Spectral and Physical Data (cont.)

LC/MS

Column: Ascentis Express C18, 2.7 μ m,
3.0 x 50 mm

Mobile Phase: A: 0.1% Formic acid in Water
B: Acetonitrile

Gradient:	Time (min)	% A	% B
	0.0	40	60
	0.5	40	60
	4.0	95	5
	5.8	95	5
	6.0	40	60
	8.0	40	60

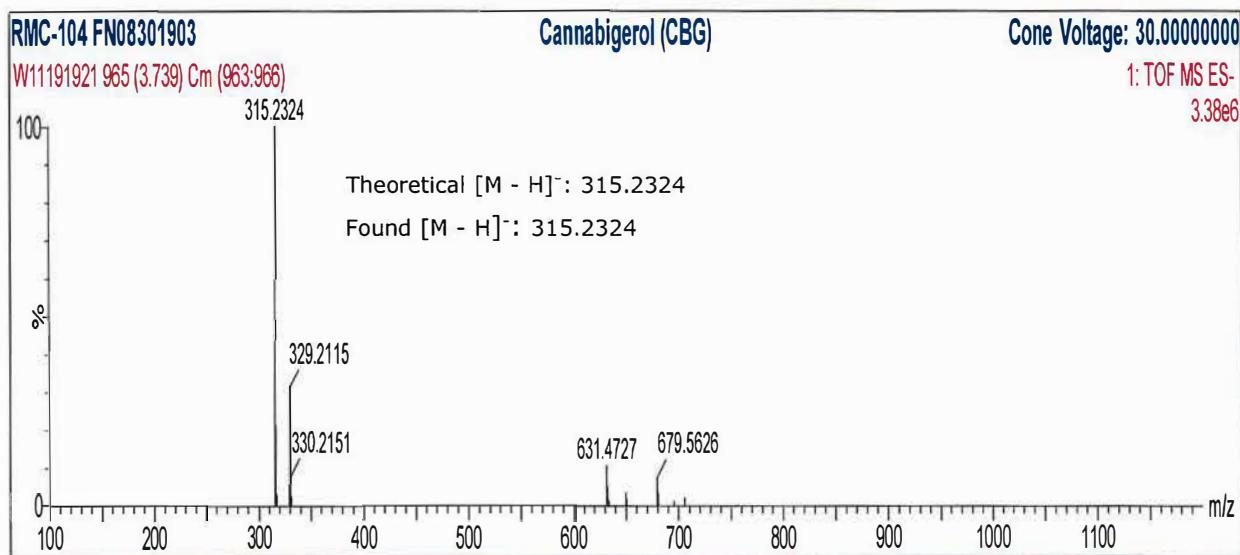
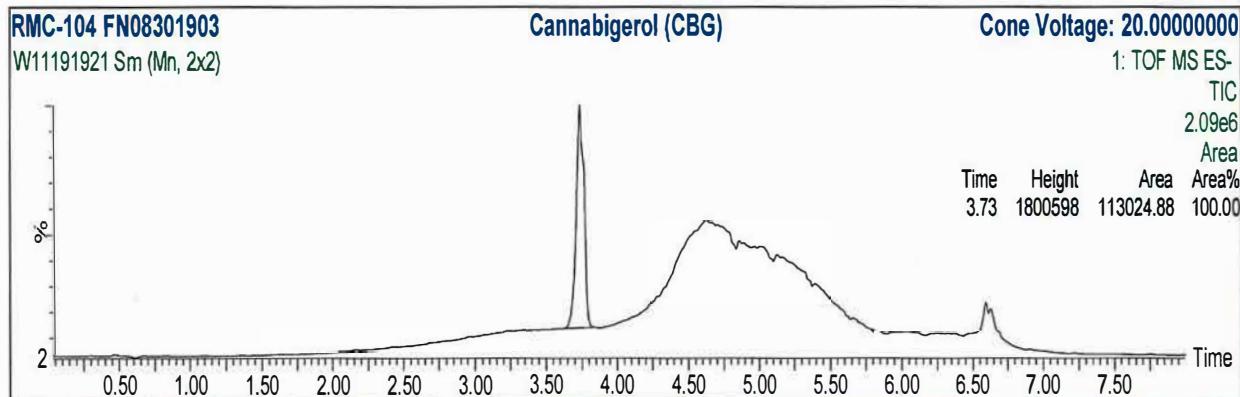
Flow Rate: 0.4 mL/min

Scan Range: 100-1200 amu

Ionization: Electrospray, Negative Ion

Instrument: Waters XEVO G2 QTOF

Acquired: November 19, 2019



Stability

Short term stability studies have been performed in multiple storage conditions for a period of up to four weeks. Short term data is utilized 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 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	3.09% decrease in purity was noted after four weeks.

Transport/Shipping: Ship cold.

Long Term Stability: Long term stability has been assessed for Freezer storage (-10 °C to -25 °C) conditions. Stability of a minimum of 47 months has been established through real-time stability studies.

Commutability

This standard is a solution of a pure substance in an organic solvent and is a Primary Standard. This Primary Standard is suitable for use in the preparation of calibrators and/or controls in any biological matrix. This standard is not in a biological matrix and therefore commutability to methods or standards in biological matrices does not apply.

COA Revision History

Revision No.	Date	Reason for Revision
00	April 02, 2020	Initial version.

The vibrant M, Supelco, TraceCERT and Sigma-Aldrich are trademarks of Merck KGaA, Darmstadt, Germany or its affiliates. All other trademarks are the property of their respective owners. Detailed information on trademarks is available via publicly accessible resources. © 2018 Merck KGaA, Darmstadt, Germany and/or its affiliates. All Rights Reserved.

The life science business of Merck KGaA, Darmstadt, Germany operates as MilliporeSigma in the US and Canada.

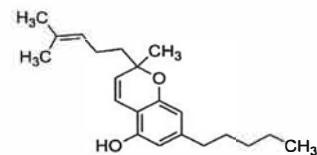


Certified Reference Material - Certificate of Analysis

Cannabichromene (CBC), Primary Measurement Standard

2-Methyl-2-(4-methyl-3-penten-1-yl)-7-pentyl-2H-1-benzopyran-5-ol

Product No.:	C-143-1ML
Lot No.:	FE06152005
Description of CRM:	Cannabichromene (CBC) in Methanol (Solution)
Expiration Date:	August 2025 See Section "Stability Assessment".
Storage:	Store unopened in freezer (-10 °C to -25 °C).
Shipping:	Ship cold. See Section "Stability Assessment".
Chemical formula:	$C_{21}H_{30}O_2$
CAS No.:	20675-51-8
Regulatory:	USDEA Exempt Canadian TK # 61-1102



Analyte	Certified Concentration ± associated uncertainty U , $u=k * u$ ($k=2$)
Cannabichromene (CBC)	1.000 ± 0.006 mg/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 certified value is calculated from high precision weighing of thoroughly characterized starting material. See "Details about certification process" on page 2.
Intended use:	This Certified Reference Material is suitable for the in vitro identification, calibration, and quantification of the analyte(s) in analytical and R&D applications. 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.
Accreditation:	Cerilliant Corp. is accredited by the US accreditation authority ANAB as registered reference material producer AR-1353 in accordance with ISO 17034 and registered testing laboratory AT-1352 according to ISO/IEC 17025.



Darron Ellsworth, Quality Assurance Manager

September 21, 2020

Issue Date

Cerilliant Corporation, 811 Paloma Drive, Suite A, Round Rock, TX, 78665, USA,
Tel: 800-848-7837 / 512-238-9974; www.cerilliant.com

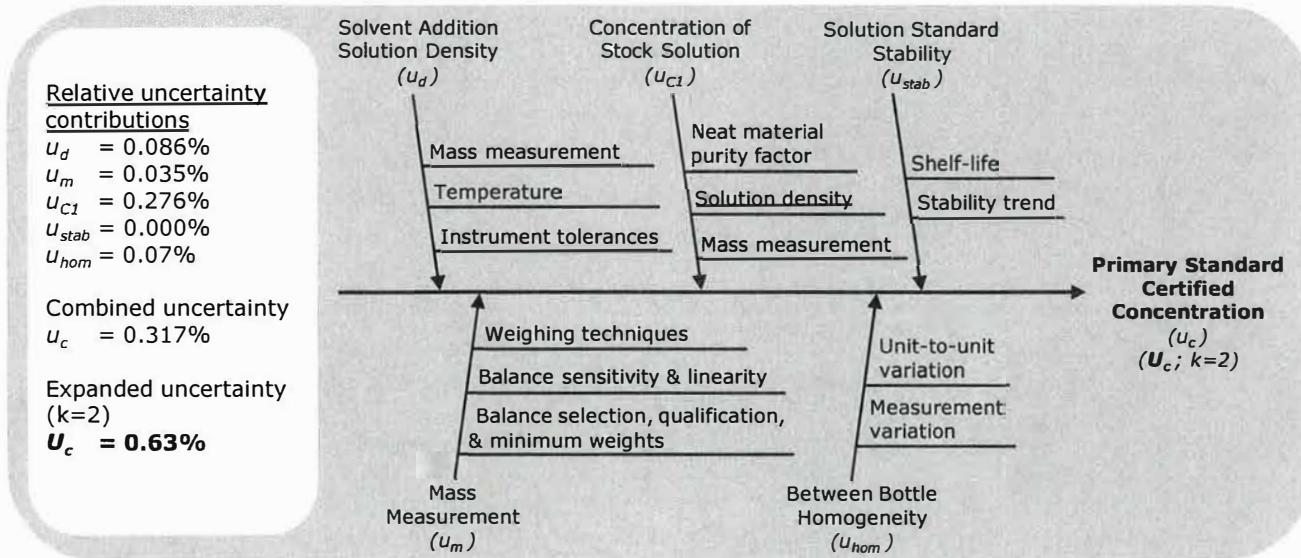
Sigma-Aldrich Production GmbH is a subsidiary of Merck KGaA, Darmstadt, Germany.



Packaging:	2 mL amber USP Type I glass ampoule containing not less than 1 mL of certified 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 Mass Balance 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 was manufactured in the USA.

Associated uncertainty:

The uncertainty has been calculated by statistical analysis of all aspects of our production system and incorporated uncertainty of the mass balance purity factor, material density, balance, weighing technique, and homogeneity. Uncertainty components of the gravimetrically prepared Primary Standard concentration are shown in the figure below. Uncertainty is expressed as an expanded uncertainty in accordance with ISO 17034 at the approximate 95% confidence interval using a coverage factor of $k=2$. Uncertainty contribution from neat material homogeneity was established to be negligible through establishment of process controls and verification of the control process. Stability uncertainty was determined to be negligible by regression analysis.



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 Mass Balance Purity Factor of each raw material is traceable to the SI and higher order reference materials through mass measurement and instrument qualification and calibrations.

Details about certification process:

This standard has been prepared and certified under the ISO 17034, ISO/IEC 17025, and ISO 9001 standards. This standard meets the requirements of a Certified Reference Material and a Primary Standard as defined by ISO and is traceable to the SI and higher order standards through an unbroken chain of comparisons.

- Nominal concentration is calculated based on: the actual mass; Mass balance purity factor of the analyte(s); measured mass of the solution; and the density of the pure diluent at 20°C.
- Fill volume is gravimetrically verified throughout the dispensing process using qualified and calibrated balances.
- Concentration is verified against an independently prepared calibration solution gravimetrically prepared.
- Additional certification information available upon request.

Solution Standard Verification

Concentration accuracy and within- and between-bottle homogeneity are analytically verified against an independently prepared calibration solution and to the prior lot.

Standard Solution Assay Parameters		Calibration Curve	
Analysis Method:	HPLC/UV	Calibration Curve:	Linear Regression
Column:	Ascentis Express C18, 2.7 µm, 3.0 x 50 mm	Number of Points:	4
Mobile Phase:	Acetonitrile:0.1% Phosphoric acid in Water (80:20)	Linearity (r) :	1.000
Flow Rate:	1.5 mL/min		
Wavelength:	225 nm		
		Verified Concentration (mg/mL)	%RSD - Homogeneity
Standard Solution	Lot Number	Actual Results	Actual Results
New Lot	FE06152005	0.995	0.6
Previous Lot	FE10281904	1.006	0.2
<ul style="list-style-type: none">Concentration is verified through multiple analyses and is calculated as the average of multiple analyses compared to an independently prepared calibration solution.Within-sample and between-sample homogeneity of the New Lot is ensured through rigorous production process controls statistically analyzed to evaluate risk and verified by analysis. Multiple samples pulled from across the lot using a random stratified sampling plan were analyzed to verify homogeneity. % RSD results shown above for the New Lot demonstrate ampoule-to-ampoule homogeneity.			

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 is utilized to calculate the weighing adjustment necessary to ensure accuracy of the solution standard concentration.

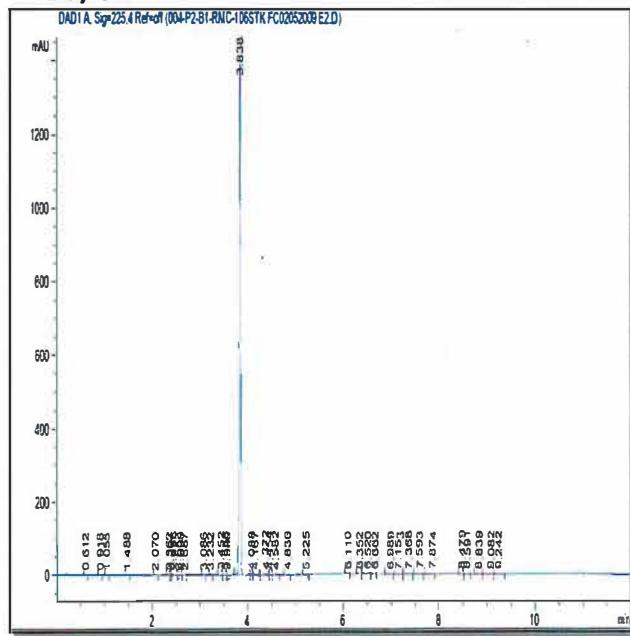
Material Name:	Cannabichromene (CBC)	Chemical Formula:	C ₂₁ H ₃₀ O ₂
Material Lot:	FC02052009	CAS Number:	20675-51-8
Material Characterization Summary			
Analytical Test		Method	Results
Primary Chromatographic Purity by HPLC/UV Analysis		20384348	98.8% ¹
Secondary Chromatographic Purity by LC/MS Analysis		20384217	99.4%
Identity by LC/MS Analysis		20384217	Consistent with Structure
Identity by ¹ H-NMR Analysis		20384224	Consistent with Structure
Residual Solvent Analysis by GC/FID Headspace		20397799 ²	0.05%
Residual Water Analysis by Karl Fischer Coulometry		20398075 ²	Below Quantitation Limit
Mass Balance Purity Factor			98.74%

¹ 0.02% Δ⁹-THC detected by HPLC/UV analysis.
² Validated analytical method

- The primary chromatographic purity is calculated as the average of two independently performed analyses utilizing two different methods. Acceptance criteria requires the purity values to be within 0.5% of each other.
- The primary purity method was selected to optimize resolution of impurities while minimizing degradation of the analyte. Secondary purity methods with orthogonal detector capabilities from the primary purity method are used as controls to confirm an accurate purity value.
- The primary chromatographic purity value is used to calculate the Mass Balance Purity Factor.
- A secondary chromatographic purity method is utilized as a control.
- Mass Balance Purity Factor = [(100 - wt% residual solvent - wt% residual water - wt% residual inorganics) x Chromatographic Purity/100].
- Mass Balance Purity Factor does not include adjustment for chiral and/or isotopic purity.

Spectral and Physical Data

HPLC/UV

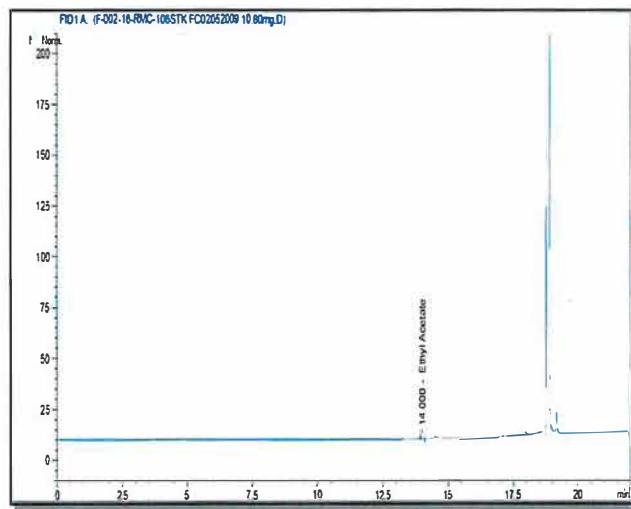


Column:	Ascentis Express C18, 2.7 µm, 3.0 x 50 mm		
Mobile Phase:	A: Acetonitrile B: 0.1% Phosphoric acid in Water		
Gradient:	<u>Time (min)</u> % A % B		
	0.0	50	50
	2.5	80	20
	8.0	95	5
	10.0	95	5
	10.1	50	50
Flow Rate:	1.0 mL/min		
Wavelength:	225 nm		
Sample Name:	FC02052009		
Acquired:	May 21, 2020		

Peak #	Ret Time	Area %		Peak #	Ret Time	Area %
1	0.61	0.00		20	4.37	0.35
2	0.92	0.00		21	4.45	0.01
3	1.06	0.02		22	4.58	0.11
4	1.49	0.01		23	4.84	0.01
5	2.07	0.01		24	5.23	0.01
6	2.36	0.01		25	6.11	0.01
7	2.40	0.02		26	6.35	0.01
8	2.46	0.07		27	6.52	0.02
9	2.55	0.00		28	6.66	0.01
10	2.61	0.00		29	6.99	0.01
11	2.69	0.01		30	7.15	0.10
12	3.09	0.00		31	7.37	0.15
13	3.23	0.01		32	7.59	0.01
14	3.45	0.03		33	7.87	0.01
15	3.54	0.02	$\Delta^9\text{-THC}$	34	8.48	0.02
16	3.58	0.00		35	8.59	0.01
17	3.84	98.74		36	8.84	0.02
18	4.09	0.01		37	9.08	0.03
19	4.17	0.08		38	9.24	0.05

Spectral and Physical Data (cont.)

Residual Solvent Analysis by GC/FID Headspace

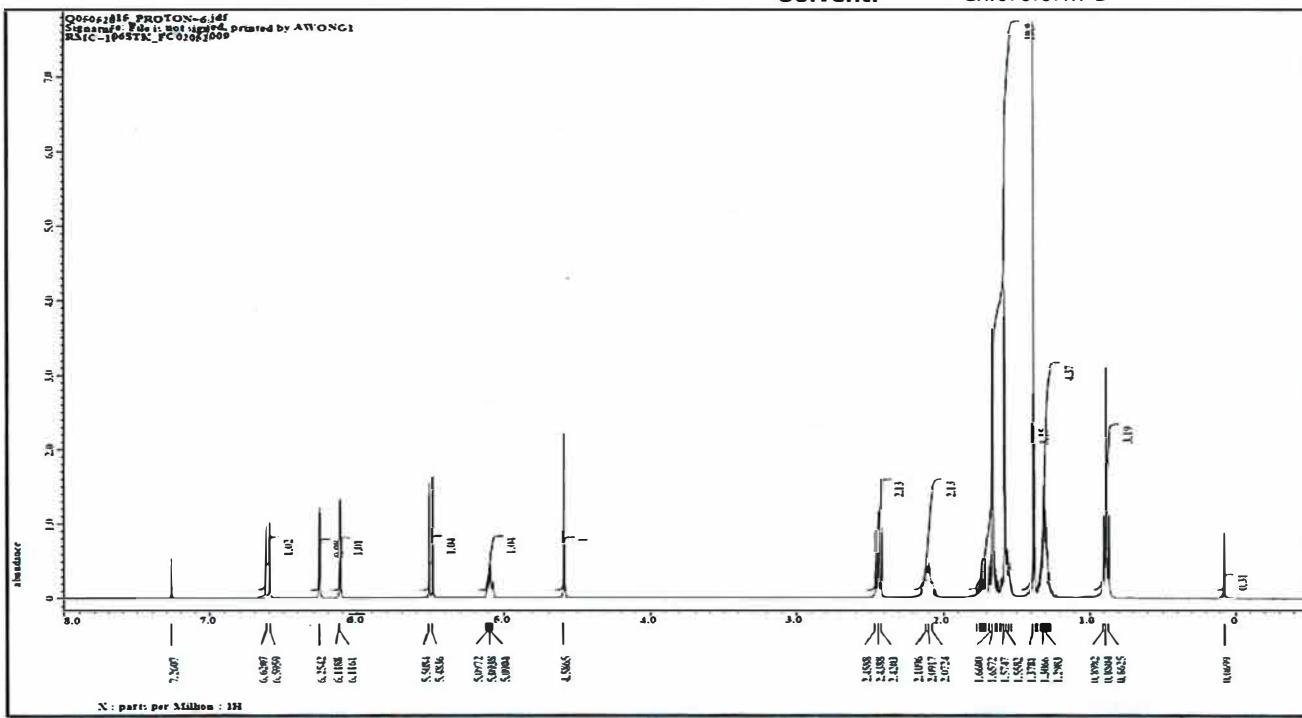


Column: DB-ALC1 30 m x 0.53 mm,
3 μ m film thickness
Temp Program: 40°C hold 12 min to 220°C at 40°C/min hold 5.5 min
Carrier Gas: Helium
Flow Rate: 2.0 mL/min
Detector Heater Temp: 250°C
Injector: Headspace Sampler
HS Oven Temp: 60°C
Vial Equilibration: 10 minutes
Sample Name: FC02052009
Acquired: May 13, 2020

Peak	Compound	Area	Weight %
1	Ethyl acetate	16.18	0.05
2	NMP	NA	NA
Total			0.05

^1H NMR

Instrument: JEOL ECS 400
Solvent: Chloroform-D



Spectral and Physical Data (cont.)

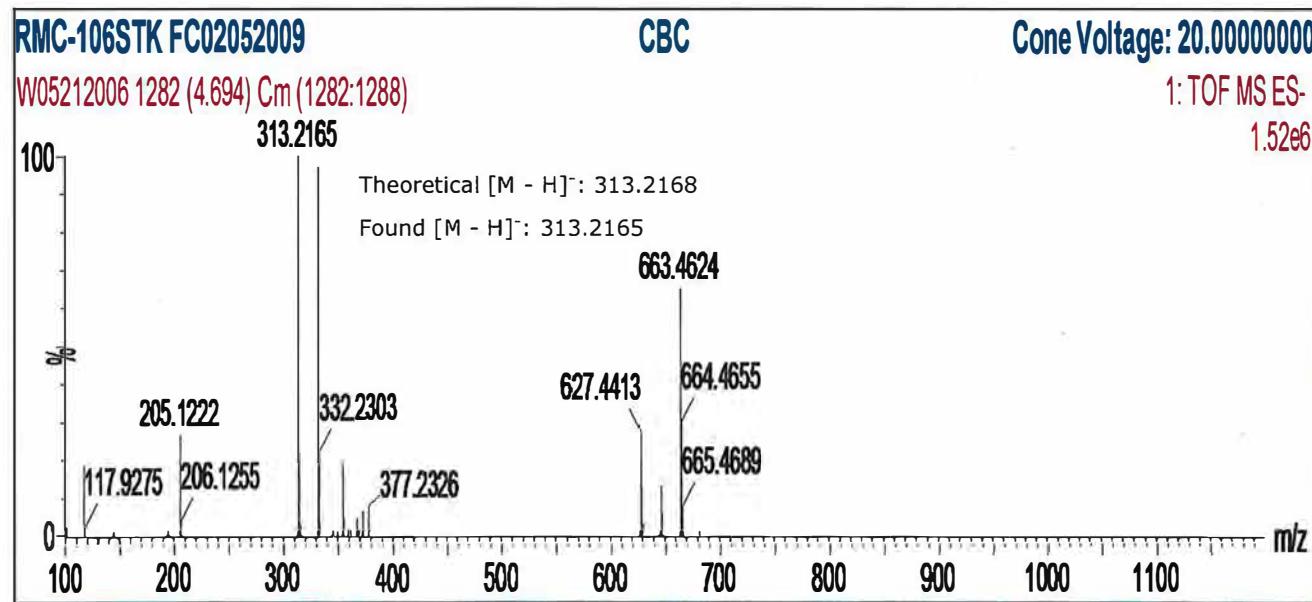
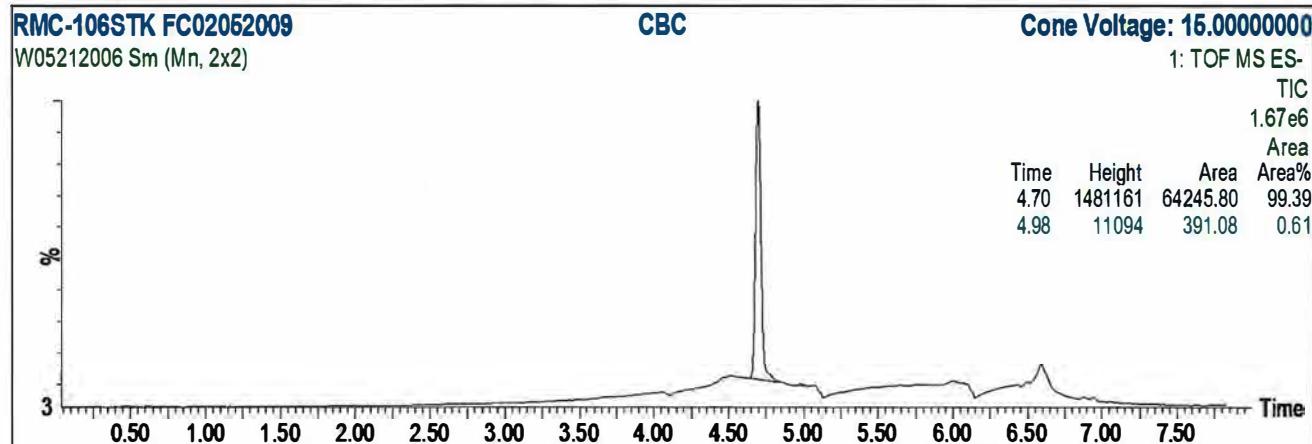
LC/MS

Column: Ascentis Express C18, 2.7 μ m,
3.0 x 50 mm

Mobile Phase: A: 0.1% Formic acid in Water
B: Acetonitrile

Gradient:	Time (min)	% A	% B
	0.0	60	40
	0.5	60	40
	4.0	5	95
	5.8	5	95
	6.0	60	40
	8.0	60	40

Flow Rate: 0.4 mL/min
Scan Range: 100-1200 amu
Ionization: Electrospray, Negative Ion
Instrument: Waters XEVO G2 QTOF
Acquired: May 21, 2020



Stability

Short term stability studies have been performed in multiple storage conditions for a period of up to four weeks. Short term data is utilized 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 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: Ship cold.

Long Term Stability: Long term stability has been assessed for Freezer storage (-10 °C to -25 °C) conditions. Stability of a minimum of 60 months has been established through real-time stability studies.

Commutability

This standard is a solution of a pure substance in an organic solvent and is a Primary Standard.

This Primary Standard is suitable for use in the preparation of calibrators and/or controls in any biological matrix. This standard is not in a biological matrix and therefore commutability to methods or standards in biological matrices does not apply.

COA Revision History

Revision No.	Date	Reason for Revision
00	September 21, 2020	Initial version.

The vibrant M, Supelco, TraceCERT and Sigma-Aldrich are trademarks of Merck KGaA, Darmstadt, Germany or its affiliates. All other trademarks are the property of their respective owners. Detailed information on trademarks is available via publicly accessible resources. © 2018 Merck KGaA, Darmstadt, Germany and/or its affiliates. All Rights Reserved.

The life science business of Merck KGaA, Darmstadt, Germany operates as MilliporeSigma in the US and Canada.

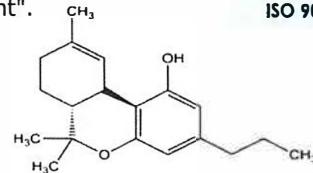


Certified Reference Material - Certificate of Analysis

Tetrahydrocannabivarin (THCV), Primary Measurement Standard

Δ^9 -Tetrahydrocannabivarin (THCV)

		Cerilliant Quality
Product No.:	T-094-1ML	ISO 17034
Lot No.:	FE10111901	ISO/IEC 17025
Description of CRM:	Tetrahydrocannabivarin (THCV) in Methanol (Solution)	ISO 13485
Expiration Date:	December 2022	See Section "Stability Assessment".
Storage:	Store unopened and upright in sub-freezer (-60 °C to -80 °C).	ISO 14001
Shipping:	Ship cold.	See Section "Stability Assessment".
Chemical formula:	$C_{19}H_{26}O_2$	ISO 9001
CAS No.:	31262-37-0	
Regulatory:	USDEA Exempt Canadian TK # 61-1571	



Analyte	Certified Concentration ± associated uncertainty U, $u=k*u$ ($k=2$)
Tetrahydrocannabivarin (THCV)	1.000 ± 0.006 mg/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 certified value is calculated from high precision weighing of thoroughly characterized starting material. See "Details about certification process" on page 2.

Intended use: This Certified Reference Material is suitable for the in vitro identification, calibration, and quantification of the analyte(s) in analytical and R&D applications. 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.

Accreditation: Cerilliant Corp. is accredited by the US accreditation authority ANAB as registered reference material producer AR-1353 in accordance with ISO 17034 and registered testing laboratory AT-1352 according to ISO/IEC 17025.




Darron Ellsworth, Quality Assurance Manager

January 22, 2020

Issue Date

Packaging:

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

Details on starting materials:

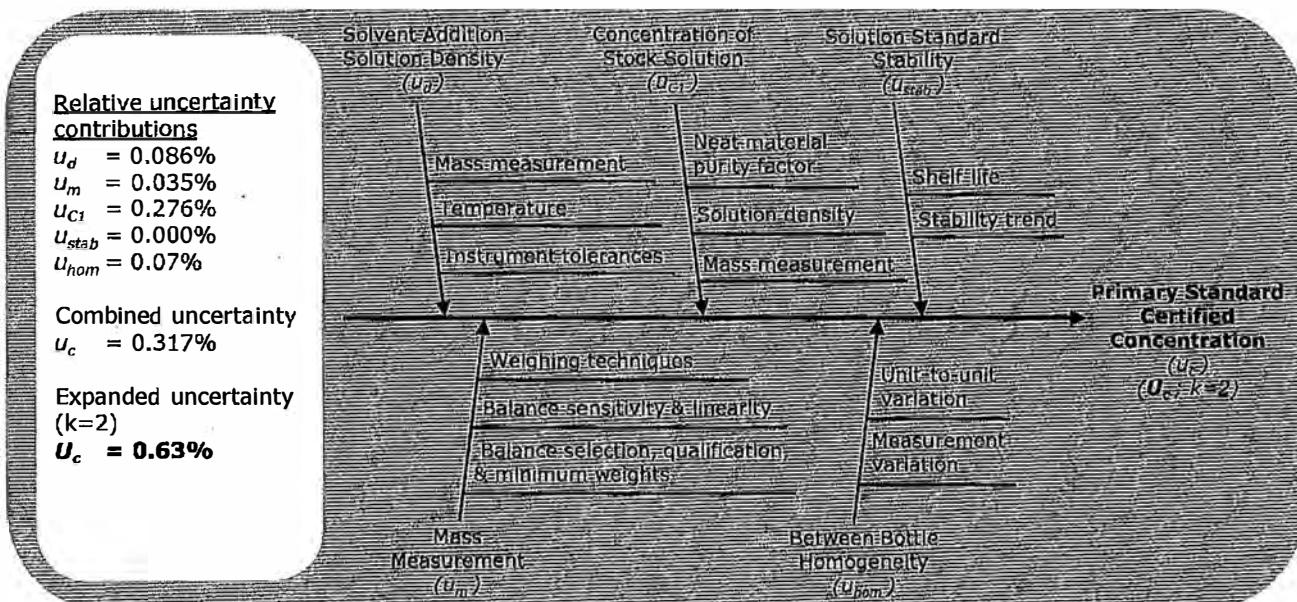
Each raw material utilized has been identified and thoroughly characterized through the use of multiple analytical techniques and is assigned a Mass Balance Purity Factor. Spectral data is provided on subsequent pages of this CoA.

Certificate of Origin:

Cerilliant Corporation certifies no material of animal origin (BSE/TSE) was used in the preparation of this product. This material was manufactured in the USA.

Associated uncertainty:

The uncertainty has been calculated by statistical analysis of all aspects of our production system and incorporated uncertainty of the mass balance purity factor, material density, balance, weighing technique, and homogeneity. Uncertainty components of the gravimetrically prepared Primary Standard concentration are shown in the figure below. Uncertainty is expressed as an expanded uncertainty in accordance with ISO 17034 at the approximate 95% confidence interval using a coverage factor of $k=2$. Uncertainty contribution from neat material homogeneity was established to be negligible through establishment of process controls and verification of the control process. Stability uncertainty was determined to be negligible by regression analysis.



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 Mass Balance Purity Factor of each raw material is traceable to the SI and higher order reference materials through mass measurement and instrument qualification and calibrations.

Details about certification process:

This standard has been prepared and certified under the ISO 17034, ISO/IEC 17025, ISO 9001 and ISO 13485 standards. This standard meets the requirements of a Certified Reference Material and a Primary Standard as defined by ISO and is traceable to the SI and higher order standards through an unbroken chain of comparisons.

- ◆ Nominal concentration is calculated based on: the actual mass; Mass balance purity factor of the analyte(s); measured mass of the solution; and the density of the pure diluent at 20°C.
- ◆ Fill volume is gravimetrically verified throughout the dispensing process using qualified and calibrated balances.
- ◆ Concentration is verified against an independently prepared calibration solution gravimetrically prepared.
- ◆ Additional certification information available upon request.

Solution Standard Verification

Concentration accuracy and within- and between-bottle homogeneity are analytically verified against an independently prepared calibration solution and to the prior lot.

Solution standard verification demonstrates confirmation that the specified requirements for the Primary Measurement Standard have been fulfilled and validated under ISO 13485.

Standard Solution Assay Parameters		Calibration Curve	
Analysis Method:	HPLC/UV	Calibration Curve:	Linear Regression
Column:	Ascentis Express C18, 2.7 µm, 3.0 x 50 mm	Number of Points:	4
Mobile Phase:	Acetonitrile:0.1% Phosphoric acid in Water (65:35)	Linearity (r) :	1.000
Flow Rate:	1.0 mL/min		
Wavelength:	228 nm		
		Verified Concentration (mg/mL)	%RSD - Homogeneity
Standard Solution	Lot Number	Actual Results	Actual Results
New Lot	FE10111901	1.009	0.3
Previous Lot	FE09271902	1.015	0.2
<ul style="list-style-type: none"> • Concentration is verified through multiple analyses and is calculated as the average of multiple analyses compared to an independently prepared calibration solution. • Within-sample and between-sample homogeneity of the New Lot is ensured through rigorous production process controls statistically analyzed to evaluate risk and verified by analysis. Multiple samples pulled from across the lot using a random stratified sampling plan were analyzed to verify homogeneity. % RSD results shown above for the New Lot demonstrate ampoule-to-ampoule homogeneity. 			

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 is utilized to calculate the weighing adjustment necessary to ensure accuracy of the solution standard concentration.

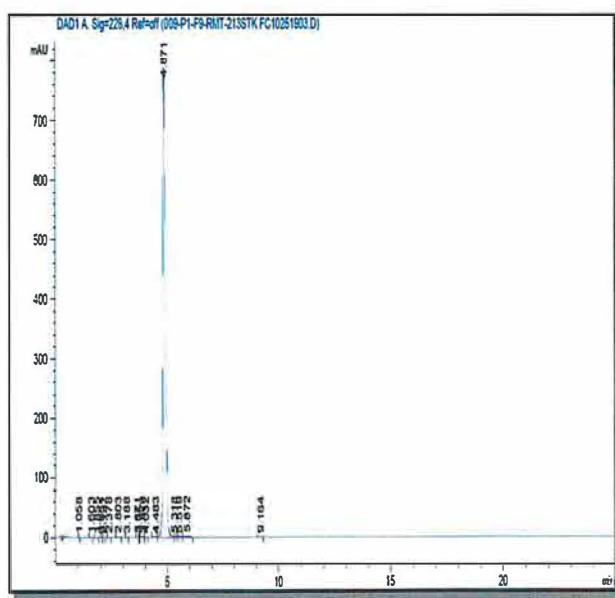
Material Name:	Tetrahydrocannabivarin (THCV)	Chemical Formula:	C ₁₉ H ₂₆ O ₂
Material Lot:	FC10251903	CAS Number:	31262-37-0
Molecular Weight: 286.41			
Material Characterization Summary			
Analytical Test	Method	Results	
Primary Chromatographic Purity by HPLC/UV Analysis	20384348	99.5%	
Secondary Chromatographic Purity by GC/FID Analysis	20384346	99.4%	
Identity by LC/MS Analysis	20384217	Consistent with Structure	
Identity by ¹ H-NMR Analysis	20384224	Consistent with Structure	
Residual Solvent Analysis by GC/FID Headspace	20397799 ¹	1.13%	
Inorganic Content by Microash Analysis	20398075 ¹	Below Quantitation Limit	
Mass Balance Purity Factor		98.39%	

¹ Validated analytical method

- The primary chromatographic purity is calculated as the average of two independently performed analyses utilizing two different methods. Acceptance criteria requires the purity values to be within 0.5% of each other.
- The primary purity method was selected to optimize resolution of impurities while minimizing degradation of the analyte. Secondary purity methods with orthogonal detector capabilities from the primary purity method are used as controls to confirm an accurate purity value.
- The primary chromatographic purity value is used to calculate the Mass Balance Purity Factor.
- A secondary chromatographic purity method is utilized as a control.
- Mass Balance Purity Factor = [(100 - wt% residual solvent - wt% residual water - wt% residual Inorganics) x Chromatographic Purity/100].
- Mass Balance Purity Factor does not include adjustment for chiral and/or isotopic purity.

Spectral and Physical Data

HPLC/UV



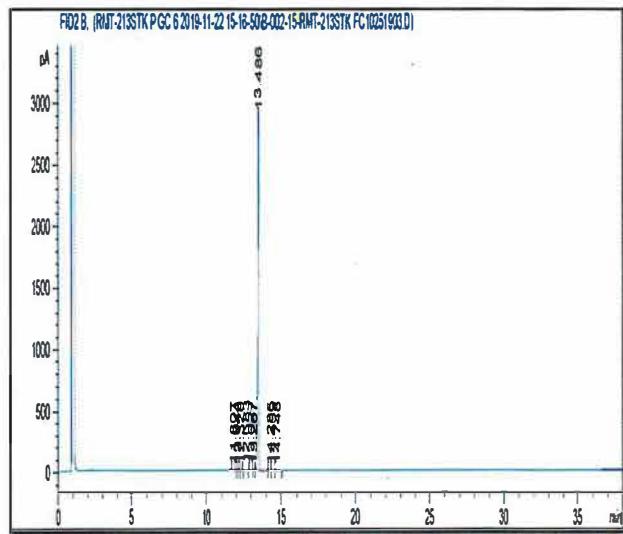
Column: Ascentis Express C18, 2.7 μ m, 3.0 x 100 mm
Mobile Phase: Methanol:Water:Tetrahydrofuran (62:33:5)
Flow Rate: 1.5 mL/min
Wavelength: 228 nm

Sample Name: FC10251903
Acquired: November 25, 2019

Peak #	Ret Time	Area %
1	1.06	0.01
2	1.60	0.02
3	1.86	0.01
4	2.05	0.00
5	2.13	0.01
6	2.38	0.01
7	2.80	0.04
8	3.19	0.01
9	3.67	0.01
10	3.75	0.00
11	3.88	0.06
12	4.03	0.02
13	4.48	0.08
14	4.87	99.38
15	5.32	0.06
16	5.52	0.06
17	5.87	0.23
18	9.16	0.01

Spectral and Physical Data (cont.)

GC/FID



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

Temp Program: 40°C to 200°C at 40°C/min
200°C to 280°C at 5°C/min
hold 18 min

Injector Temp: Cool-on-Column

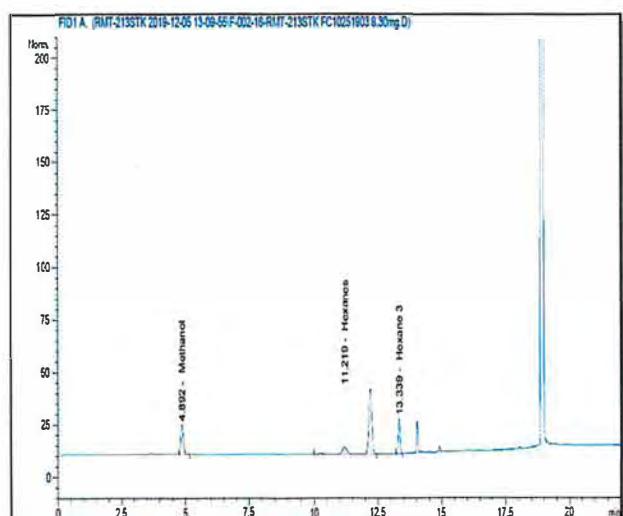
Detector Temp: 325°C

Sample Name: FC10251903

Acquired: November 22, 2019

Peak #	Ret Time	Area %
1	11.81	0.01
2	12.04	0.01
3	12.14	0.00
4	12.32	0.01
5	12.68	0.23
6	13.03	0.26
7	13.21	0.01
8	13.49	99.38
9	14.29	0.03
10	14.46	0.04
11	14.75	0.02

Residual Solvent Analysis by GC/FID Headspace



Column: DB-ALC1 30 m x 0.53 mm,
3 μ m 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: FC10251903

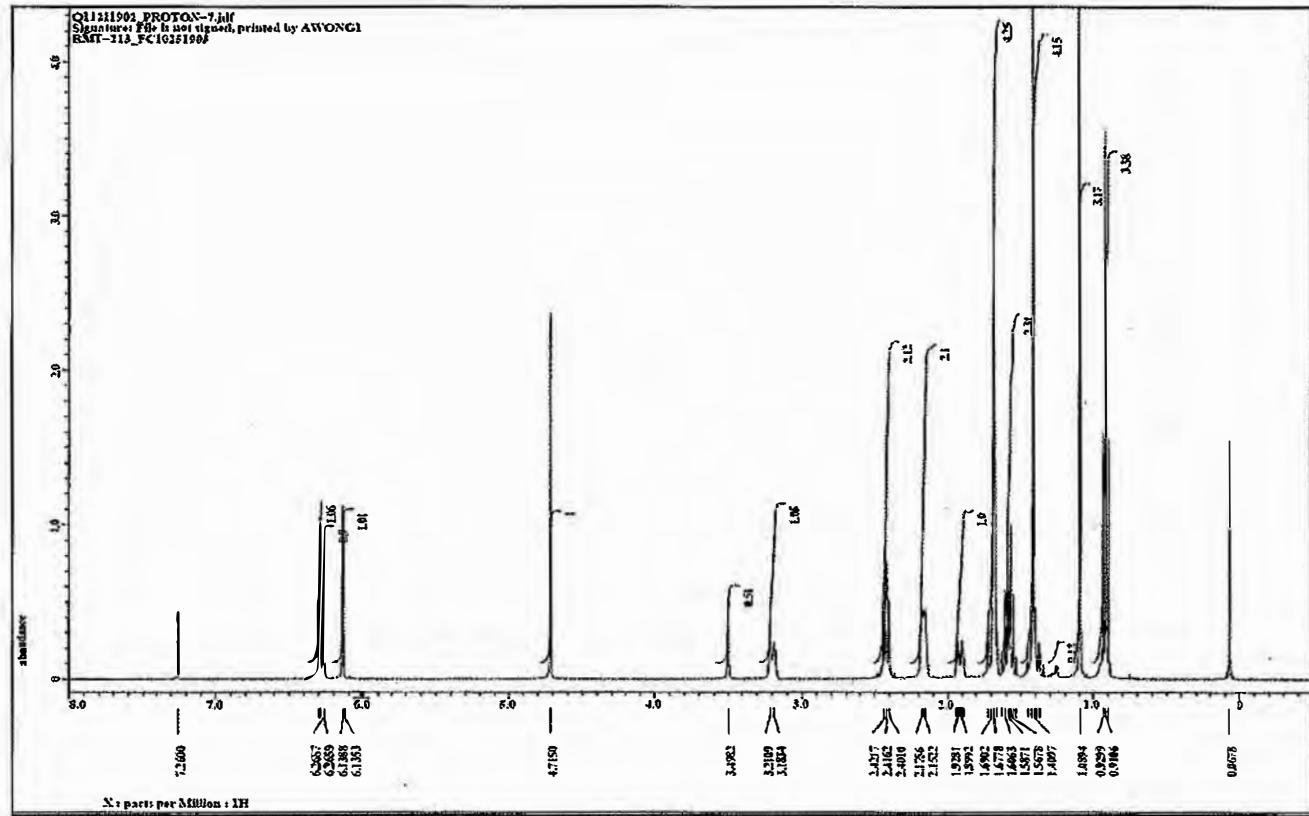
Acquired: December 05, 2019

Peak	Compound	Area	Weight %
1	Methanol	94.46	1.03
2	Hexanes	318.39	0.10
3	NMP	NA	NA
Total			1.13

Spectral and Physical Data (cont.)

¹H NMR

Instrument: JEOL ECS 400
Solvent: Chloroform-D



Spectral and Physical Data (cont.)

LC/MS

Column: Ascentis Express C18, 2.7 µm,

3.0 x 50 mm

Mobile Phase: A: 0.1% Formic acid in Water

B: Acetonitrile

Gradient:	Time (min)	% A	% B
	0.0	60	40
	0.5	60	40
	4.0	5	95
	5.8	5	95
	6.0	60	40
	8.0	60	40

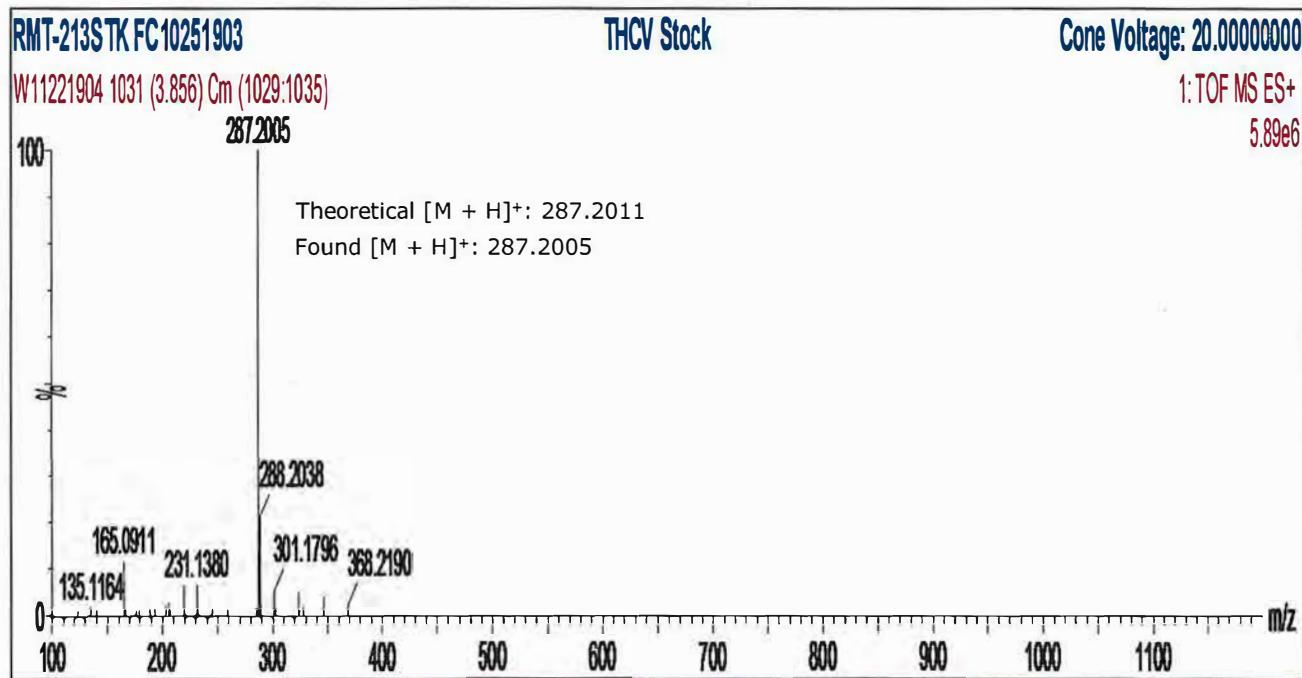
Flow Rate: 0.4 mL/min

Scan Range: 100-1200 amu

Ionization: Electrospray, Positive Ion

Instrument: Waters XEVO G2 QTOF

Acquired: November 22, 2019



Stability

Short term stability studies have been performed in multiple storage conditions for a period of up to four weeks. Short term data is utilized 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 stability findings for this product is listed below.

Storage Condition	Mean Kinetic Temperature (MKT)	Time Period/Result
Sub-Freezer	-70°C	No decrease in purity was noted after four weeks.
Freezer	-15°C	
Refrigerator	4°C	
Room Temperature	21°C	
40°C	40°C	

Transport/Shipping: Ship cold.

Short Term Storage: Stability data supports short term storage for no more than 12 months at Freezer conditions.

Long Term Stability: Long term stability has been assessed for Sub-freezer storage (-60 °C to -80 °C) conditions. Stability of a minimum of 36 months has been established through real-time stability studies.

Commutability

This standard is a solution of a pure substance in an organic solvent and is a Primary Standard. This Primary Standard is suitable for use in the preparation of calibrators and/or controls in any biological matrix. This standard is not in a biological matrix and therefore commutability to methods or standards in biological matrices does not apply.

COA Revision History

Revision No.	Date	Reason for Revision
00	January 22, 2020	Initial version.

Intra-Day Precision

Day 1	Cannabinoids Concentration in Sample (mg/g)								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
F1-1	0.477	0.450	<RL	2.424	4.107	60.286	3.800	104.698	0.976
F1-2	0.459	0.456	<RL	2.338	3.834	57.290	3.612	99.193	0.912
F1-3	0.453	0.436	<RL	2.342	3.844	57.096	3.642	97.100	0.911
AVE	0.463	0.447	<RL	2.368	3.929	58.224	3.684	100.331	0.933
RSD	2.75%	2.35%	NA	2.06%	3.94%	3.07%	2.74%	3.91%	3.98%

Inter-day reproducibility

	Cannabinoids Concentration in Sample (mg/g)								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
Day1	0.463	0.447	<RL	2.368	3.929	58.224	3.684	100.331	0.933
Day2	0.455	0.423	<RL	2.286	3.875	56.543	3.592	97.986	0.922
Day3	0.446	0.440	<RL	2.240	3.842	55.072	3.834	97.837	0.898
RSD	1.89%	2.81%	NA	2.82%	1.12%	2.79%	3.30%	1.42%	1.94%
AVG	0.455	0.437	NA	2.298	3.882	56.613	3.704	98.718	0.918

Note: The concentration of each cannabinoid is the average of samples analyzed in each day.

Robustness-alter injection volume

	Cannabinoids Concentration in Sample (mg/g)								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
Day1	0.463	0.447	<RL	2.368	3.929	58.224	3.684	100.331	0.933
Day4	0.463	0.450	<RL	2.344	4.004	56.939	3.616	101.752	0.928
RPD	0.0%	0.7%	NA	1.0%	1.9%	2.2%	1.9%	1.4%	0.5%

Note: The concentration of each cannabinoid is the average in all samples in day 1 or day 4.

	Cannabinoids Concentration in Sample (mg/g)								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
Day1-3	0.456	0.438	<RL	2.308	3.889	56.843	3.701	98.948	0.920
Day4	0.463	0.450	<RL	2.344	4.004	56.939	3.616	101.752	0.928
RPD	1.6%	2.7%	NA	1.5%	2.9%	0.2%	2.3%	2.8%	0.9%

Note: The concentration of each cannabinoid is the average in all samples in day 1 to 3 or day 4.

Robustness-alter matrix: hemp

Day 4	Cannabinoids Concentration in Sample (mg/g)								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
UPLC	65.887	<RL	54.775	1.685	0.267	3.150	0.161	0.923	3.576
CoA	67.160	NA	52.300	1.425	0.267	2.987	NA	1.078	3.193
PD	1.9%	NA	4.7%	18.2%	0.0%	5.5%	NA	14.4%	12.0%

Note: The concentration of each cannabinoid is the average in all hemp samples in day 4 and from CoA. PD: Percentage difference.

Compound	Sample Name							Stdev	LOD	LOQ	LOD in sample	LOQ in sample
	LOD-1	LOD-2	LOD-3	LOD-4	LOD-5	LOD-6	LOD-7					
CBDA	0.607	0.624	0.628	0.612	0.604	0.589	0.581	0.017	0.054	0.161	0.011	0.032
THCV	0.694	0.612	0.54	0.562	0.563	0.552	0.541	0.056	0.175	0.524	0.035	0.105
CBD	0.764	0.592	0.531	0.509	0.531	0.605	0.539	0.088	0.275	0.826	0.055	0.165
CBG	0.677	0.559	0.534	0.503	0.522	0.589	0.532	0.059	0.184	0.553	0.037	0.111
CBN	0.511	0.517	0.502	0.513	0.516	0.511	0.509	0.005	0.016	0.047	0.003	0.009
Δ9-THC	0.571	0.528	0.528	0.534	0.537	0.534	0.58	0.022	0.068	0.203	0.014	0.041
Δ8-THC	0.498	0.445	0.534	0.526	0.522	0.426	0.595	0.057	0.179	0.538	0.036	0.108
THCA	0.502	0.464	0.479	0.506	0.472	0.448	0.466	0.021	0.066	0.197	0.013	0.039
CBC	0.541	0.528	0.567	0.555	0.544	0.559	0.555	0.013	0.041	0.123	0.008	0.025

LOD = t x Stdev, t = 3.14 at 99% confidance level

Matrix Spike	Cannabinoids Concentration in Matrix Spike (mg/g)								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
Day 1	0.0025	0.0025	0.0024	0.0024	0.0025	0.0024	0.0024	0.0025	0.0024
Day 2	0.0026	0.0024	0.0024	0.0024	0.0024	0.0025	0.0025	0.0026	0.0026
Day 3	0.0025	0.0025	0.0023	0.0024	0.0023	0.0025	0.0024	0.0024	0.0025
Day 4	0.0026	0.0025	0.0024	0.0024	0.0024	0.0025	0.0025	0.0024	0.0026
RSD	1.68%	1.52%	1.15%	0.78%	2.29%	1.69%	2.12%	3.86%	2.73%

Measurement Uncertainty:

95% confidence level: 2 x RSD

	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
Measurement Uncertainty	3.4%	3.0%	2.3%	1.6%	4.6%	3.4%	4.2%	7.7%	5.5%

Retention time study

Day 1	CBDA	THCV	CBD	CBG	CBN	$\Delta 9\text{-THC}$	$\Delta 8\text{-THC}$	THCA	CBC
9Mix_0.5ppm_Std	2.159	2.714	2.512	2.374	3.651	4.569	4.717	6.15	5.674
9Mix_2ppm_Std	2.16	2.714	2.513	2.375	3.651	4.568	4.719	6.149	5.675
9Mix_5ppm_Std	2.16	2.716	2.515	2.377	3.654	4.57	4.721	6.143	5.677
9Mix_10ppm_Std	2.162	2.718	2.517	2.379	3.656	4.573	4.725	6.137	5.68
9Mix_20ppm_Std	2.157	2.713	2.512	2.374	3.649	4.565	4.716	6.111	5.667
9Mix_50ppm_Std	2.155	2.712	2.511	2.373	3.647	4.561	4.712	6.086	5.662
9Mix_100ppm_Std	2.155	2.714	2.512	2.375	3.65	4.565	4.717	6.08	5.669
ICV_10ppm	2.159	2.714	2.514	2.376	3.652	4.568	4.72	6.133	5.675
CCV1_50ppm	2.164	2.724	2.523	2.386	3.668	4.59	4.742	6.13	5.703
CCV2_50ppm	2.177	2.741	2.541	2.403	3.692	4.62	4.774	6.162	5.742
MS3	2.156	2.709	2.508	2.37	3.642	4.554	4.704	6.13	5.657
Average	2.158	2.714	2.513	2.375	3.651	4.567	4.718	6.122	5.672
Day 2	CBDA	THCV	CBD	CBG	CBN	$\Delta 9\text{-THC}$	$\Delta 8\text{-THC}$	THCA	CBC
9Mix_0.5ppm_Std	2.169	2.727	2.527	2.388	3.672	4.596	4.745	6.179	5.712
9Mix_2ppm_Std	2.171	2.729	2.529	2.391	3.675	4.596	4.75	6.177	5.712
9Mix_5ppm_Std	2.169	2.727	2.527	2.388	3.67	4.592	4.744	6.167	5.706
9Mix_10ppm_Std	2.167	2.725	2.525	2.387	3.669	4.59	4.742	6.153	5.702
9Mix_20ppm_Std	2.165	2.724	2.523	2.385	3.667	4.587	4.739	6.137	5.698
9Mix_50ppm_Std	2.163	2.724	2.523	2.385	3.666	4.584	4.737	6.116	5.695
9Mix_100ppm_Std	2.161	2.723	2.522	2.384	3.665	4.584	4.737	6.102	5.693
ICV_10ppm	2.163	2.72	2.519	2.382	3.662	4.581	4.733	6.143	5.692
CCV1_50ppm	2.164	2.725	2.524	2.386	3.668	4.59	4.742	6.125	5.703
CCV2_50ppm	2.165	2.727	2.525	2.387	3.67	4.592	4.744	6.127	5.705
MS_1x	2.16	2.716	2.515	2.377	3.656	4.575	4.727	6.149	5.684
Average	2.166	2.726	2.525	2.387	3.669	4.590	4.742	6.147	5.703
Day 3	CBDA	THCV	CBD	CBG	CBN	$\Delta 9\text{-THC}$	$\Delta 8\text{-THC}$	THCA	CBC
9Mix_0.5ppm_Std	2.161	2.719	2.517	2.38	3.66	4.582	4.735	6.162	5.696
9Mix_2ppm_Std	2.164	2.722	2.522	2.383	3.662	4.582	4.734	6.154	5.693
9Mix_5ppm_Std	2.164	2.722	2.521	2.384	3.666	4.587	4.739	6.153	5.7
9Mix_10ppm_Std	2.163	2.722	2.521	2.383	3.665	4.584	4.736	6.141	5.696
9Mix_20ppm_Std	2.164	2.724	2.523	2.385	3.668	4.589	4.741	6.137	5.703
9Mix_50ppm_Std	2.166	2.729	2.528	2.39	3.674	4.595	4.748	6.13	5.711
9Mix_100ppm_Std	2.162	2.725	2.524	2.387	3.669	4.59	4.743	6.11	5.703
ICV_10ppm	2.168	2.729	2.527	2.389	3.675	4.598	4.751	6.161	5.714
CCV1_50ppm	2.167	2.727	2.527	2.389	3.673	4.596	4.749	6.13	5.711
CCV2_50ppm	2.166	2.726	2.526	2.388	3.671	4.59	4.743	6.123	5.703
MS_1x	2.17	2.73	2.529	2.39	3.678	4.602	4.755	6.184	5.721
Average	2.163	2.723	2.522	2.385	3.666	4.587	4.739	6.141	5.700
Day 4	CBDA	THCV	CBD	CBG	CBN	$\Delta 9\text{-THC}$	$\Delta 8\text{-THC}$	THCA	CBC
9Mix_0.5ppm_Std	2.165	2.724	2.523	2.385	3.673	4.597	4.749	6.178	5.71
9Mix_2ppm_Std	2.169	2.729	2.527	2.389	3.677	4.602	4.756	6.18	5.721
9Mix_5ppm_Std	2.169	2.73	2.528	2.39	3.678	4.603	4.756	6.172	5.722
9Mix_10ppm_Std	2.166	2.727	2.525	2.386	3.673	4.598	4.751	6.158	5.717
9Mix_20ppm_Std	2.167	2.73	2.528	2.39	3.679	4.607	4.76	6.155	5.727
9Mix_50ppm_Std	2.169	2.732	2.531	2.393	3.682	4.607	4.761	6.142	5.729
9Mix_100ppm_Std	2.169	2.733	2.532	2.394	3.682	4.607	4.76	6.126	5.725
ICV_10ppm	2.168	2.73	2.528	2.389	3.68	4.606	4.76	6.17	5.73
CCV1_50ppm	2.172	2.737	2.535	2.397	3.689	4.617	4.772	6.154	5.741
CCV2_50ppm	2.172	2.735	2.534	2.396	3.686	4.613	4.767	6.148	5.735
MS_1x	2.171	2.73	2.529	2.391	3.68	4.606	4.76	6.188	5.73
Average	2.168	2.729	2.528	2.390	3.678	4.603	4.756	6.159	5.722

STDEV (CalStds)	0.004401	0.006096	0.006212	0.006073	0.010396	0.013696	0.014509	0.027147	0.019087
-----------------	----------	----------	----------	----------	----------	----------	----------	----------	----------

STDEV (CalStds+ICVCCV)	0.004695	0.006774	0.006816	0.006698	0.011186	0.014707	0.015624	0.024215	0.0203
------------------------	----------	----------	----------	----------	----------	----------	----------	----------	--------

STDEV (+MS2.5ppm)	0.004884	0.007117	0.007151	0.007048	0.0118	0.01556	0.016544	0.024455	0.021414
-------------------	----------	----------	----------	----------	--------	---------	----------	----------	----------

Standard Preparation for Cannabinoids Concentration Test

CHEM3-D361-E100 µl, CHEM3-D361-E1000 µl,
CHEM1-D361-E300 µl, CHEM2-D361-E20 µl

Analyst	MS	Pipettes#:				
Stock Standards: CHEM3-D361-E100 µl, CHEM3-D361-E1000 µl, CHEM1-D361-E300 µl, CHEM2-D361-E20 µl						
CBDA	Cayman	18090	0587881	May 02 2023	1.0mg/ml	1ml
CBD	Cayman	ISO60156	0586575	March 29 2024	1.0mg/ml	1ml
THCA	Cayman	ISO60175	0626035	September 01 2024	1.0mg/ml	1ml
delta9-THC	Cayman	ISO60157	0612973	April 27 2024	1.0mg/ml	1ml
delta8-THC	Cerilant	T-032	FE12271903	January 2025	1.0mg/ml	1ml
CBN	Cayman	ISO60183	0584229	March 13 2023	1.0mg/ml	1ml
CBG	Cayman	20164	0567652	August 01 2022	1.0mg/ml	1ml
CBC	Cayman	ISO60163	0586327	March 29 2023	1.0mg/ml	1ml
THCV	Cayman	18091	0606999	January 25 2024	1.0mg/ml	1ml
CBDA (2nd Source)	Cerilant	C-144	FE02202007	August 2022	1.0mg/ml	1ml
CBD (2nd Source)	Cerilant	C-045	FE10071912	November 2024	1.0mg/ml	1ml
THCA (2nd Source)	Cerilant	T-093	FE11102003	October 2023	1.0mg/ml	1ml
delta9-THC (2nd Source)	Cerilant	T-005	FE02072001	September 2023	1.0mg/ml	1ml
delta8-THC (2nd Source)	Cerilant	T-032	FE04282108	May 2026	1.0mg/ml	1ml
CBN (2nd Source)	Cerilant	C-046	FE11211801	March 2024	1.0mg/ml	1ml
CBG (2nd Source)	Cerilant	C-141	FN03072001	November 2024	1.0mg/ml	1ml
CBC (2nd Source)	Cerilant	C-143	FE06152005	December 2022	1.0mg/ml	1ml
THCV (2nd Source)	Cerilant	T-094	FE10111901	June 2022	1.0mg/ml	1ml
Solvents	Manufacturer	Catlog#	Lot#	Expiration Date		
Acetonitrile	Fisher	A955-4	203672	June 2025		
Methanol	Fisher	A456-4	194144	October 2024		

Working Standards & Spiking Solution (Stored in -20 °C freezer)		Preparation Date	Quantity
A - 100ppm 9 Mix	Take 1 ml of each stock standard and add 1 ml diluent	3/16/2022	10 ml
B - 10ppm 9 Mix	Take 600 ul of A and add 5400ul diluent	3/16/2022	6 ml
C - 100 ppm 9 Mix (2nd source)	Take 1 ml of each stock standard and add 1 ml diluent	3/16/2022	10 ml
D - 10 ppm 9 Mix (2nd source)	Take 400 ul of 100 ppm (2nd source) and add 3600ul diluent	3/16/2022	4 ml

Note: Diluent = Acetonitrile : Methanol 80:20

Calibration Standards and ICV Standards		Preparation Date	Quantity
100 ppm Mix Std	Take 1 ml Working standard A	3/16/2022	1ml
50 ppm Mix Std	Take 500 ul Working standard A and add 500 ul diluent	3/16/2022	1ml
20 ppm Mix Std	Take 200 ul Working standard A and add 800ul diluent	3/16/2022	1ml
10 ppm Mix Std	Take 1 ml Working standard B	3/16/2022	1ml
5 ppm Mix Std	Take 500 ul Working standard B and add 500 ul diluent	3/16/2022	1ml
2 ppm Mix Std	Take 200 ul Working standard B and add 800ul diluent	3/16/2022	1ml
0.5 ppm Mix Std	Take 50ul Working standard B and add 950ul diluent	3/16/2022	1ml
ICV 10 ppm	Take 1 ml 10 ppm working standard D	3/16/2022	1ml

Note: Diluent = Acetonitrile : Methanol 80:20

Mobile Phase Preparation for Cannabinoids Concentration Method

Solvents	Manufacturer	Catlog#	Lot#	Expiration Date
Acetonitrile	Fisher	A955-4	203672	June 2025
Water	Honeywell	LC365-4	EB057-B-US	February 2023
Formic Acid	Fisher	A117-50	208176	April 2026
			Preparation Date	Quantity
Mobile Phase A	0.5ml Formic Acid + 1L Water			3/17/2022 1L
Mobile Phase B	0.5ml Formic Acid + 1L Acetonitrile			3/17/2022 1L

	Spiking Solution	Spiking Volume	Concentration in Vial	Note
Method Standard	100 ppm 2nd source (C)	2 ml	5 ppm	Spike into 40 ml solvent and go through sample prep.
Matrix Spike Day 1-1	100 ppm 1st source (A)	2 ml	5 ppm	Spike into 200 mg cellulose powder + 40 ml solvent and go through sample prep.
Matrix Spike Day 1-2	100 ppm 1st source (A)	1.4 ml	3.5 ppm	Spike into 200 mg cellulose powder + 40 ml solvent and go through sample prep.
Matrix Spike Day 1-3	100 ppm 1st source (A)	1 ml	2.5 ppm	Spike into 200 mg cellulose powder + 40 ml solvent and go through sample prep.
Matrix Spike Day 2	100 ppm 2nd source (C)	1 ml	2.5 ppm	Spike into 200 mg cellulose powder + 40 ml solvent and go through sample prep.
Matrix Spike Day 3	100 ppm 2nd source (C)	1 ml	2.5 ppm	Spike into 200 mg cellulose powder + 40 ml solvent and go through sample prep.
Matrix Spike Day 4	100 ppm 2nd source (C)	1 ml	2.5 ppm	Spike into 200 mg cellulose powder + 40 ml solvent and go through sample prep.
Post Dilution Spike Day 1 to Day 4	100 ppm 2nd source (C)	200 µl	40 ppm	Sample extract dilution 20x. (25 µl sample extract+200 µl spiking solution+275 µl diluent.)
LOD x 7	100 ppm 2nd source (C)	200 µl	0.5 ppm	Spike into 200 mg cellulose powder + 40 ml solvent and go through sample prep.

Sample Name	Weight (g)	Concentration in 1:10 dilution of 40 ml ACN:MeOH 80:20 Extract (mg/L)									Concentration in sample (mg/g) calculated from 1:10 dilution									
		CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC	
F1-1_10x	0.202	0.000	0.000	0.000	0.802	2.053	30.384	1.805	52.768	0.476	0.000	0.000	0.000	1.591	4.073	60.286	3.581	104.698	0.944	
F1-2_10x	0.202	0.000	0.000	0.000	1.166	1.945	28.903	1.749	50.043	0.516	0.000	0.000	0.000	2.311	3.855	57.290	3.467	99.193	1.023	
F1-3_10x	0.201	0.000	0.000	0.000	1.167	1.917	28.748	1.632	48.890	0.499	0.000	0.000	0.000	2.318	3.807	57.096	3.241	97.100	0.991	
Concentration in 40 ml ACN:MeOH 80:20 Extract (mg/L)										Amount in 40 ml ACN:MeOH 80:20 Extract (mg)										
MS1	0.2026	4.857	4.710	4.667	4.710	4.701	4.729	4.720	4.800	4.732	0.194	0.188	0.187	0.188	0.188	0.189	0.189	0.192	0.189	
Amount spiked											0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
Recovery											97%	94%	93%	94%	94%	95%	94%	96%	95%	95%
MS2	0.2007	3.523	3.437	3.249	3.257	3.303	3.452	3.469	3.480	3.453	0.141	0.137	0.130	0.130	0.132	0.138	0.139	0.139	0.138	0.138
Amount spiked											0.140	0.140	0.140	0.140	0.140	0.140	0.140	0.140	0.140	0.140
Recovery											101%	98%	93%	93%	94%	99%	99%	99%	99%	99%
MS3	0.2011	2.516	2.468	2.422	2.428	2.465	2.450	2.425	2.500	2.448	0.101	0.099	0.097	0.097	0.099	0.098	0.097	0.100	0.098	0.098
Amount spiked											0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
Recovery											101%	99%	97%	97%	99%	98%	97%	100%	98%	98%
Concentration in 1: 20 dilution of 40 ml Sample Extract (mg/L)										Amount in 40 ml ACN:MeOH 80:20 Extract (mg)										
Post-dilution Spike		42.660	42.088	39.589	39.96	40.506	56.366	42.269	67.358	41.703										
Amount spiked		40	40	40	40	40	40	40	40	40										
Unspiked sample		0	0	0	1.167	1.917	28.748	1.632	48.89	0.499										
Recovery		107%	105%	99%	98%	99%	105%	104%	107%	104%										
Concentration in 40 ml ACN:MeOH 80:20 Extract (mg/L)										Amount in 40 ml ACN:MeOH 80:20 Extract (mg)										
Method blank		CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC	
Matrix blank 1		N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	0	0	0	0	0	0	0	0	0	0
Matrix blank 2		0.2033	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	0	0	0	0	0	0	0	0	0	0
Method Std		4.817	4.813	4.644	4.657	4.536	4.772	4.746	4.649	4.885	0.193	0.193	0.186	0.186	0.186	0.181	0.191	0.190	0.186	0.195
Amount spiked											0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
Recovery											96%	96%	93%	93%	91%	95%	95%	93%	98%	98%
Concentration in 1:1 dilution of 40 ml Sample Extract (mg/L)										Concentration in sample (mg/g) calculated from 1:1 dilution										
Sample Name	Weight (g)	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC	
F1-1_1x	0.2016	2.405	2.269	0.000	12.219	20.700	307.493	19.150	533.625	4.919	0.477	0.450	0.000	2.424	4.107	61.011	3.800	105.878	0.976	
F1-2_1x	0.2018	2.316	2.300	0.000	11.796	19.344	290.069	18.223	506.521	4.603	0.459	0.456	0.000	2.338	3.834	57.496	3.612	100.401	0.912	
F1-3_1x	0.2014	2.279	2.193	0.000	11.793	19.356	290.442	18.335	497.584	4.586	0.453	0.436	0.000	2.342	3.844	57.685	3.642	98.825	0.911	

day 1

Note: For Δ9-THC and THCA
For all the other cannabinoids

Concentration in sample (mg/g) = (Concentration in 1: 10 of 40ml sample extract ug/L) x 10 x 40 / Weight (g) / 1000 / 1000
Concentration in sample (mg/g) = (Concentration in 1: 1 of 40ml sample extract ug/L) x 1 x 40 / Weight (g) / 1000 / 1000

	Cannabinoids Concentration in Sample (mg/g)								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
F1-1	0.477	0.450	0.000	2.424	4.107	60.286	3.800	104.698	0.976
F1-2	0.459	0.456	0.000	2.338	3.834	57.290	3.612	99.193	0.912
F1-3	0.453	0.436	0.000	2.342	3.844	57.096	3.642	97.100	0.911
RL	0.100	0.100	0.100	0.100	0.100	1.000	0.100	1.000	0.100
AVG	0.463	0.447	<RL	2.368	3.929	58.224	3.684	100.331	0.933
RSD	2.7%	2.3%		2.1%	3.9%	3.1%	2.7%	3.9%	4.0%
	Cannabinoids Concentration in Sample (%)								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
F1-1	0.048	0.045	0.000	0.242	0.411	6.029	0.380	10.470	0.098
F1-2	0.046	0.046	0.000	0.234	0.383	5.729	0.361	9.919	0.091
F1-3	0.045	0.044	0.000	0.234	0.384	5.710	0.364	9.710	0.091

Sample Name	Retention Time (min)								
	CBDA	THCV	CBD	CBG	CBN	Δ ₉ -THC	Δ ₈ -THC	THCA	CBC
9Mix_0.5ppm_Std	2.16	2.71	2.51	2.37	3.65	4.57	4.72	6.15	5.67
9Mix_2ppm_Std	2.16	2.71	2.51	2.38	3.65	4.57	4.72	6.15	5.68
9Mix_5ppm_Std	2.16	2.72	2.52	2.38	3.65	4.57	4.72	6.14	5.68
9Mix_10ppm_Std	2.16	2.72	2.52	2.38	3.66	4.57	4.73	6.14	5.68
9Mix_20ppm_Std	2.16	2.71	2.51	2.37	3.65	4.57	4.72	6.11	5.67
9Mix_50ppm_Std	2.16	2.71	2.51	2.37	3.65	4.56	4.71	6.09	5.66
9Mix_100ppm_Std	2.16	2.71	2.51	2.38	3.65	4.57	4.72	6.08	5.67
Average	2.16	2.71	2.51	2.38	3.65	4.57	4.72	6.12	5.67
MethStd	2.16	2.72	2.52	2.38	3.66	4.58	4.73	6.15	5.68
MS1	2.16	2.72	2.51	2.38	3.65	4.57	4.72	6.14	5.67
MS2	2.16	2.71	2.51	2.37	3.65	4.56	4.71	6.13	5.66
MS3	2.16	2.71	2.51	2.37	3.64	4.55	4.70	6.13	5.66
F1-1_10x	2.16	2.71	2.51	2.38	3.65	4.57	4.76	6.10	5.68
F1-2_10x	2.16	2.71	2.51	2.38	3.67	4.58	4.78	6.12	5.69
F1-3_10x	2.16	2.71	2.51	2.39	3.67	4.59	4.78	6.13	5.70
F1-3_PDS_20x	2.17	2.73	2.52	2.39	3.67	4.59	4.74	6.12	5.70
F1-1_1x	2.17	2.72	2.51	2.39	3.67	4.58	4.74	6.06	5.70
F1-2_1x	2.17	2.72	2.51	2.38	3.67	4.58	4.74	6.06	5.70
F1-3_1x	2.17	2.73	2.51	2.39	3.67	4.58	4.74	6.07	5.70

**Method Validation
Quality Control Report**
for Initial and Continuing Calibration Verification Standard, Method Blanks, Method Standard, and Laboratory Control Sample

Date of Analysis: 3/17/2022
 Matrix: Cannabis flower, Cellulose powder (LCS)
 CTLB Nos.: 19-01597-CE

Analytical Method: Cannabinoids Concentration by UPLC

Analyte	Initial and Continuing Calibration Verification Standard				Method Blanks		Matrix Blanks		Method Standard				
	Sample Name	Found	True Value	Recovery	Control Limits	Repl. 1	Repl. 2	Repl. 1	Repl. 2	Found	True Value	Recovery	Control Limits
		mg/L	mg/L	%	%	mg/L	mg/L	mg/L	mg/L	mg	mg	%	%
CBDA	ICV_10ppm	9.6	10.0	96.4	80-120	ND		ND	ND	0.193	0.200	96.3	80-120
THCV		9.8	10.0	98.5	80-120	ND		ND	ND	0.193	0.200	96.3	80-120
CBD		9.5	10.0	94.8	80-120	ND		ND	ND	0.186	0.200	92.9	80-120
CBG		9.4	10.0	94.4	80-120	ND		ND	ND	0.186	0.200	93.1	80-120
CBN		9.3	10.0	92.7	80-120	ND		ND	ND	0.181	0.200	90.7	80-120
Δ9-THC		9.7	10.0	97.2	80-120	ND		ND	ND	0.191	0.200	95.4	80-120
Δ8-THC		9.8	10.0	98.0	80-120	ND		ND	ND	0.190	0.200	94.9	80-120
THCA		9.3	10.0	93.1	80-120	ND		ND	ND	0.186	0.200	93.0	80-120
CBC		9.7	10.0	97.5	80-120	ND		ND	ND	0.195	0.200	97.7	80-120
CBDA	CCV_50ppm_001	50.7	50.0	101.5	80-120								
THCV		50.9	50.0	101.7	80-120								
CBD		50.8	50.0	101.6	80-120								
CBG		50.8	50.0	101.5	80-120								
CBN		50.7	50.0	101.4	80-120								
Δ9-THC		50.6	50.0	101.2	80-120								
Δ8-THC		50.5	50.0	101.0	80-120								
THCA		50.6	50.0	101.2	80-120								
CBC		50.5	50.0	101.0	80-120								
CBDA	CCV_50ppm_002	51.9	50.0	103.8	80-120								
THCV		52.1	50.0	104.3	80-120								
CBD		52.0	50.0	104.1	80-120								
CBG		52.0	50.0	104.0	80-120								
CBN		52.0	50.0	104.0	80-120								
Δ9-THC		52.2	50.0	104.3	80-120								
Δ8-THC		51.9	51.0	101.8	80-120								
THCA		51.6	50.0	103.3	80-120								
CBC		51.8	50.0	103.6	80-120								

Notes:

Miaotian Sun

Analyst

3/24/2022

Date



3-30-22

Supervisor

**Method Validation
Quality Control Report
for Matrix Spike Recovery**

Date of Analysis: 3/17/2022
 Matrix: Cannabis flower, Cellulose powder (LCS)
 I.S. Nos.: 19-01597-CE
 CTLB Nos.: 19-01597-CE
 Analytical Method: Cannabinoids Concentration by UPLC

Page 2 of 2

Analyte	Matrix Spikes 1			Matrix Spikes 2			Matrix Spikes 3			Control Limits %		
	Weight (g)	0.2026		Weight (g)	0.2007		Weight (g)	0.2011				
	Found mg	Amount Added mg	Recovery %	Control Limits %	Found mg	Amount Added mg	Recovery %	Found mg	Amount Added mg	Recovery %		
CBDA	0.194	0.200	97.1	70-130	0.141	0.140	100.7	70-130	0.101	0.100	100.6	70-130
THCV	0.188	0.200	94.2	70-130	0.137	0.140	98.2	70-130	0.099	0.100	98.7	70-130
CBD	0.187	0.200	93.3	70-130	0.130	0.140	92.8	70-130	0.097	0.100	96.9	70-130
CBG	0.188	0.200	94.2	70-130	0.130	0.140	93.1	70-130	0.097	0.100	97.1	70-130
CBN	0.188	0.200	94.0	70-130	0.132	0.140	94.4	70-130	0.099	0.100	98.6	70-130
Δ9-THC	0.189	0.200	94.6	70-130	0.138	0.140	98.6	70-130	0.098	0.100	98.0	70-130
Δ8-THC	0.189	0.200	94.4	70-130	0.139	0.140	99.1	70-130	0.097	0.100	97.0	70-130
THCA	0.192	0.200	96.0	70-130	0.139	0.140	99.4	70-130	0.100	0.100	100.0	70-130
CBC	0.189	0.200	94.6	70-130	0.138	0.140	98.7	70-130	0.098	0.100	97.9	70-130
	Unspiked Sample			Post Dilution Spike								
	mg/L	mg/L	mg/L	RPD	mg/L	mg/L	%	%				
CBDA	0.0		0.0	#DIV/0!	42.7	40.0	106.7	70-130				
THCV	0.0		0.0	#DIV/0!	42.1	40.0	105.2	70-130				
CBD	0.0		0.0	#DIV/0!	39.6	40.0	99.0	70-130				
CBG	1.2		1.2	100.0%	40.0	40.0	98.4	70-130				
CBN	1.9		1.9	100.0%	40.5	40.0	98.9	70-130				
Δ9-THC	28.7		28.7	100.0%	56.4	40.0	105.0	70-130				
Δ8-THC	1.6		1.6	100.0%	42.3	40.0	103.6	70-130				
THCA	48.9		48.9	100.0%	67.4	40.0	107.3	70-130				
CBC	0.5		0.5	100.0%	41.7	40.0	103.6	70-130				

Notes: Recovery of Post Dilution Spike (PDS) = (Concentration in PDS (mg/L) - Concentration in Unspiked Sample (mg/L) / 2) / Amount Spiked (mg/L)

Dilution factor of PDS is twice as of the Unspiked Sample.

Miaotian Sun 3/24/2022
 Analyst Date


 Supervisor

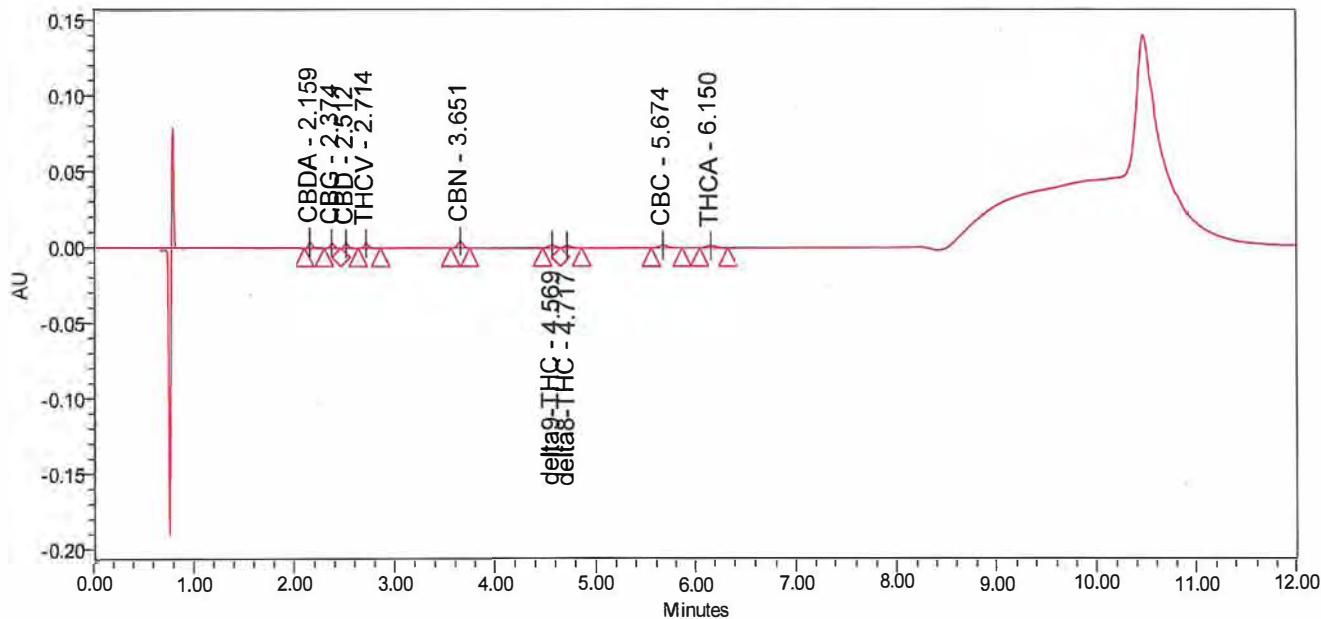

 Date

	Vial	Inj Vol (uL)	# of Injs	Label	SampleName	Level	Function	Method Set / Report or Export Method	Label Reference	Processing	Run Time (Minutes)
1							Clear Calibration	Cannabinoids_20220317		Normal	
2							Refresh Syringe	Cannabinoids_20220317			
3							Wash Needle	Cannabinoids_20220317			
4							Purge Inj	Cannabinoids_20220317			10.00
5	1	2.0	3	03162022	SolvBlk		Inject Samples	Cannabinoids_20220317		Normal	12.00
6	2	2.0	1	03162022	9Mix_0.5ppm_Std	Level 1	Inject Standards	Cannabinoids_20220317		Normal	12.00
7	3	2.0	1	03162022	9Mix_2ppm_Std	Level 2	Inject Standards	Cannabinoids_20220317		Normal	12.00
8	4	2.0	1	03162022	9Mix_5ppm_Std	Level 3	Inject Standards	Cannabinoids_20220317		Normal	12.00
9	5	2.0	1	03162022	9Mix_10ppm_Std	Level 4	Inject Standards	Cannabinoids_20220317		Normal	12.00
10	6	2.0	1	03162022	9Mix_20ppm_Std	Level 5	Inject Standards	Cannabinoids_20220317		Normal	12.00
11	7	2.0	1	03162022	9Mix_50ppm_Std	Level 6	Inject Standards	Cannabinoids_20220317		Normal	12.00
12	8	2.0	1	03162022	9Mix_100ppm_Std	Level 7	Inject Standards	Cannabinoids_20220317		Normal	12.00
13							Purge Inj	Cannabinoids_20220317			10.00
14	1	2.0	1	03162022	SolvBlk		Inject Samples	Cannabinoids_20220317		Normal	12.00
15	9	2.0	1	03162022	ICV_10ppm		Inject Samples	Cannabinoids_20220317		Normal	12.00
16	10	2.0	1	Smp	MethBlk		Inject Samples	Cannabinoids_20220317		Normal	12.00
17	11	2.0	1	Smp	MatrixBlk1		Inject Samples	Cannabinoids_20220317		Normal	12.00
18	12	2.0	1	Smp	MatrixBlk2		Inject Samples	Cannabinoids_20220317		Normal	12.00
19	13	2.0	1	Smp	MethStd		Inject Samples	Cannabinoids_20220317		Normal	12.00
20	14	2.0	1	Smp	MS1		Inject Samples	Cannabinoids_20220317		Normal	12.00
21	15	2.0	1	Smp	MS2		Inject Samples	Cannabinoids_20220317		Normal	12.00
22	16	2.0	1	Smp	MS3		Inject Samples	Cannabinoids_20220317		Normal	12.00
23	17	2.0	1	Smp	F1-1_10x		Inject Samples	Cannabinoids_20220317		Normal	12.00
24	18	2.0	1	Smp	F1-2_10x		Inject Samples	Cannabinoids_20220317		Normal	12.00
25							Purge Inj	Cannabinoids_20220317			10.00
26	1	2.0	1	03162022	SolvBlk		Inject Samples	Cannabinoids_20220317		Normal	12.00
27	7	2.0	1	03162022	CCV_50ppm		Inject Samples	Cannabinoids_20220317		Normal	12.00
28	19	2.0	1	Smp	F1-3_10x		Inject Samples	Cannabinoids_20220317		Normal	12.00
29	20	2.0	1	Smp	F1-3_PDS_20x		Inject Samples	Cannabinoids_20220317		Normal	12.00
30	21	2.0	1	Smp	F1-1_1x		Inject Samples	Cannabinoids_20220317		Normal	12.00
31	22	2.0	1	Smp	F1-2_1x		Inject Samples	Cannabinoids_20220317		Normal	12.00
32	23	2.0	1	Smp	F1-3_1x		Inject Samples	Cannabinoids_20220317		Normal	12.00
33	24	2.0	1	Smp	F1-3_1x		Inject Samples	Cannabinoids_20220317		Normal	12.00
34							Purge Inj	Cannabinoids_20220317			10.00
35	7	2.0	1	03162022	CCV_50ppm		Inject Samples	Cannabinoids_20220317		Normal	12.00
36	1	2.0	3	03162022	SolvBlk		Inject Samples	Cannabinoids_20220317		Normal	12.00
37							Equilibrate	End			12.00

SAMPLE INFORMATION

Sample Name: 9Mix_0.5ppm_Std
Sample Type: Standard
Vial: 2
Injection #: 1
Injection Volume: 2.00 μ l
Run Time: 12.0 Minutes
Acquired By: System
Sample Set Name: ValidationDay1_20220317
Acq. Method Set: Cannabinoids_20220317
Processing Method: Cannabinoids_20220317
Channel Name: PDA Ch1 220nm@4.8nm
Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm
Date Acquired: 3/17/2022 5:45:45 PM PDT
Date Processed: 3/22/2022 4:54:58 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.159	11102	4078	0.500	ppm
2	CBG	2.374	8199	3086	0.500	ppm
3	CBD	2.512	8307	2999	0.500	ppm
4	THCV	2.714	8740	2939	0.500	ppm
5	CBN	3.651	15634	4450	0.500	ppm
6	delta9-THC	4.569	8151	1856	0.500	ppm
7	delta8-THC	4.717	6282	1390	0.500	ppm
8	CBC	5.674	9694	1809	0.500	ppm
9	THCA	6.150	9308	1475	0.500	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 1 of 22

Project Name: 2021\Method Development Miao

Date Printed:

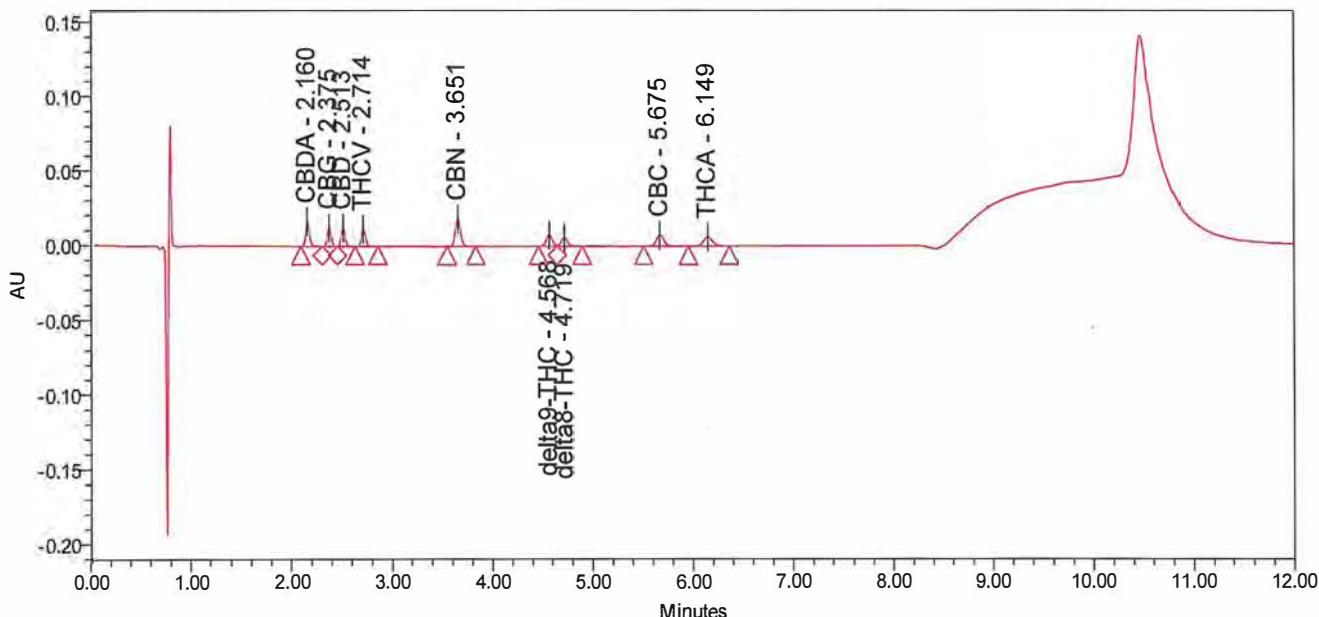
3/22/2022

7:49:26 PM US/Pacific

SAMPLE INFORMATION

Sample Name:	9Mix_2ppm_Std	Acquired By:	System
Sample Type:	Standard	Sample Set Name:	ValidationDay1_20220317
Vial:	3	Acq. Method Set:	Cannabinoids_20220317
Injection #:	1	Processing Method:	Cannabinoids_20220317
Injection Volume:	2.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm
Date Acquired:	3/17/2022 5:58:17 PM PDT		
Date Processed:	3/22/2022 4:54:58 PM PDT		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.160	43562	16604	2.000	ppm
2	CBG	2.375	33866	12572	2.000	ppm
3	CBD	2.513	33509	12305	2.000	ppm
4	THCV	2.714	32541	11706	2.000	ppm
5	CBN	3.651	64803	18269	2.000	ppm
6	delta9-THC	4.568	31228	7381	2.000	ppm
7	delta8-THC	4.719	25020	5547	2.000	ppm
8	CBC	5.675	38809	7224	2.000	ppm
9	THCA	6.149	39786	6302	2.000	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 2 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/22/2022

7:49:26 PM US/Pacific

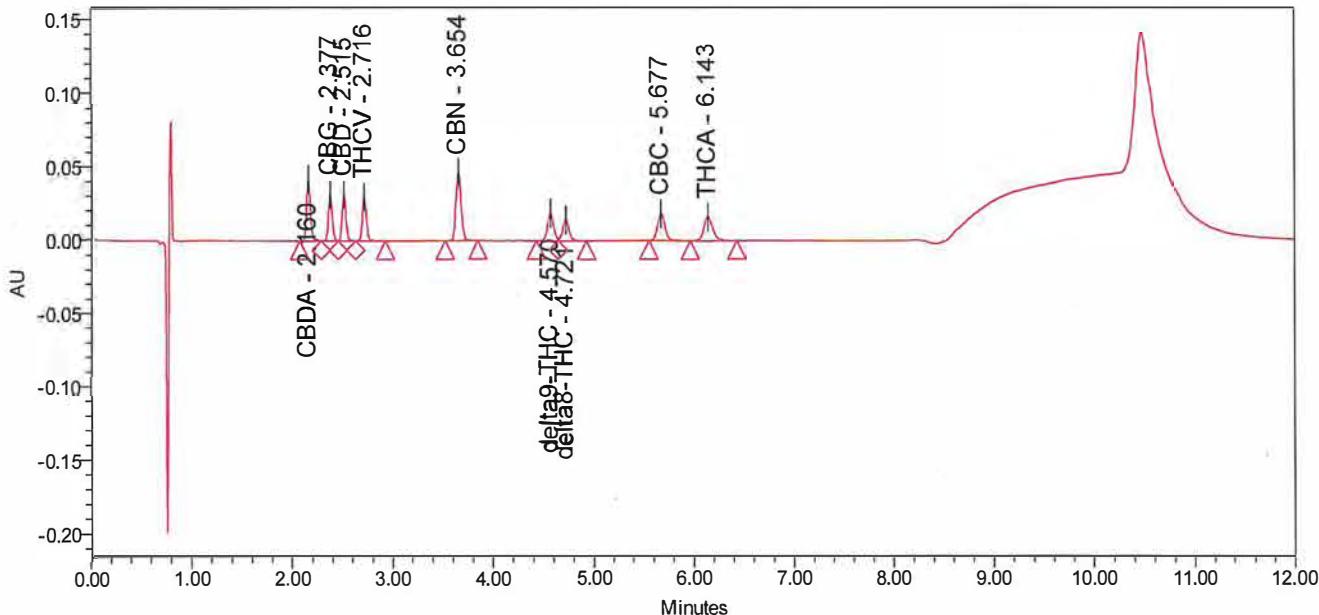
SAMPLE INFORMATION

Sample Name: 9Mix_5ppm_Std
 Sample Type: Standard
 Vial: 4
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

 Acquired By: System
 Sample Set Name: ValidationDay1_20220317
 Acq. Method Set: Cannabinoids_20220317
 Processing Method: Cannabinoids_20220317
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/17/2022 6:10:49 PM PDT
 Date Processed: 3/22/2022 4:54:58 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.160	108871	42198	5.000	ppm
2	CBG	2.377	84880	31651	5.000	ppm
3	CBD	2.515	85484	31130	5.000	ppm
4	THCV	2.716	83871	29711	5.000	ppm
5	CBN	3.654	164065	46317	5.000	ppm
6	delta9-THC	4.570	79533	18688	5.000	ppm
7	delta8-THC	4.721	62531	13978	5.000	ppm
8	CBC	5.677	94887	18198	5.000	ppm
9	THCA	6.143	100835	16060	5.000	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 3 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/22/2022

7:49:26 PM US/Pacific

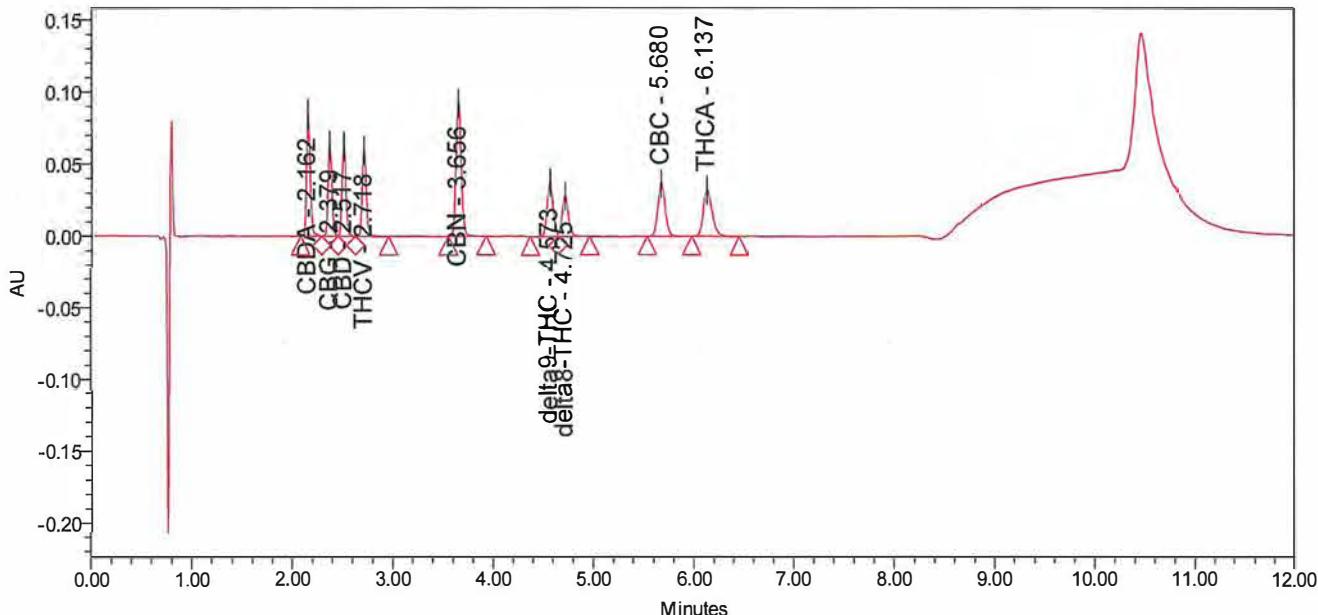
SAMPLE INFORMATION

Sample Name: 9Mix_10ppm_Std
 Sample Type: Standard
 Vial: 5
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay1_20220317
 Acq. Method Set: Cannabinoids_20220317
 Processing Method: Cannabinoids_20220317
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/17/2022 6:23:21 PM PDT
 Date Processed: 3/22/2022 4:54:59 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.162	218344	85026	10.000	ppm
2	CBG	2.379	169752	63419	10.000	ppm
3	CBD	2.517	170373	62295	10.000	ppm
4	THCV	2.718	167306	59376	10.000	ppm
5	CBN	3.656	329234	92498	10.000	ppm
6	delta ⁹ -THC	4.573	157797	37220	10.000	ppm
7	delta ⁸ -THC	4.725	126046	28001	10.000	ppm
8	CBC	5.680	188600	36381	10.000	ppm
9	THCA	6.137	200227	32213	10.000	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 4 of 22

Project Name: 2021\Method Development Miao

Date Printed:

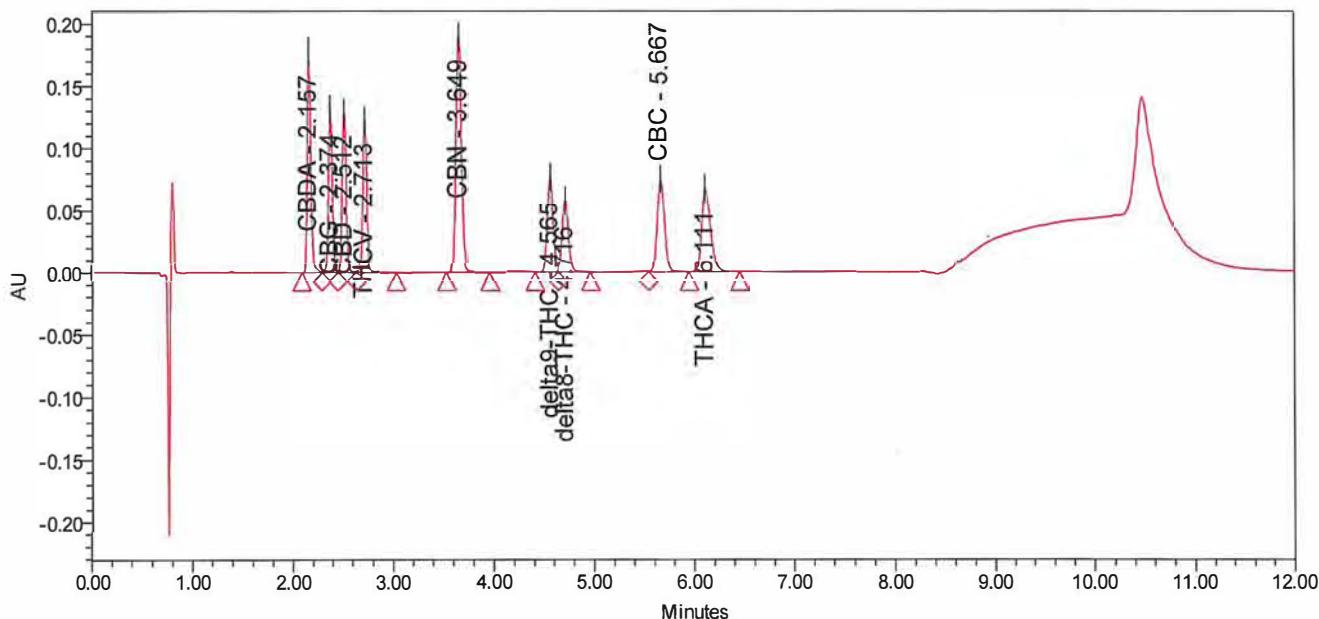
3/22/2022

7:49:26 PM US/Pacific

SAMPLE INFORMATION

Sample Name:	9Mix_20ppm_Std	Acquired By:	System
Sample Type:	Standard	Sample Set Name:	ValidationDay1_20220317
Vial:	6	Acq. Method Set:	Cannabinoids_20220317
Injection #:	1	Processing Method:	Cannabinoids_20220317
Injection Volume:	2.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm
Date Acquired:	3/17/2022 6:35:58 PM PDT		
Date Processed:	3/22/2022 4:54:59 PM PDT		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.157	449764	178168	20.000	ppm
2	CBG	2.374	349317	131606	20.000	ppm
3	CBD	2.512	351678	128867	20.000	ppm
4	THCV	2.713	344912	122711	20.000	ppm
5	CBN	3.649	674090	190378	20.000	ppm
6	delta9-THC	4.565	324056	76776	20.000	ppm
7	delta8-THC	4.716	256695	57546	20.000	ppm
8	CBC	5.667	388050	74888	20.000	ppm
9	THCA	6.111	416479	67490	20.000	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 5 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/22/2022

7:49:26 PM US/Pacific

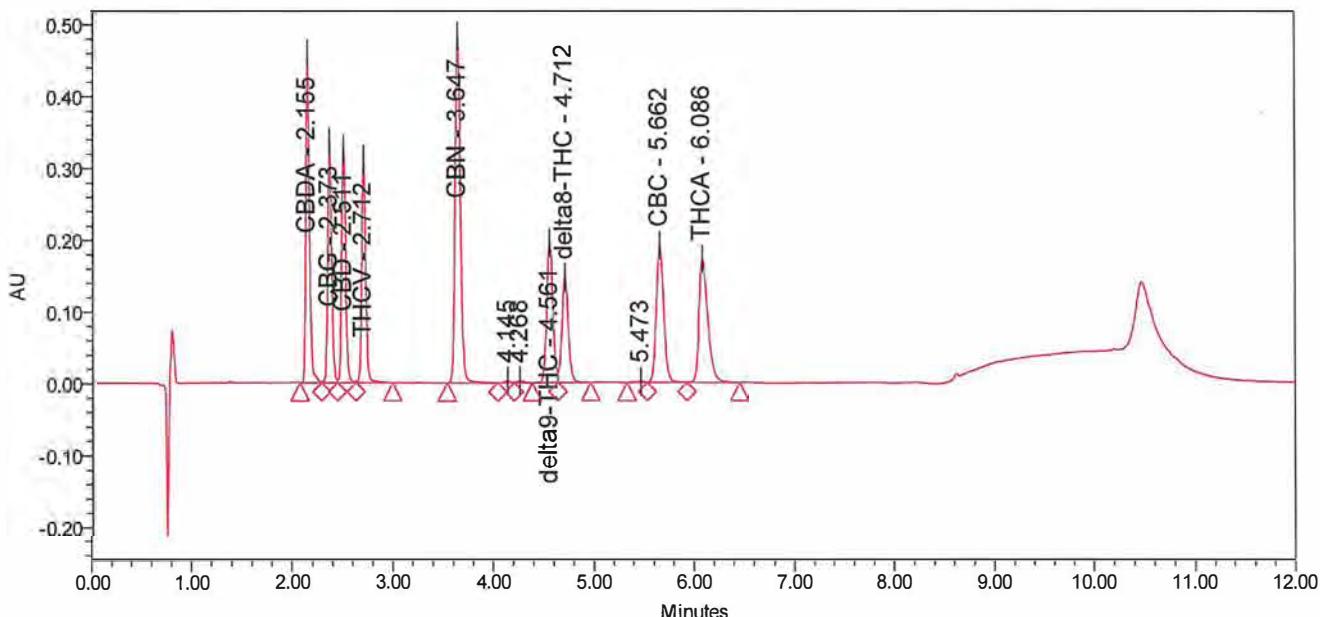
SAMPLE INFORMATION

Sample Name: 9Mix_50ppm_Std
 Sample Type: Standard
 Vial: 7
 Injection #: 1
 Injection Volume: 2.00 μ l
 Run Time: 12.0 Minutes

 Acquired By: System
 Sample Set Name: ValidationDay1_20220317
 Acq. Method Set: Cannabinoids_20220317
 Processing Method: Cannabinoids_20220317
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

 Date Acquired: 3/17/2022 6:48:29 PM PDT
 Date Processed: 3/22/2022 4:54:59 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.155	1138034	460058	50.000	ppm
2	CBG	2.373	884671	336257	50.000	ppm
3	CBD	2.511	890836	326817	50.000	ppm
4	THCV	2.712	871515	311522	50.000	ppm
5	CBN	3.647	1715503	483880	50.000	ppm
6	delta9-THC	4.561	823130	195382	50.000	ppm
7	delta8-THC	4.712	653304	146561	50.000	ppm
8	CBC	5.662	986331	191429	50.000	ppm
9	THCA	6.086	1053603	172519	50.000	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 6 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/22/2022

7:49:26 PM US/Pacific

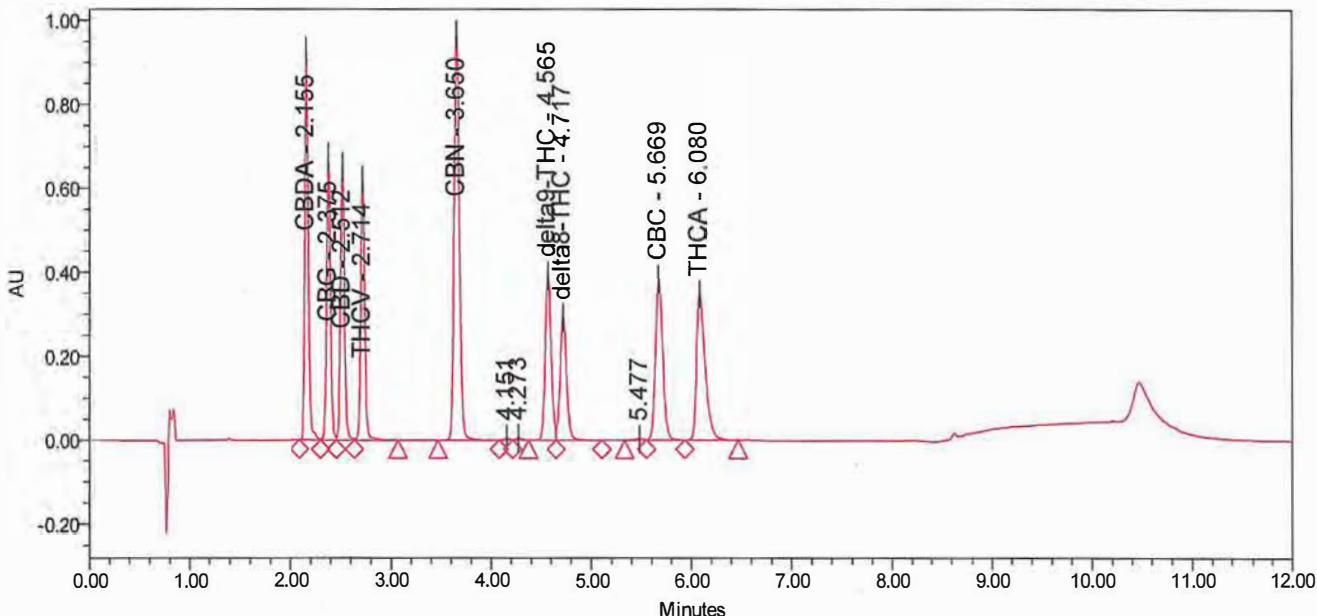
SAMPLE INFORMATION

Sample Name: 9Mix_100ppm_Std
 Sample Type: Standard
 Vial: 8
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay1_20220317
 Acq. Method Set: Cannabinoids_20220317
 Processing Method: Cannabinoids_20220317
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/17/2022 7:01:06 PM PDT
 Date Processed: 3/22/2022 4:54:59 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.155	2267575	928797	100.000	ppm
2	CBG	2.375	1765627	676017	100.000	ppm
3	CBD	2.512	1778559	652555	100.000	ppm
4	THCV	2.714	1740570	620332	100.000	ppm
5	CBN	3.650	3421299	967157	100.000	ppm
6	delta9-THC	4.565	1644350	392420	100.000	ppm
7	delta8-THC	4.717	1316017	292214	100.000	ppm
8	CBC	5.669	1975246	383686	100.000	ppm
9	THCA	6.080	2101586	347002	100.000	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 7 of 22

Project Name: 2021\Method Development Miao

Date Printed:

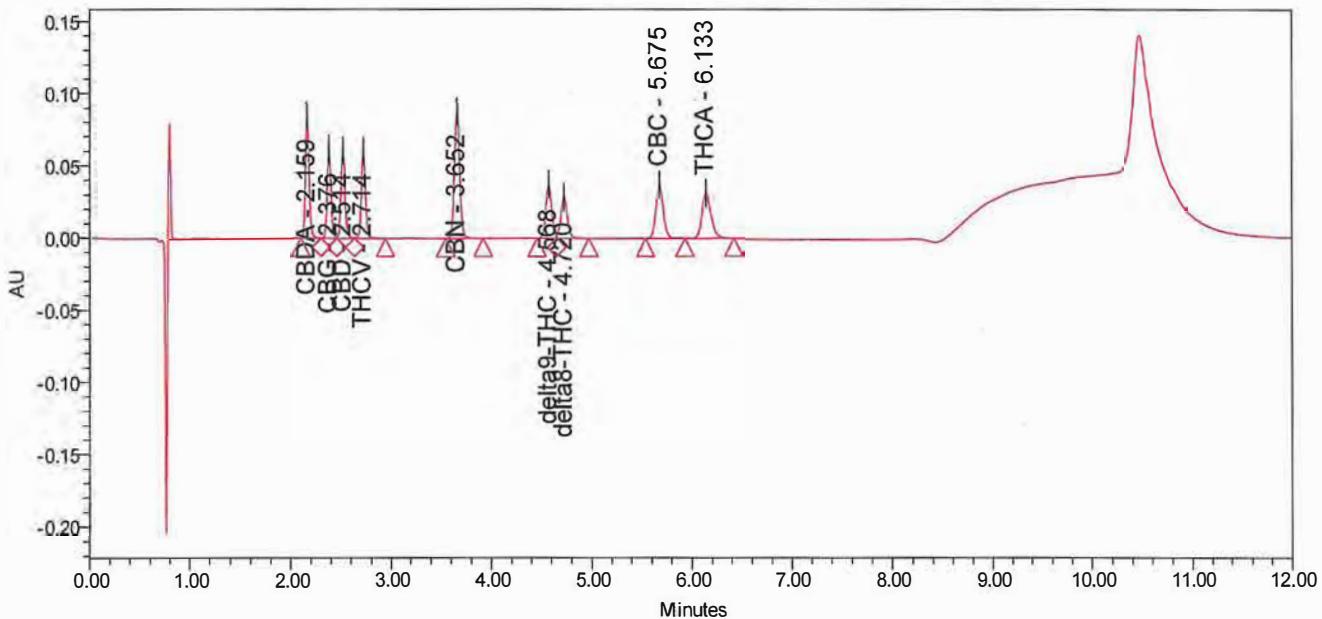
3/22/2022

7:49:26 PM US/Pacific

SAMPLE INFORMATION

Sample Name:	ICV_10ppm	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ValidationDay1_20220317
Vial:	9	Acq. Method Set:	Cannabinoids_20220317
Injection #:	1	Processing Method:	Cannabinoids_20220317
Injection Volume:	2.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm
Date Acquired:	3/17/2022 7:26:32 PM PDT		
Date Processed:	3/22/2022 4:55:00 PM PDT		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.159	217245	85567	9.642	ppm
2	CBG	2.376	165246	61992	9.441	ppm
3	CBD	2.514	166957	61132	9.477	ppm
4	THCV	2.714	170150	60605	9.846	ppm
5	CBN	3.652	313796	88339	9.265	ppm
6	delta9-THC	4.568	158533	37466	9.715	ppm
7	delta8-THC	4.720	127343	28425	9.800	ppm
8	CBC	5.675	190964	37019	9.749	ppm
9	THCA	6.133	193573	31071	9.312	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 8 of 22

Project Name: 2021\Method Development Miao

Date Printed:

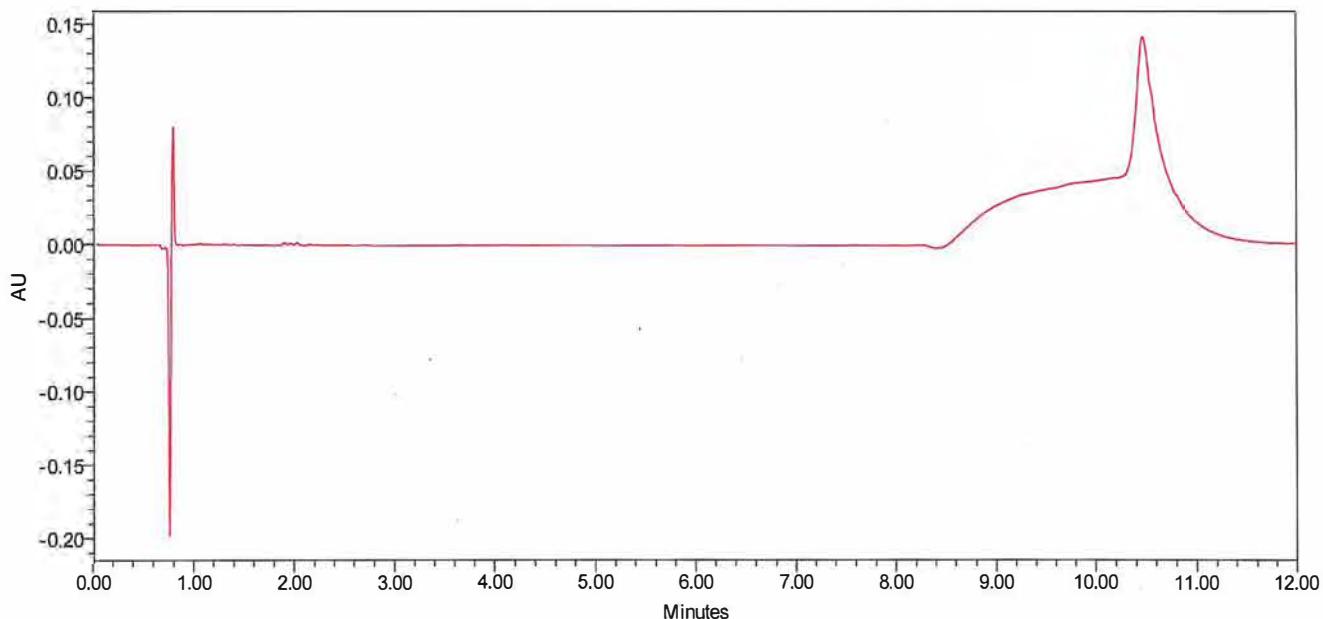
3/22/2022

7:49:26 PM US/Pacific

SAMPLE INFORMATION

Sample Name:	MethBlk	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ValidationDay1_20220317
Vial:	10	Acq. Method Set:	Cannabinoids_20220317
Injection #:	1	Processing Method:	Cannabinoids_20220317
Injection Volume:	2.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm
Date Acquired:	3/17/2022 7:39:03 PM PDT		
Date Processed:	3/22/2022 4:55:01 PM PDT		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.158				
2	CBG	2.369				
3	CBD	2.506				
4	THCV	2.706				
5	CBN	3.633				
6	delta9-THC	4.546				
7	delta8-THC	4.694				
8	CBC	5.636				
9	THCA	6.131				

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 9 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/22/2022

7:49:26 PM US/Pacific

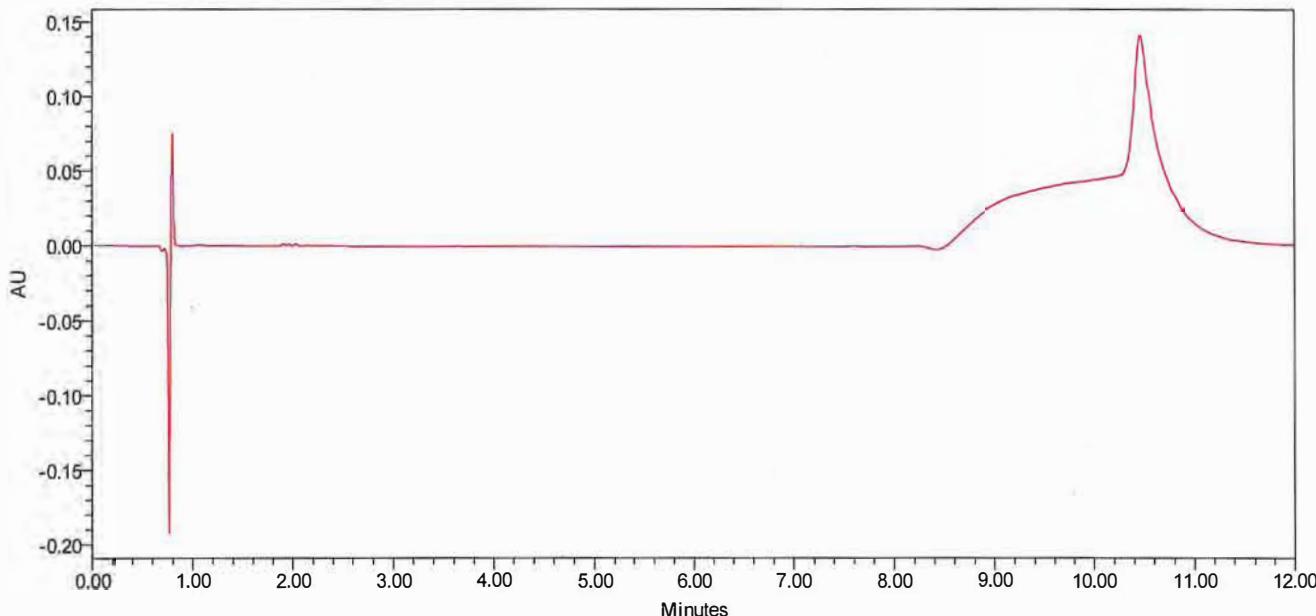
SAMPLE INFORMATION

Sample Name: MatrixBlk1
 Sample Type: Unknown
 Vial: 11
 Injection #: 1
 Injection Volume: 2.00 μ l
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay1_20220317
 Acq. Method Set: Cannabinoids_20220317
 Processing Method: Cannabinoids_20220317
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/17/2022 7:51:40 PM PDT
 Date Processed: 3/22/2022 4:55:01 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.158				
2	CBG	2.369				
3	CBD	2.506				
4	THCV	2.706				
5	CBN	3.633				
6	delta9-THC	4.546				
7	delta8-THC	4.694				
8	CBC	5.636				
9	THCA	6.131				

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 10 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/22/2022

7:49:26 PM US/Pacific

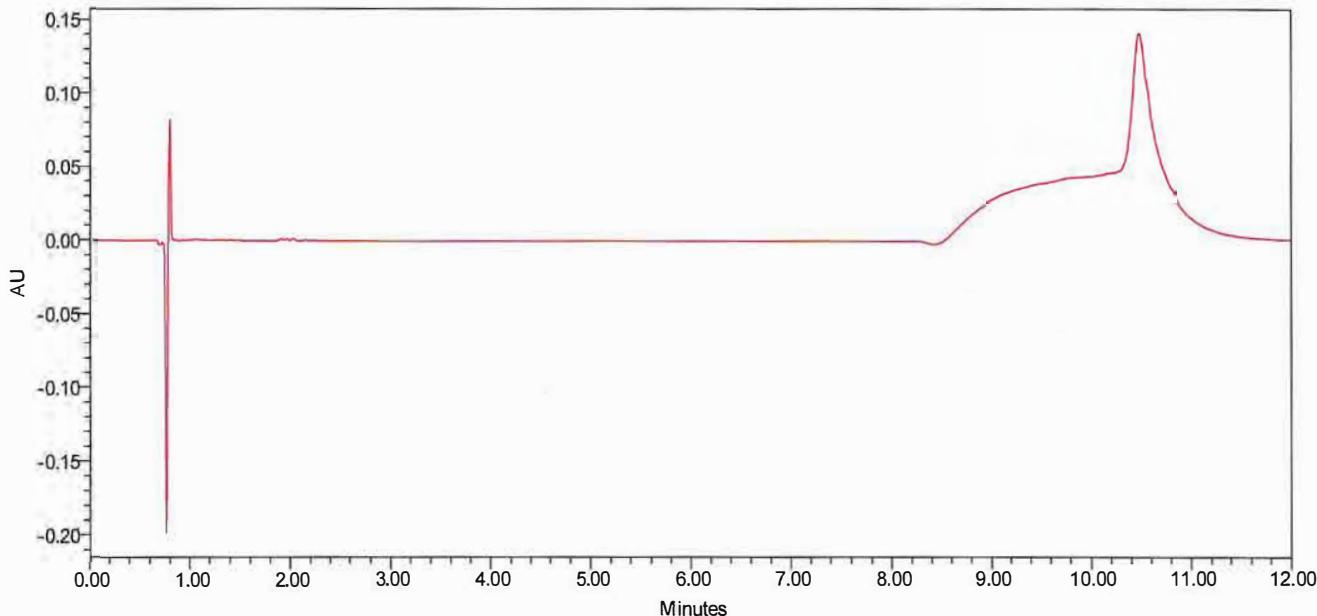
SAMPLE INFORMATION

Sample Name: MatrixBk2
 Sample Type: Unknown
 Vial: 12
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay1_20220317
 Acq. Method Set: Cannabinoids_20220317
 Processing Method: Cannabinoids_20220317
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/17/2022 8:04:15 PM PDT
 Date Processed: 3/22/2022 4:55:02 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.158				
2	CBG	2.369				
3	CBD	2.506				
4	THCV	2.706				
5	CBN	3.633				
6	delta9-THC	4.546				
7	delta8-THC	4.694				
8	CBC	5.636				
9	THCA	6.131				

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 11 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/22/2022

7:49:26 PM US/Pacific

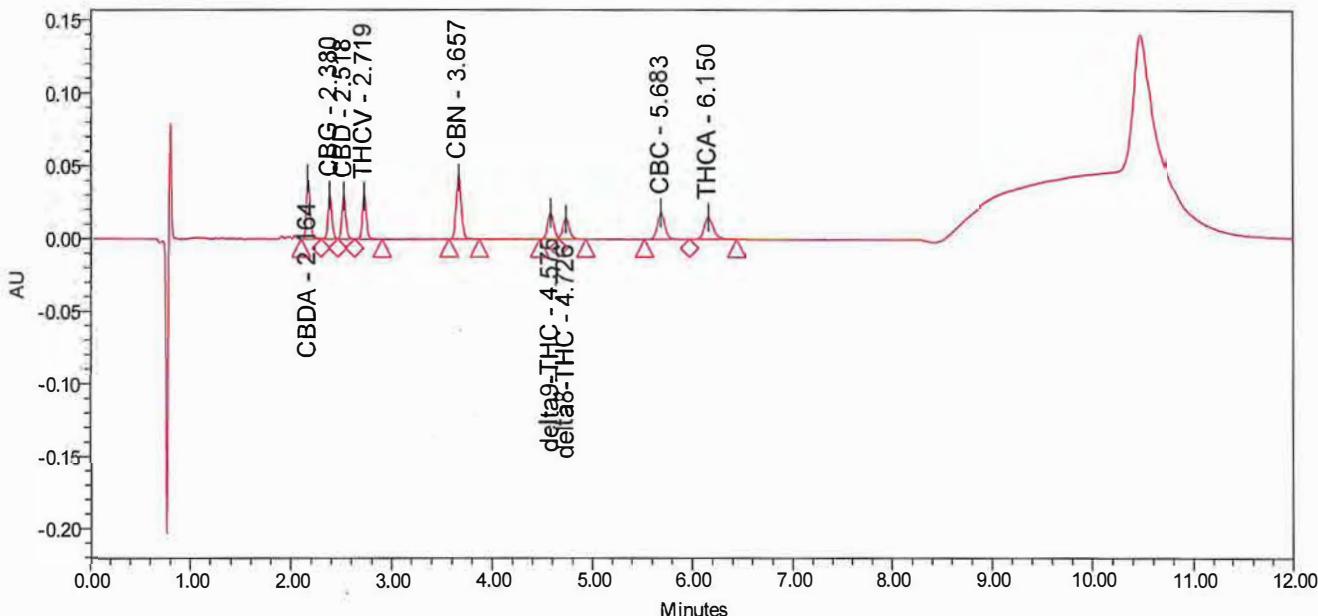
SAMPLE INFORMATION

Sample Name: MethStd
 Sample Type: Unknown
 Vial: 13
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay1_20220317
 Acq. Method Set: Cannabinoids_20220317
 Processing Method: Cannabinoids_20220317
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/17/2022 8:16:51 PM PDT
 Date Processed: 3/22/2022 4:55:02 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.164	108020	41774	4.817	ppm
2	CBG	2.380	80933	30048	4.657	ppm
3	CBD	2.518	81181	29451	4.644	ppm
4	THCV	2.719	82790	29306	4.813	ppm
5	CBN	3.657	152317	42742	4.536	ppm
6	delta9-THC	4.575	77517	18237	4.772	ppm
7	delta8-THC	4.726	61256	13774	4.746	ppm
8	CBC	5.683	95317	18024	4.885	ppm
9	THCA	6.150	95718	15025	4.649	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 12 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/22/2022

7:49:26 PM US/Pacific

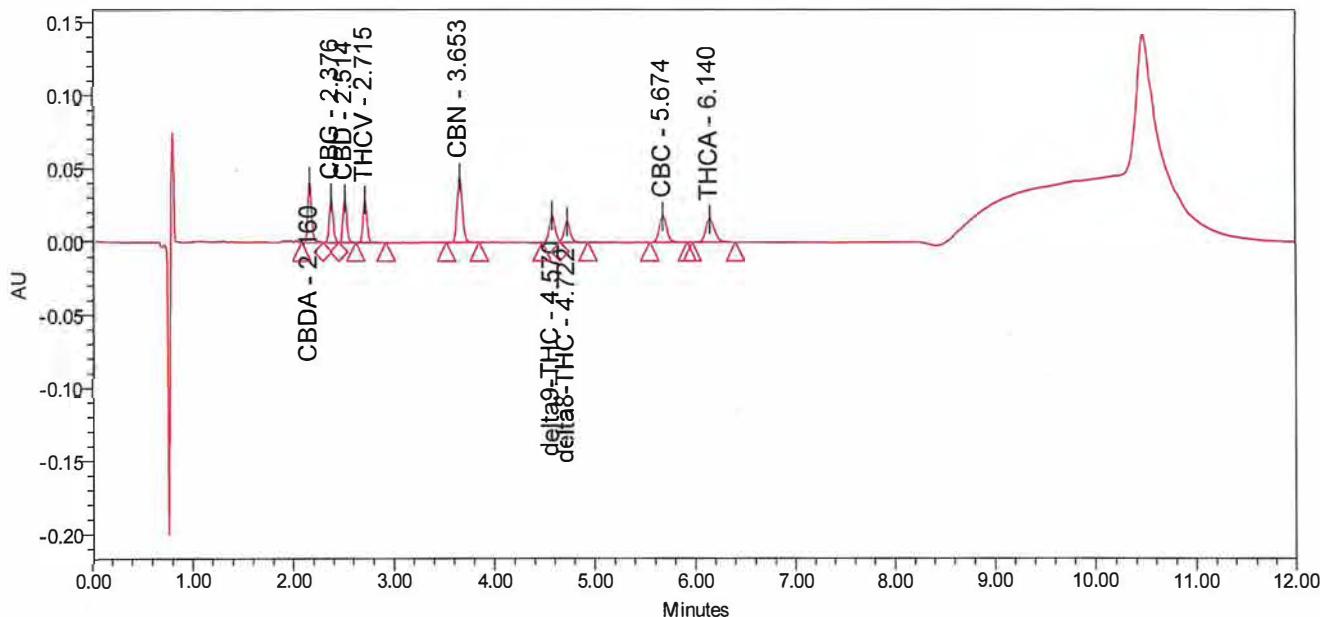
SAMPLE INFORMATION

Sample Name: MS1
 Sample Type: Unknown
 Vial: 14
 Injection #: 1
 Injection Volume: 2.00 μ l
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay1_20220317
 Acq. Method Set: Cannabinoids_20220317
 Processing Method: Cannabinoids_20220317
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/17/2022 8:29:27 PM PDT
 Date Processed: 3/22/2022 4:55:03 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.160	108919	41765	4.857	ppm
2	CBG	2.376	81869	30455	4.710	ppm
3	CBD	2.514	81602	29772	4.667	ppm
4	THCV	2.715	81012	28928	4.710	ppm
5	CBN	3.653	157958	44391	4.701	ppm
6	delta ⁹ -THC	4.570	76816	18176	4.729	ppm
7	delta ⁸ -THC	4.722	60926	13663	4.720	ppm
8	CBC	5.674	92303	17770	4.732	ppm
9	THCA	6.140	98889	15719	4.800	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 13 of 22

Project Name: 2021\Method Development Miao

Date Printed:

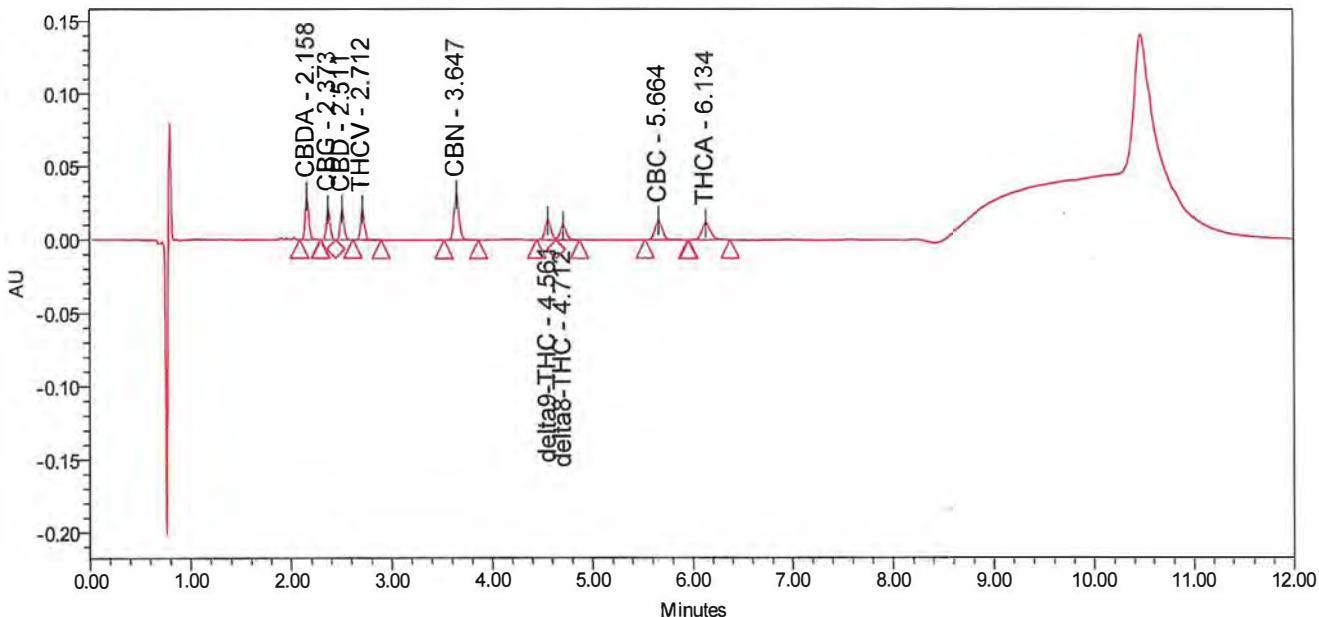
3/22/2022

7:49:26 PM US/Pacific

SAMPLE INFORMATION

Sample Name:	MS2	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ValidationDay1_20220317
Vial:	15	Acq. Method Set:	Cannabinoids_20220317
Injection #:	1	Processing Method	Cannabinoids_20220317
Injection Volume:	2.00 μ l	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm
Date Acquired:	3/17/2022 8:42:03 PM PDT		
Date Processed:	3/22/2022 4:55:03 PM PDT		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.158	78740	30188	3.523	ppm
2	CBG	2.373	56262	21050	3.257	ppm
3	CBD	2.511	56422	20653	3.249	ppm
4	THCV	2.712	58903	20899	3.437	ppm
5	CBN	3.647	110222	30856	3.303	ppm
6	delta9-THC	4.561	55882	13148	3.452	ppm
7	delta8-THC	4.712	44564	9956	3.469	ppm
8	CBC	5.664	67160	12869	3.453	ppm
9	THCA	6.134	71186	11312	3.480	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 14 of 22

Project Name: 2021\Method Development Miao

Date Printed:

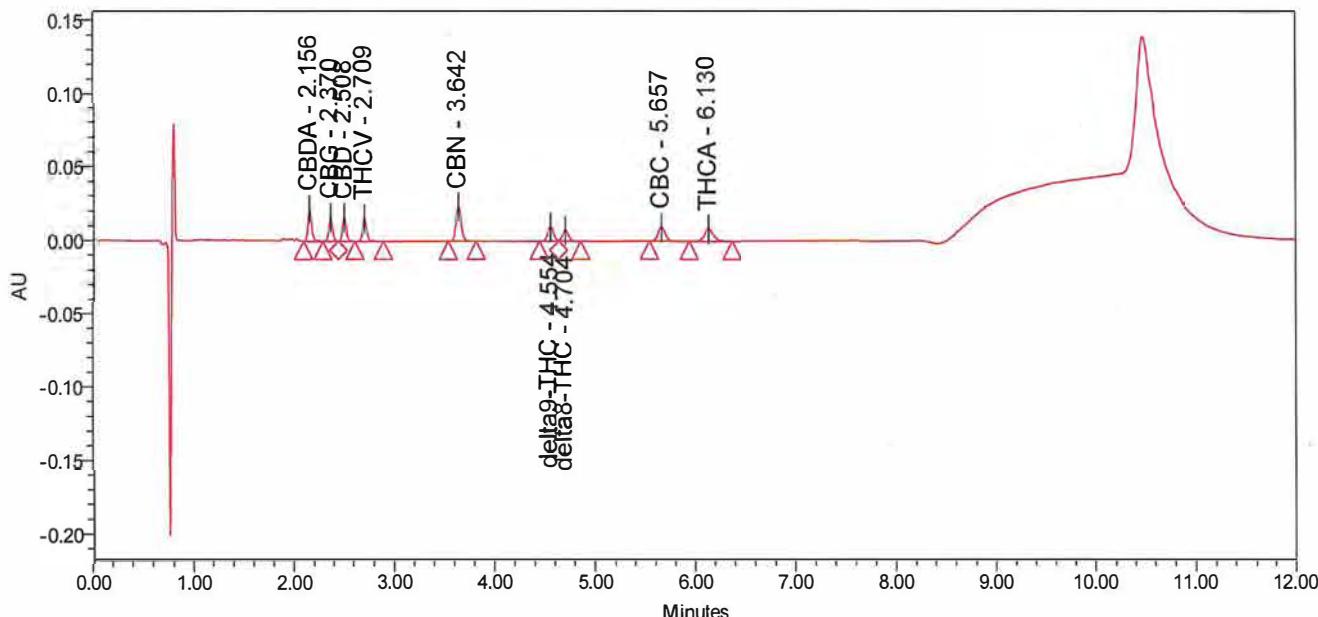
3/22/2022

7:49:26 PM US/Pacific

SAMPLE INFORMATION

Sample Name:	MS3	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ValidationDay1_20220317
Vial:	16	Acq. Method Set:	Cannabinoids_20220317
Injection #:	1	Processing Method:	Cannabinoids_20220317
Injection Volume:	2.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm
Date Acquired:	3/17/2022 8:54:38 PM PDT		
Date Processed:	3/22/2022 4:55:04 PM PDT		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.156	55941	21313	2.516	ppm
2	CBG	2.370	41650	15748	2.428	ppm
3	CBD	2.508	41754	15424	2.422	ppm
4	THCV	2.709	42093	14905	2.468	ppm
5	CBN	3.642	81606	23031	2.465	ppm
6	delta9-THC	4.554	39453	9270	2.450	ppm
7	delta8-THC	4.704	30918	7002	2.425	ppm
8	CBC	5.657	47405	9074	2.448	ppm
9	THCA	6.130	50620	7914	2.500	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 15 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/22/2022

7:49:26 PM US/Pacific

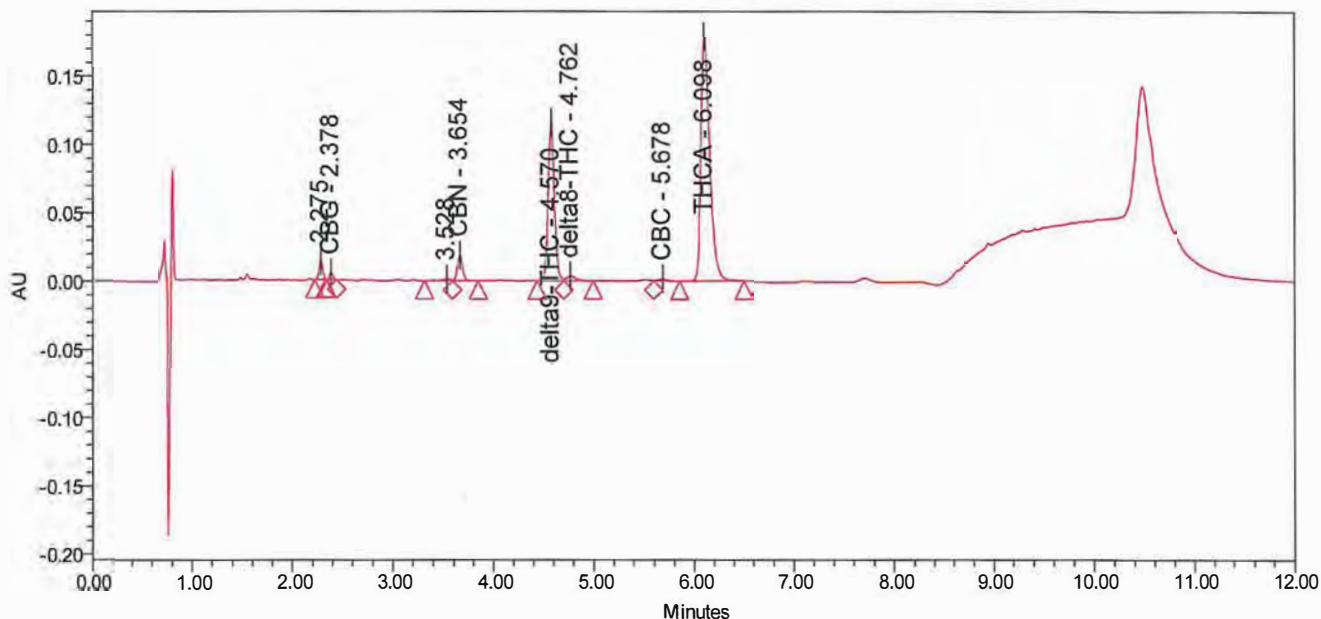
SAMPLE INFORMATION

Sample Name: F1-1_10x
 Sample Type: Unknown
 Vial: 17
 Injection #: 1
 Injection Volume: 2.00 μ l
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay1_20220317
 Acq. Method Set: Cannabinoids_20220317
 Processing Method: Cannabinoids_20220317
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/17/2022 9:07:14 PM PDT
 Date Processed: 3/22/2022 5:49:18 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.158				
2	CBG	2.378	12996	5117	0.802	ppm
3	CBD	2.506				
4	THCV	2.706				
5	CBN	3.654	67528	18898	2.053	ppm
6	$\delta_9\text{-THC}$	4.570	497299	115971	30.384	ppm
7	$\delta_8\text{-THC}$	4.762	22812	3590	1.805	ppm
8	CBC	5.678	8615	1536	0.476	ppm
9	THCA	6.098	1105502	179345	52.768	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 16 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/22/2022

7:49:26 PM US/Pacific

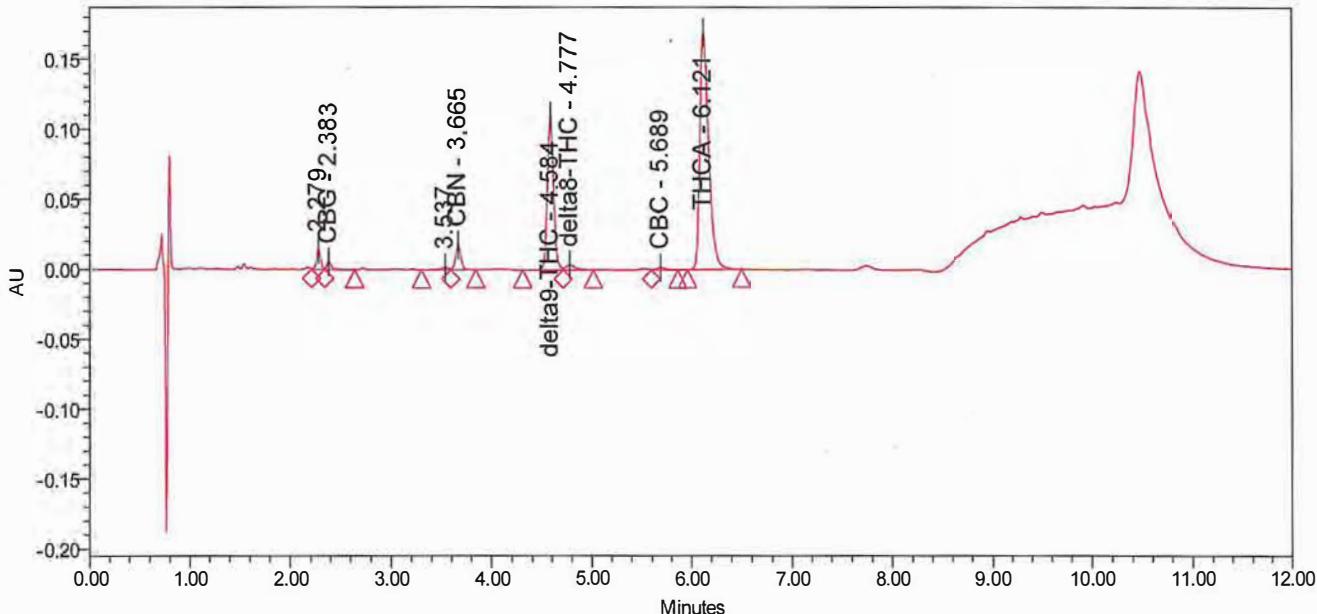
SAMPLE INFORMATION

Sample Name: F1-2_10x
 Sample Type: Unknown
 Vial: 18
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay1_20220317
 Acq. Method Set: Cannabinoids_20220317
 Processing Method: Cannabinoids_20220317
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/17/2022 9:19:51 PM PDT
 Date Processed: 3/22/2022 4:55:05 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.158				
2	CBG	2.383	19418	5534	1.166	ppm
3	CBD	2.506				
4	THCV	2.706				
5	CBN	3.665	63832	17803	1.945	ppm
6	delta9-THC	4.584	473028	109650	28.903	ppm
7	delta8-THC	4.777	22074	3465	1.749	ppm
8	CBC	5.689	9416	1513	0.516	ppm
9	THCA	6.121	1048302	169762	50.043	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 17 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/22/2022

7:49:26 PM US/Pacific

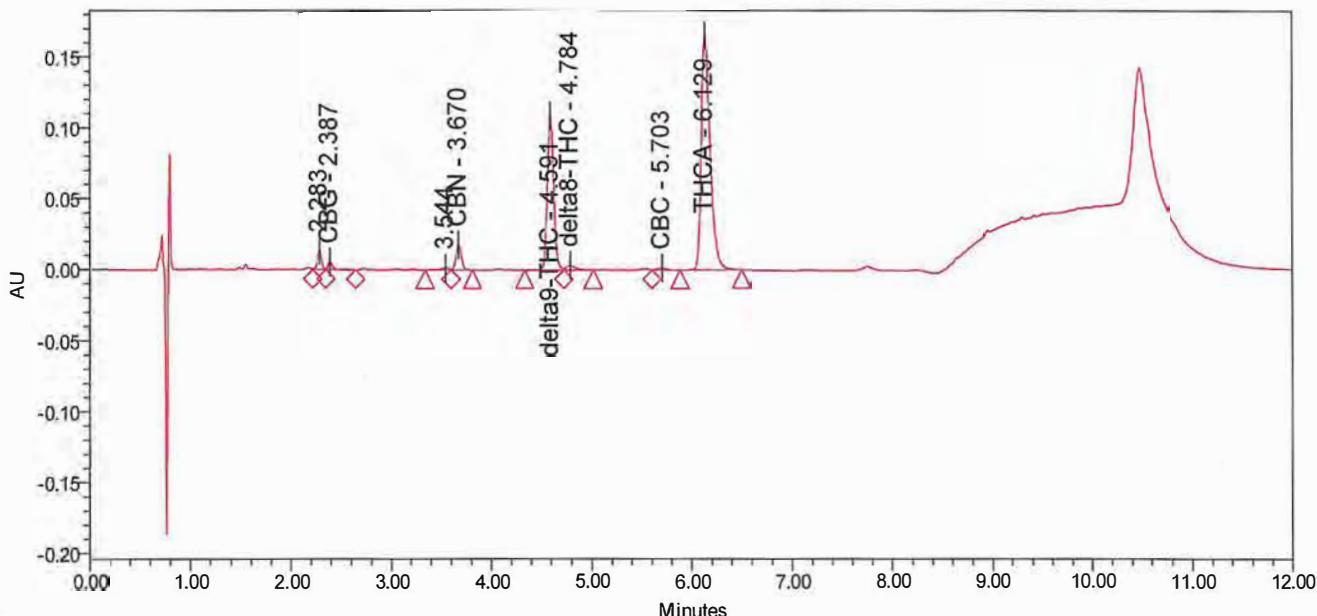
SAMPLE INFORMATION

Sample Name: F1-3_10x
 Sample Type: Unknown
 Vial: 19
 Injection #: 1
 Injection Volume: 2.00 μ l
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay1_20220317
 Acq. Method Set: Cannabinoids_20220317
 Processing Method: Cannabinoids_20220317
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/17/2022 9:57:49 PM PDT
 Date Processed: 3/22/2022 4:55:06 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.158				
2	CBG	2.387	19432	5561	1.167	ppm
3	CBD	2.506				
4	THCV	2.706				
5	CBN	3.670	62882	17635	1.917	ppm
6	delta9-THC	4.591	470486	108958	28.748	ppm
7	delta8-THC	4.784	20553	3323	1.632	ppm
8	CBC	5.703	9066	1492	0.499	ppm
9	THCA	6.129	1024118	165586	48.890	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 18 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/22/2022

7:49:26 PM US/Pacific

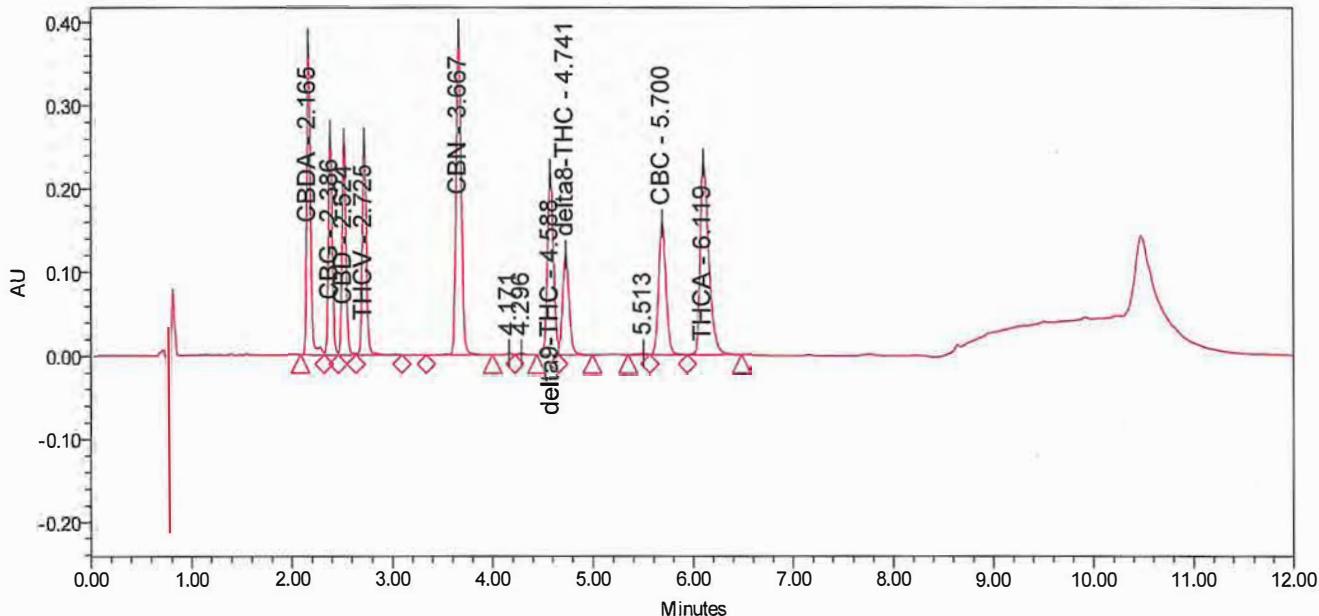
SAMPLE INFORMATION

Sample Name: F1-3_PDS_20x
 Sample Type: Unknown
 Vial: 20
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay1_20220317
 Acq. Method Set: Cannabinoids_20220317
 Processing Method: Cannabinoids_20220317
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/17/2022 10:10:26 PM PDT
 Date Processed: 3/22/2022 4:55:07 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.165	964657	376468	42.660	ppm
2	CBG	2.386	703068	265187	39.960	ppm
3	CBD	2.524	701311	256130	39.589	ppm
4	THCV	2.725	729830	256955	42.088	ppm
5	CBN	3.667	1380591	387979	40.506	ppm
6	delta9-THC	4.171	923149	218279	56.366	ppm
7	delta8-THC	4.588	551845	121027	42.269	ppm
8	CBC	5.700	819269	157910	41.703	ppm
9	THCA	6.119	1411659	230308	67.358	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 19 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/22/2022

7:49:26 PM US/Pacific

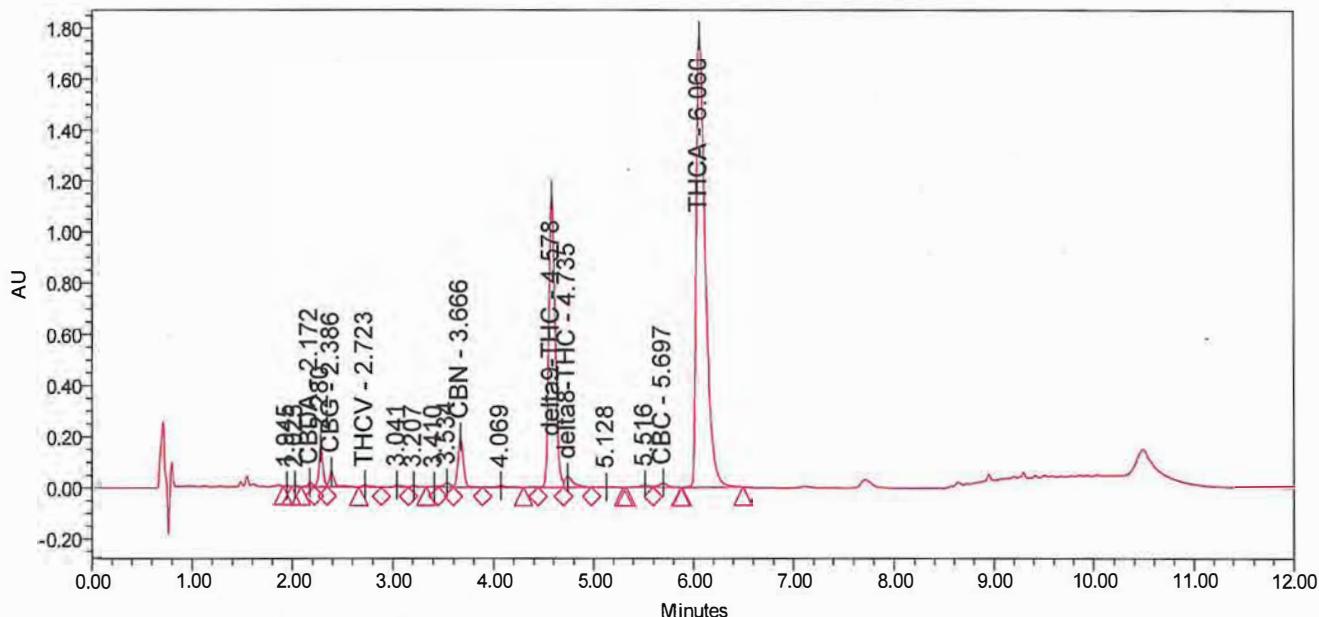
SAMPLE INFORMATION

Sample Name: F1-1_1x
 Sample Type: Unknown
 Vial: 21
 Injection #: 1
 Injection Volume: 2.00 μ l
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay1_20220317
 Acq. Method Set: Cannabinoids_20220317
 Processing Method: Cannabinoids_20220317
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/17/2022 10:23:01 PM PDT
 Date Processed: 3/22/2022 4:55:07 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.172	53423	16455	2.405	ppm
2	CBG	2.386	214192	61037	12.219	ppm
3	CBD	2.506				
4	THCV	2.723	38628	10001	2.269	ppm
5	CBN	3.666	704288	196551	20.700	ppm
6	delta9-THC	4.578	5039166	1144428	307.493	ppm
7	delta8-THC	4.735	249583	40431	19.150	ppm
8	CBC	5.697	95977	16415	4.919	ppm
9	THCA	6.060	11196232	1772619	533.625	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 20 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/22/2022

7:49:26 PM US/Pacific

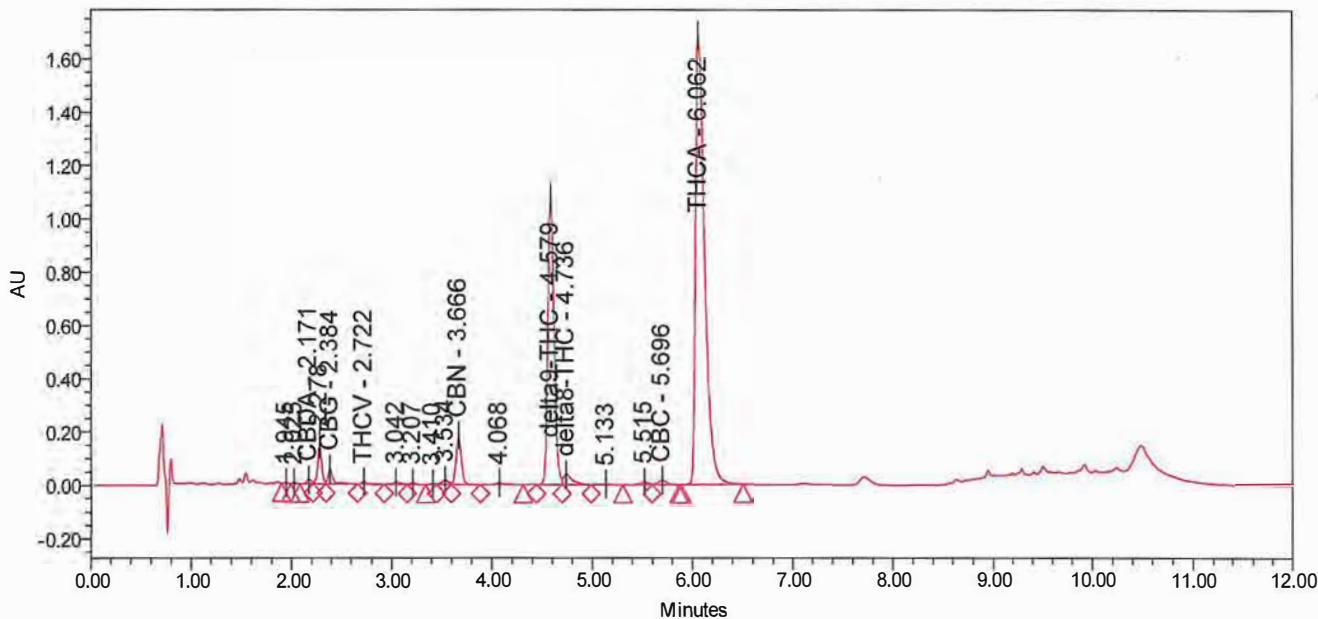
SAMPLE INFORMATION

Sample Name: F1-2_1x
 Sample Type: Unknown
 Vial: 22
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay1_20220317
 Acq. Method Set: Cannabinoids_20220317
 Processing Method: Cannabinoids_20220317
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/17/2022 10:35:37 PM PDT
 Date Processed: 3/22/2022 4:55:08 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.171	51404	15759	2.316	ppm
2	CBG	2.384	206745	57505	11.796	ppm
3	CBD	2.506				
4	THCV	2.722	39174	9608	2.300	ppm
5	CBN	3.666	657983	183432	19.344	ppm
6	delta9-THC	4.579	4753577	1081641	290.069	ppm
7	delta8-THC	4.736	237459	38312	18.223	ppm
8	CBC	5.696	89772	15340	4.603	ppm
9	THCA	6.062	10627456	1689726	506.521	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 21 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/22/2022

7:49:26 PM US/Pacific

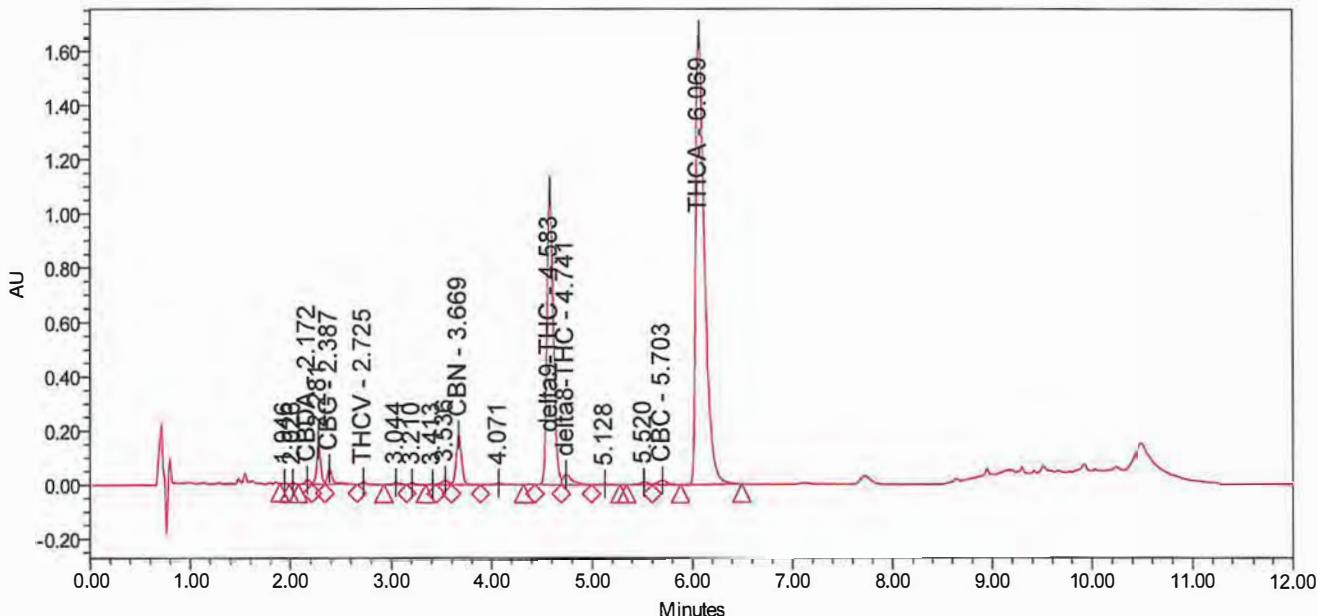
SAMPLE INFORMATION

Sample Name: F1-3_1x
 Sample Type: Unknown
 Vial: 23
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay1_20220317
 Acq. Method Set: Cannabinoids_20220317
 Processing Method: Cannabinoids_20220317
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/17/2022 10:48:13 PM PDT
 Date Processed: 3/22/2022 7:03:30 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.172	50565	15475	2.279	ppm
2	CBG	2.387	206692	57994	11.793	ppm
3	CBD	2.506				
4	THCV	2.725	37308	9455	2.193	ppm
5	CBN	3.669	656376	183618	19.356	ppm
6	delta9-THC	4.583	4759695	1083617	290.442	ppm
7	delta8-THC	4.741	238931	37609	18.335	ppm
8	CBC	5.703	89425	15333	4.586	ppm
9	THCA	6.069	10439916	1660950	497.584	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 22 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/22/2022

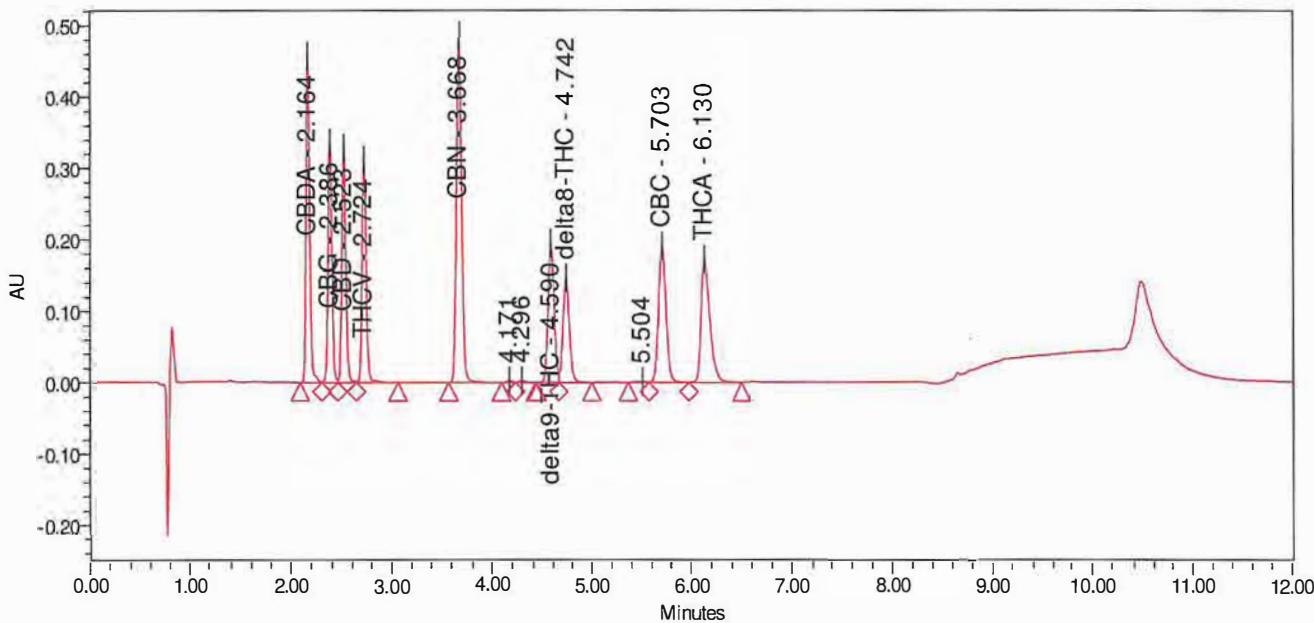
7:49:26 PM US/Pacific

SAMPLE INFORMATION

Sample Name: CCV_50ppm
Sample Type: Unknown
Vial: 7
Injection #: 1
Injection Volume: 2.00 ul
Run Time: 12.0 Minutes
Acquired By: System
Sample Set Name: ValidationDay1_20220317
Acq. Method Set: Cannabinoids_20220317
Processing Method: Cannabinoids_20220317
Channel Name: PDA Ch1 220nm@4.8nm
Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/17/2022 9:45:17 PM PDT
Date Processed: 3/22/2022 4:55:06 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.164	1147504	458914	50.737	ppm
2	CBG	2.386	893368	336832	50.759	ppm
3	CBD	2.523	900006	328445	50.786	ppm
4	THCV	2.724	881970	313116	50.852	ppm
5	CBN	3.668	1728137	486103	50.684	ppm
6	delta9-THC	4.590	829030	195494	50.624	ppm
7	delta8-THC	4.742	659376	146742	50.494	ppm
8	CBC	5.703	991836	190882	50.480	ppm
9	THCA	6.130	1059492	172571	50.576	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 1 of 1

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

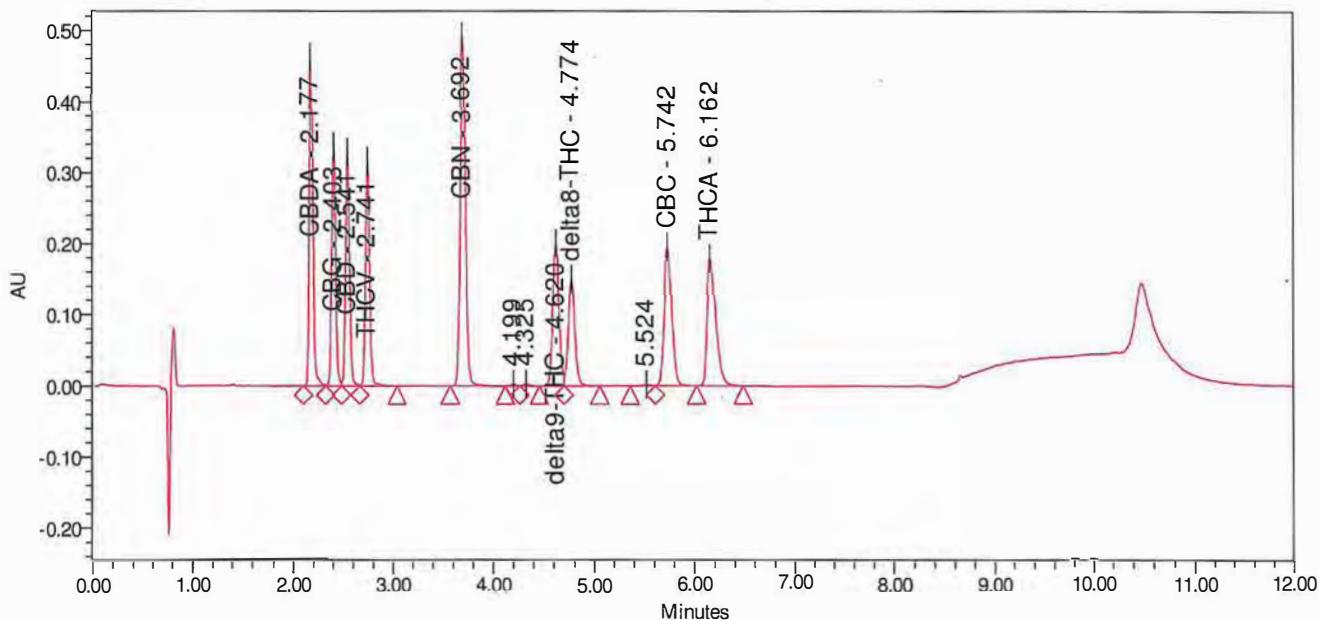
12:09:40 PM US/Pacific

SAMPLE INFORMATION

Sample Name: CCV_50ppm
Sample Type: Unknown
Vial: 7
Injection #: 1
Injection Volume: 2.00 ul
Run Time: 12.0 Minutes
Acquired By: System
Sample Set Name: ValidationDay1_20220317
Acq. Method Set: Cannabinoids_20220317
Processing Method: Cannabinoids_20220317
Channel Name: PDA Ch1 220nm@4.8nm
Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/18/2022 10:55:49 AM PDT
Date Processed: 3/22/2022 4:55:09 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.177	1173749	465322	51.896	ppm
2	CBG	2.403	915203	338041	51.998	ppm
3	CBD	2.541	922093	330280	52.030	ppm
4	THCV	2.741	904248	316418	52.136	ppm
5	CBN	3.692	1772394	492540	51.980	ppm
6	delta9-THC	4.620	854409	200185	52.172	ppm
7	delta8-THC	4.774	677716	149436	51.896	ppm
8	CBC	5.742	1017707	194911	51.795	ppm
9	THCA	6.162	1081872	178977	51.642	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 1 of 1

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

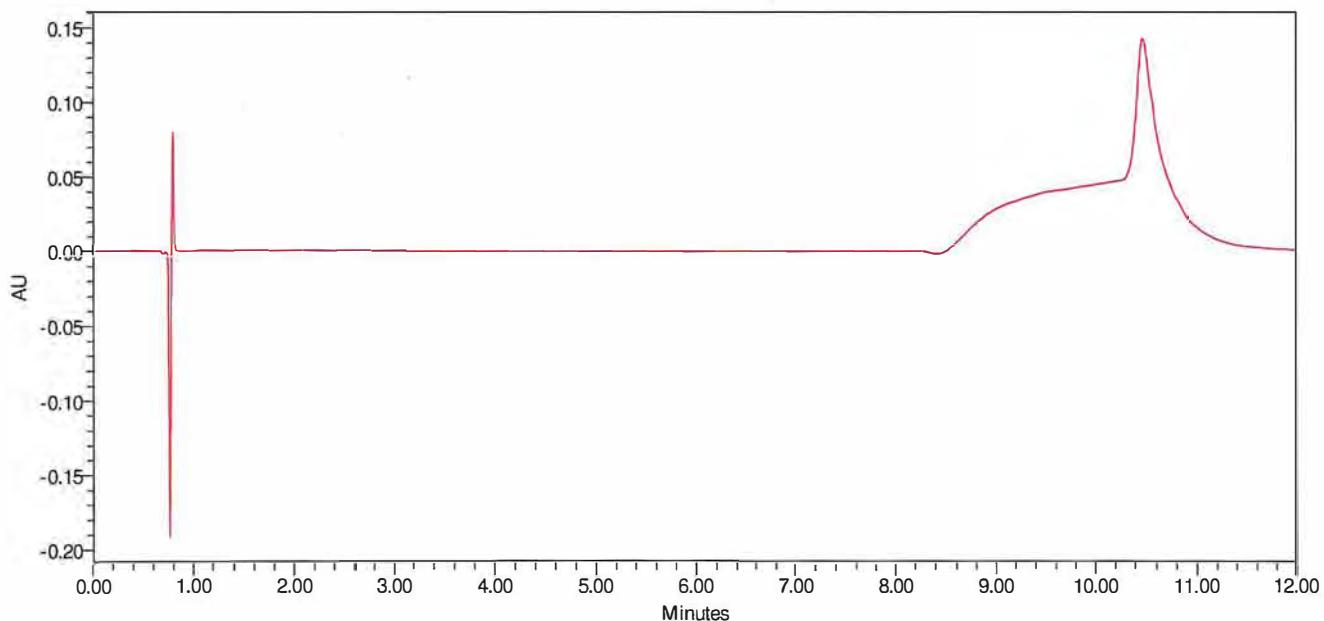
12:10:07 PM US/Pacific

SAMPLE INFORMATION

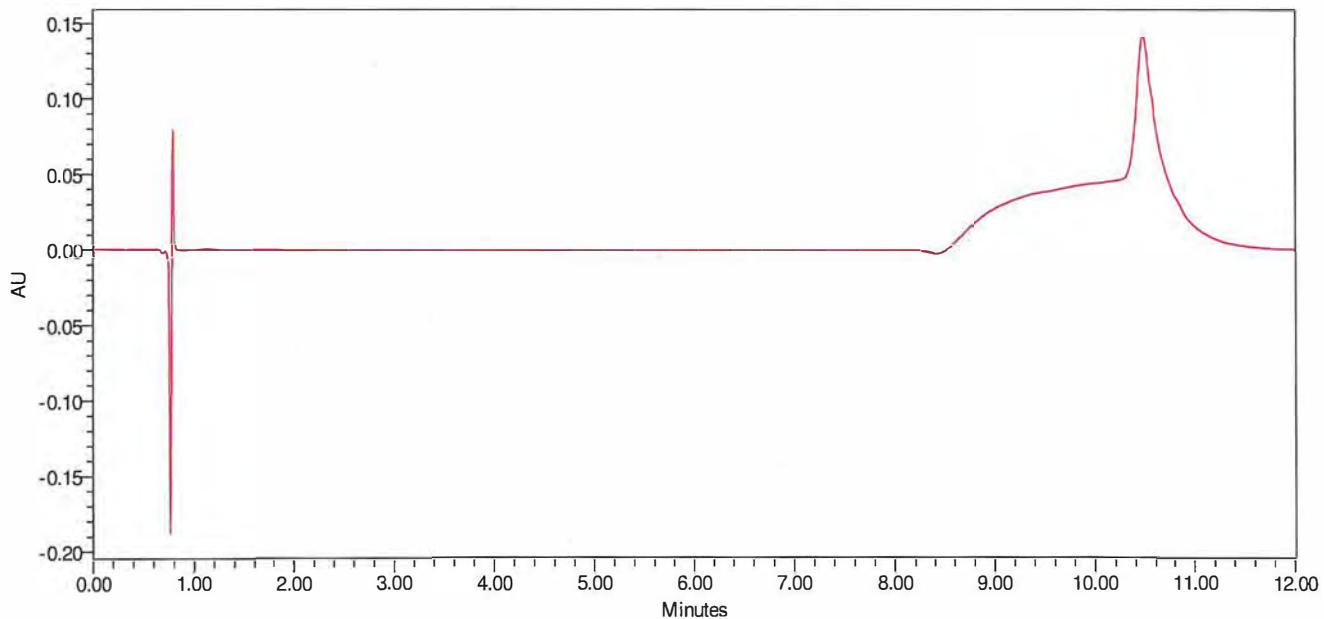
Sample Name:	SolvBlk	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ValidationDay1_20220317
Vial:	1	Acq. Method Set:	Cannabinoids_20220317
Injection #:	1, 2, 3	Processing Method	Cannabinoids_20220317
Injection Volume:	2.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm

Date Acquired: 3/17/2022 5:08:01 PM PDT, 3/17/2022 5:20:33 PM PDT, 3/17/2022 5:33:09 PM PDT,
Date Processed: 3/22/2022 4:54:56 PM PDT, 3/22/2022 4:54:57 PM PDT, 3/22/2022 4:55:00 PM PDT,

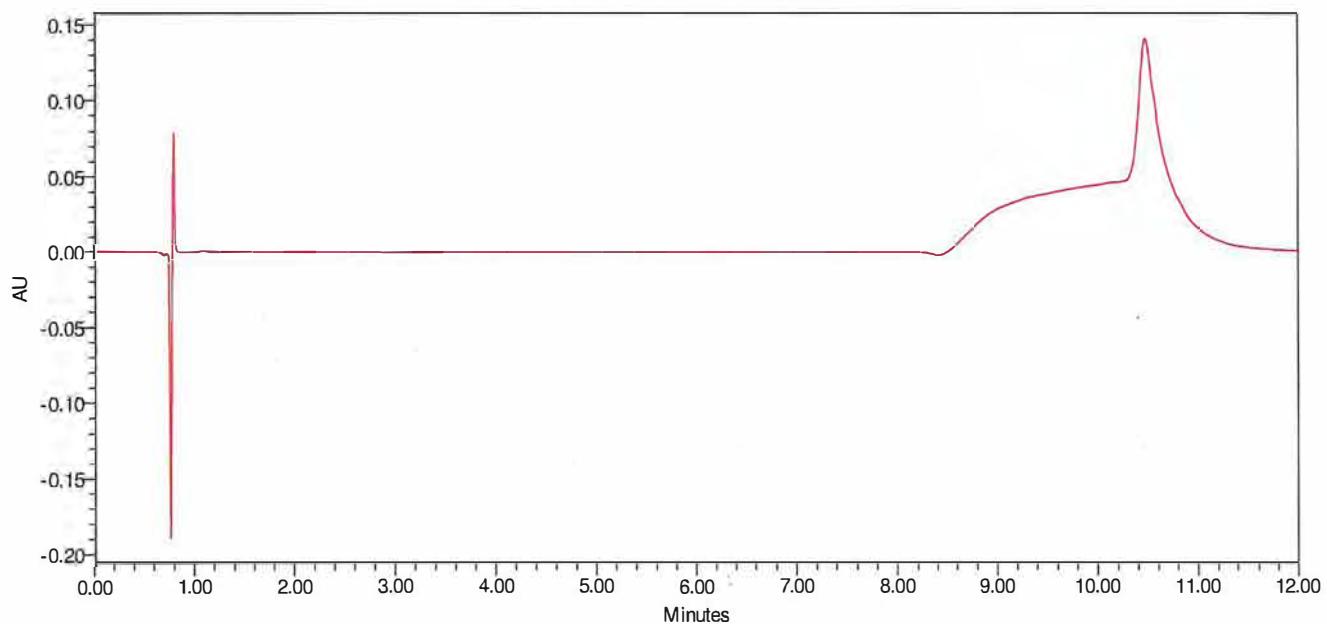
Auto-Scaled Chromatogram



Auto-Scaled Chromatogram



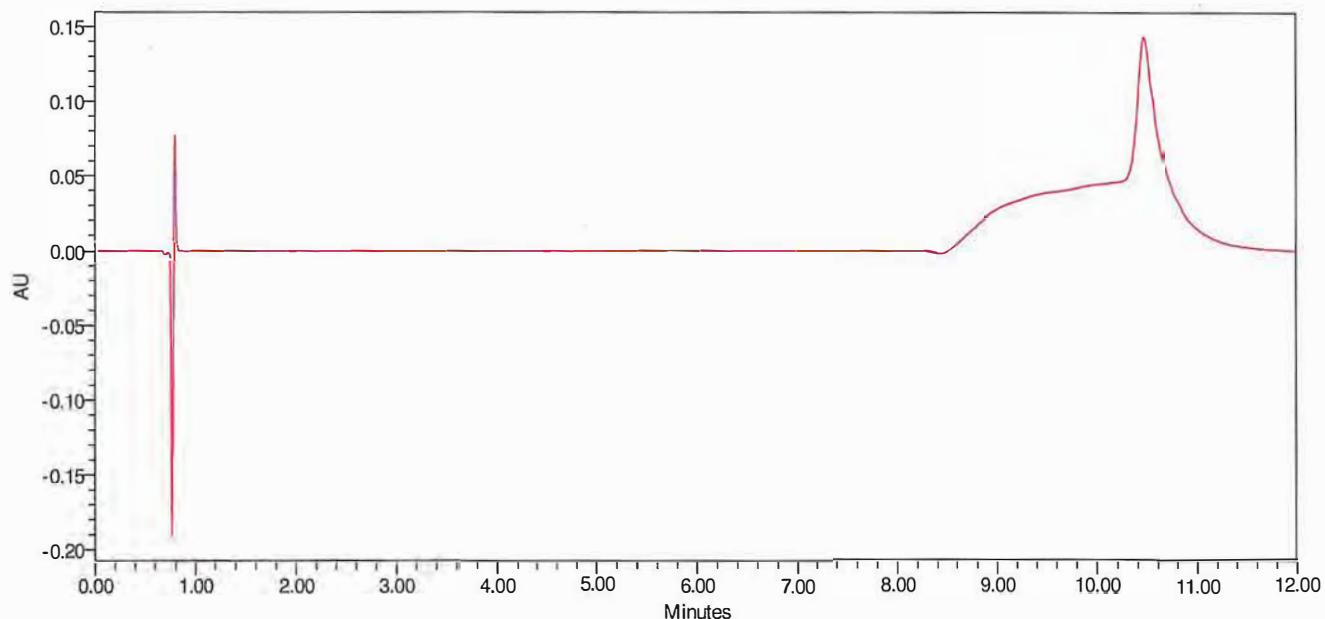
Auto-Scaled Chromatogram



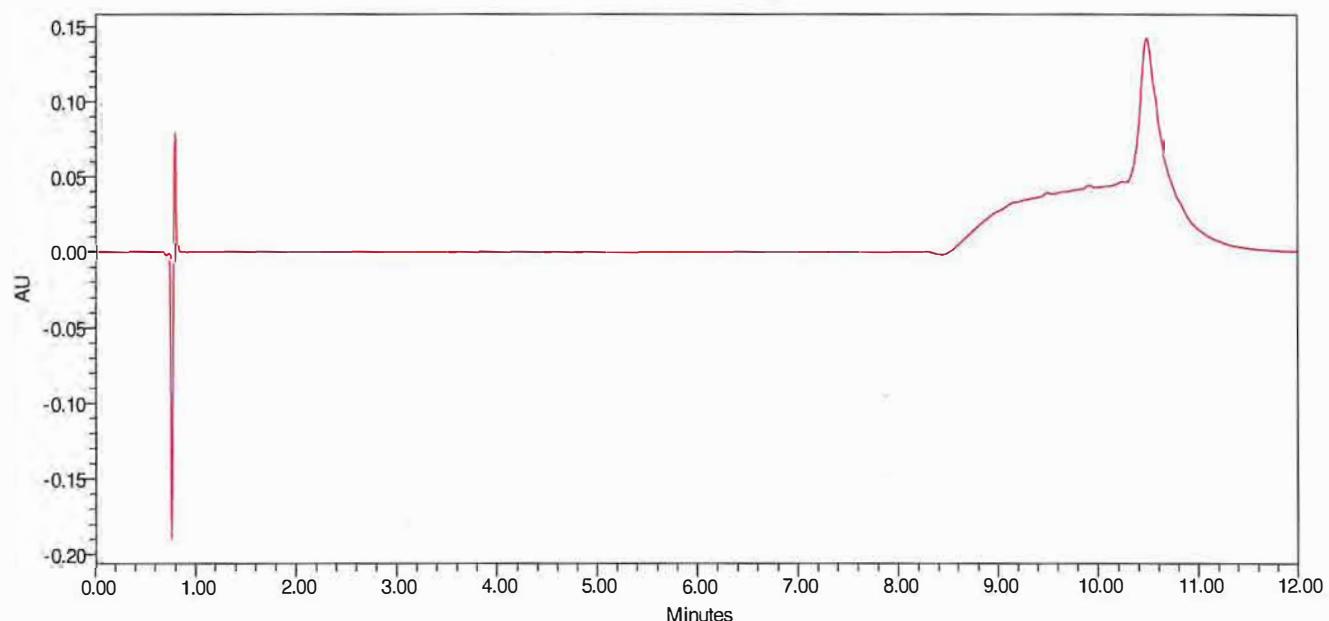
Reported by User: System
Report Method: Cannabinoids Quan Rep
Report Method ID: 13447
Page: 2 of 7

Project Name: 2021\Method Development Miao
Date Printed:
3/23/2022
12:10:49 PM US/Pacific

Auto-Scaled Chromatogram



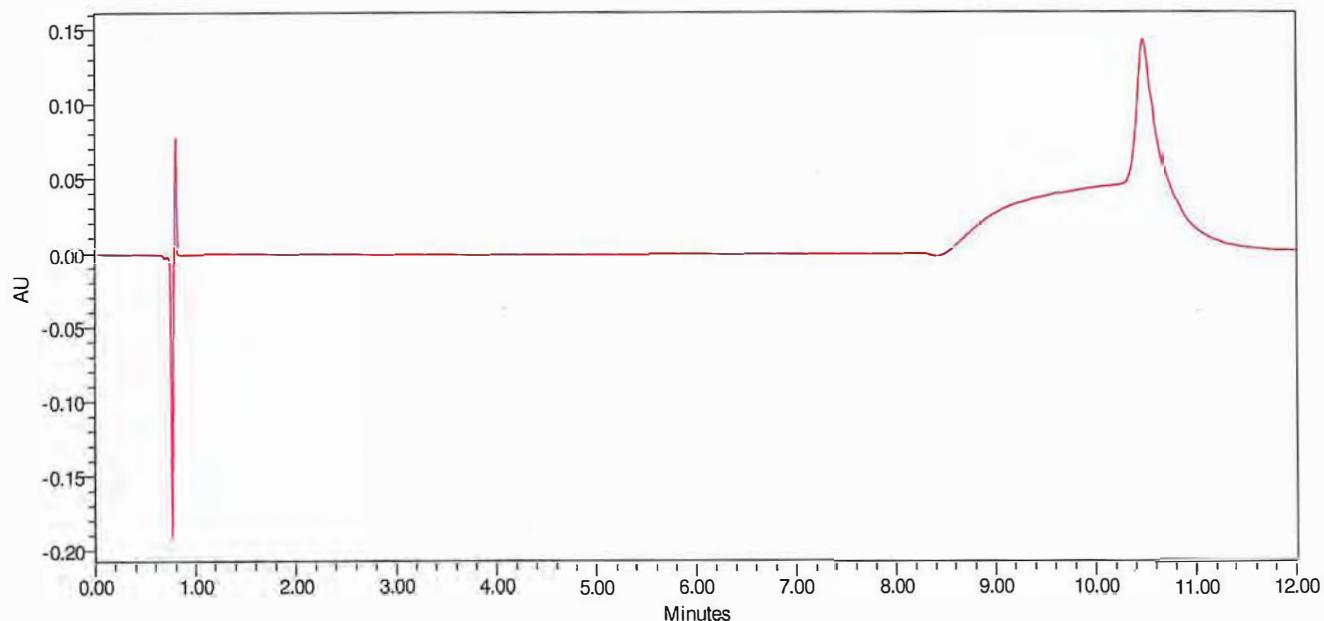
Auto-Scaled Chromatogram



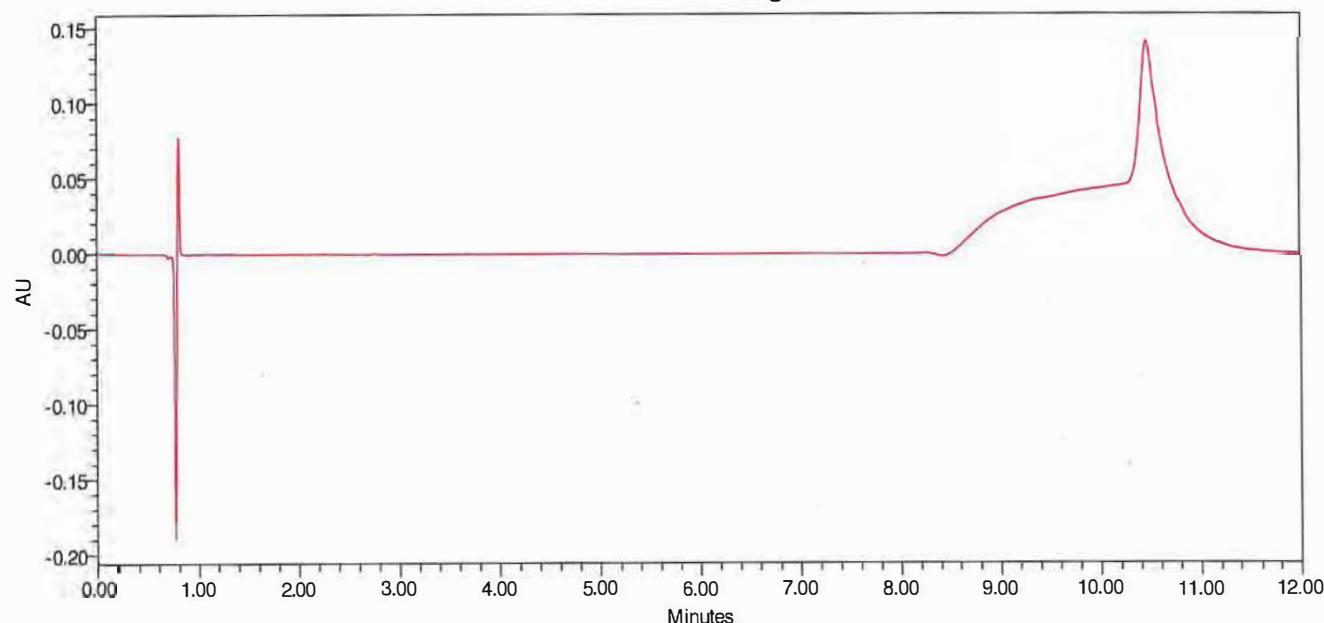
Reported by User: System
Report Method: Cannabinoids Quan Rep
Report Method ID: 13447
Page: 3 of 7

Project Name: 2021\Method Development Miao
Date Printed:
3/23/2022
12:10:49 PM US/Pacific

Auto-Scaled Chromatogram



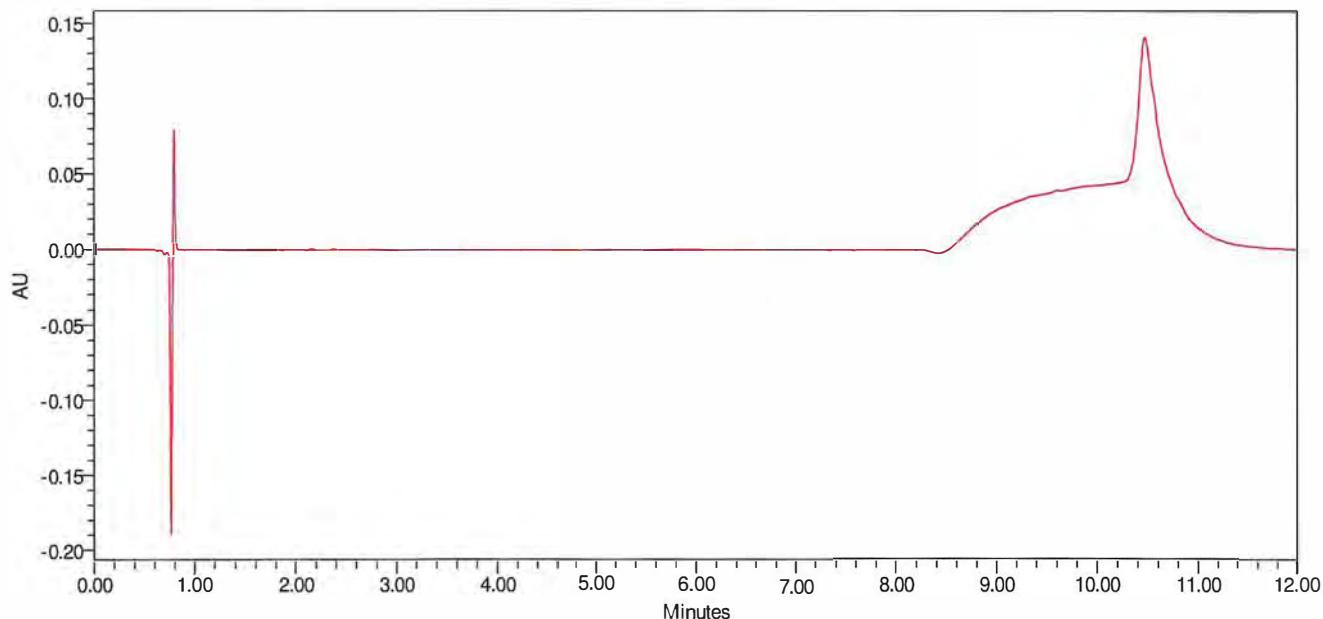
Auto-Scaled Chromatogram



Reported by User: System
Report Method: Cannabinoids Quan Rep
Report Method ID: 13447
Page: 4 of 7

Project Name: 2021\Method Development Miao
Date Printed:
3/23/2022
12:10:49 PM US/Pacific

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.158				
2	CBDA	2.158				
3	CBDA	2.158				
4	CBDA	2.158				
5	CBDA	2.158				
6	CBDA	2.158				
7	CBDA	2.158				
8	CBDA	2.158				
9	CBG	2.369				
10	CBG	2.369				
11	CBG	2.369				
12	CBG	2.369				
13	CBG	2.369				
14	CBG	2.369				
15	CBG	2.369				
16	CBG	2.369				
17	CBD	2.506				
18	CBD	2.506				
19	CBD	2.506				
20	CBD	2.506				
21	CBD	2.506				
22	CBD	2.506				
23	CBD	2.506				

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 5 of 7

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

12:10:49 PM US/Pacific

Peak Results

	Name	RT	Area	Height	Amount	Units
24	CBD	2.506				
25	THCV	2.706				
26	THCV	2.706				
27	THCV	2.706				
28	THCV	2.706				
29	THCV	2.706				
30	THCV	2.706				
31	THCV	2.706				
32	THCV	2.706				
33	CBN	3.633				
34	CBN	3.633				
35	CBN	3.633				
36	CBN	3.633				
37	CBN	3.633				
38	CBN	3.633				
39	CBN	3.633				
40	CBN	3.633				
41	delta9-THC	4.546				
42	delta9-THC	4.546				
43	delta9-THC	4.546				
44	delta9-THC	4.546				
45	delta9-THC	4.546				
46	delta9-THC	4.546				
47	delta9-THC	4.546				
48	delta9-THC	4.546				
49	delta8-THC	4.694				
50	delta8-THC	4.694				
51	delta8-THC	4.694				
52	delta8-THC	4.694				
53	delta8-THC	4.694				
54	delta8-THC	4.694				
55	delta8-THC	4.694				
56	delta8-THC	4.694				
57	CBC	5.636				
58	CBC	5.636				
59	CBC	5.636				
60	CBC	5.636				
61	CBC	5.636				
62	CBC	5.636				
63	CBC	5.636				
64	CBC	5.636				

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 6 of 7

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

12:10:49 PM US/Pacific

Peak Results

	Name	RT	Area	Height	Amount	Units
65	THCA	6.131				
66	THCA	6.131				
67	THCA	6.131				
68	THCA	6.131				
69	THCA	6.131				
70	THCA	6.131				
71	THCA	6.131				
72	THCA	6.131				

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

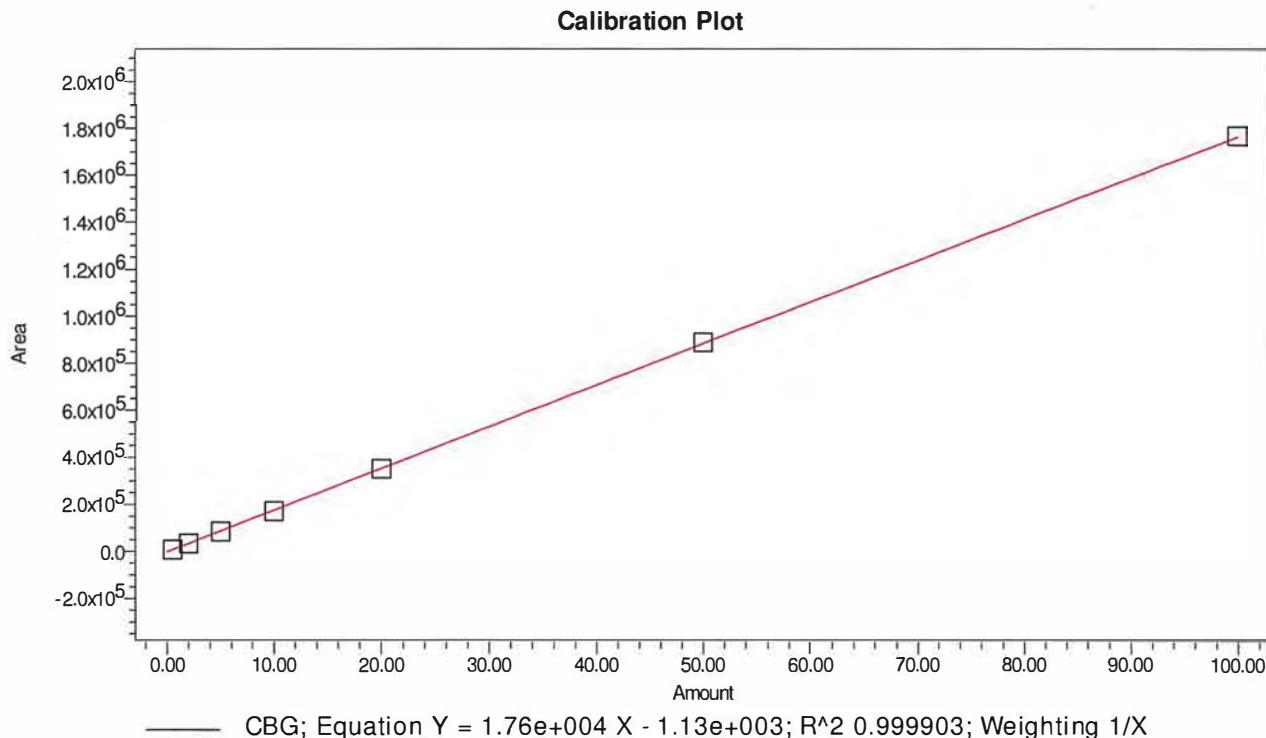
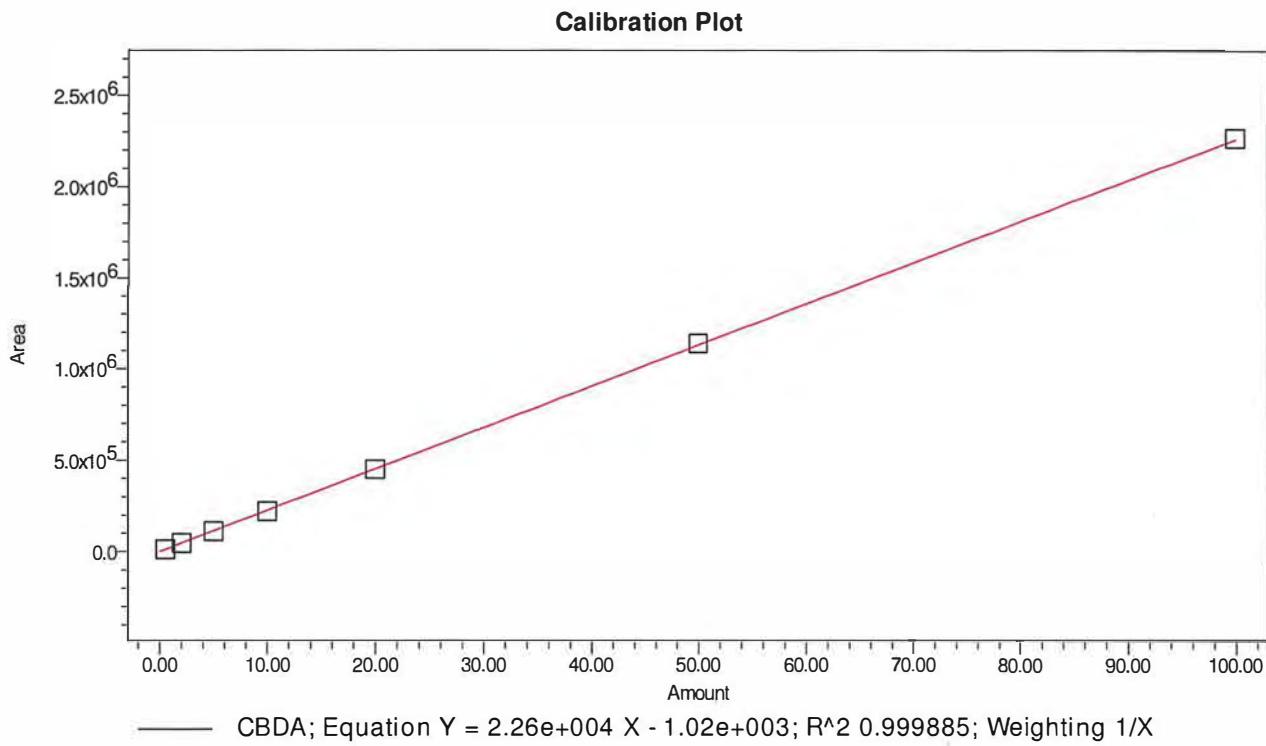
Page: 7 of 7

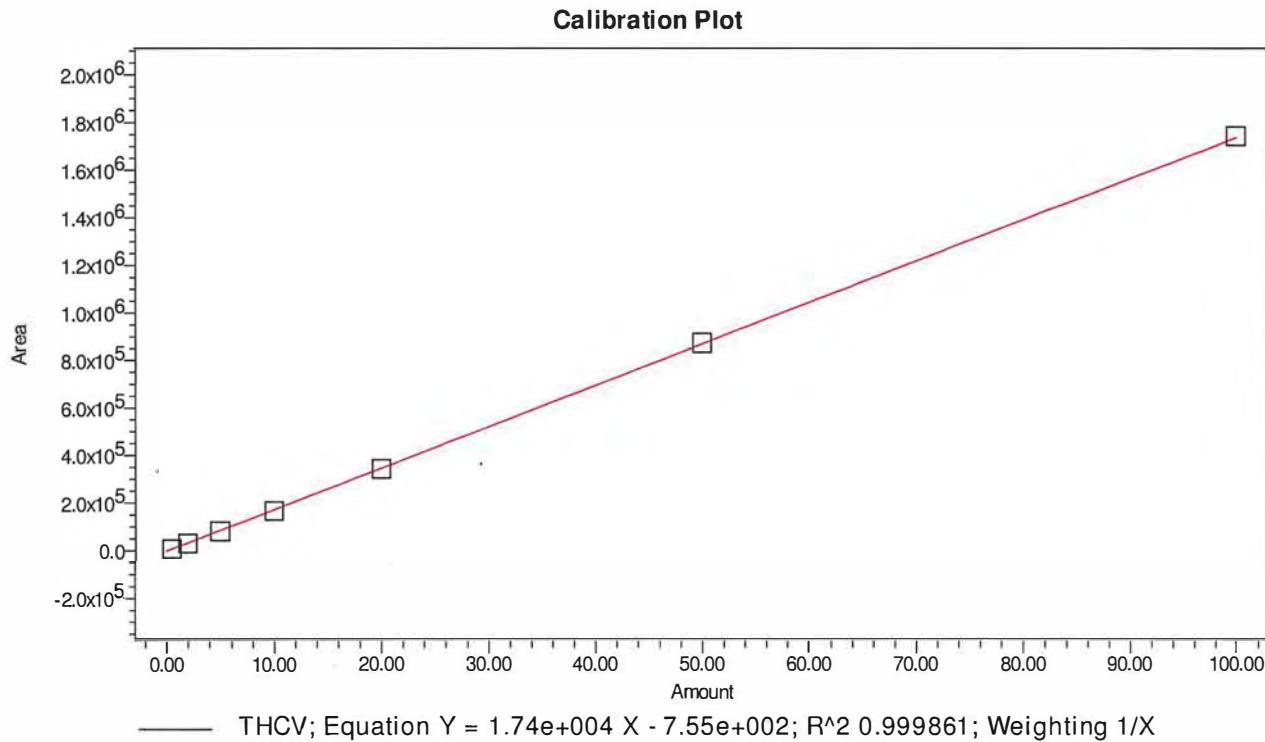
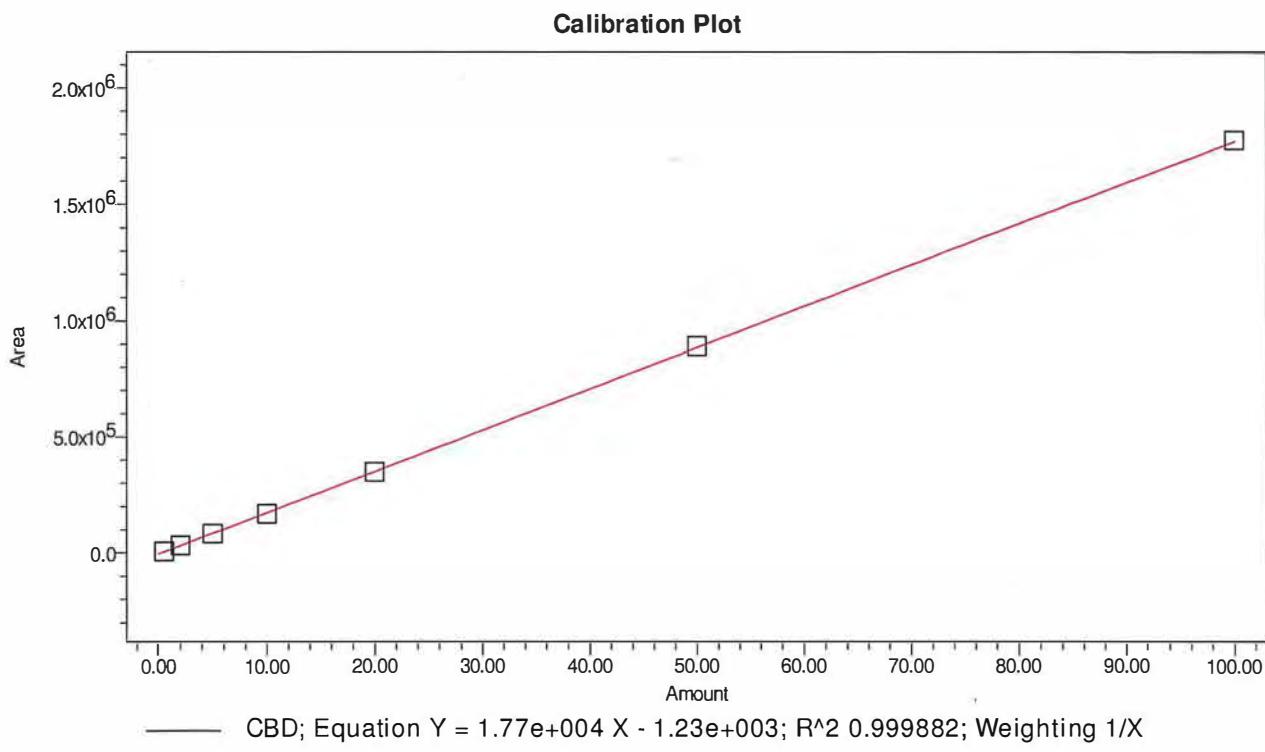
Project Name: 2021\Method Development Miao

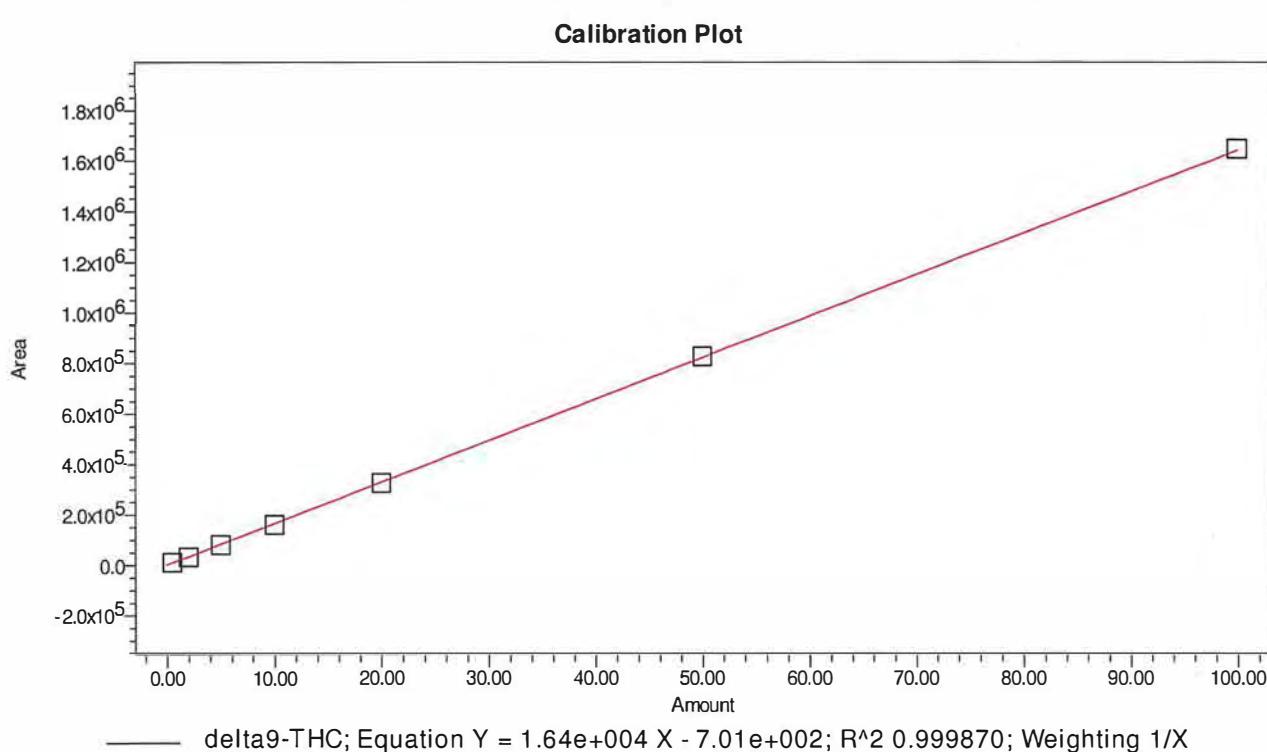
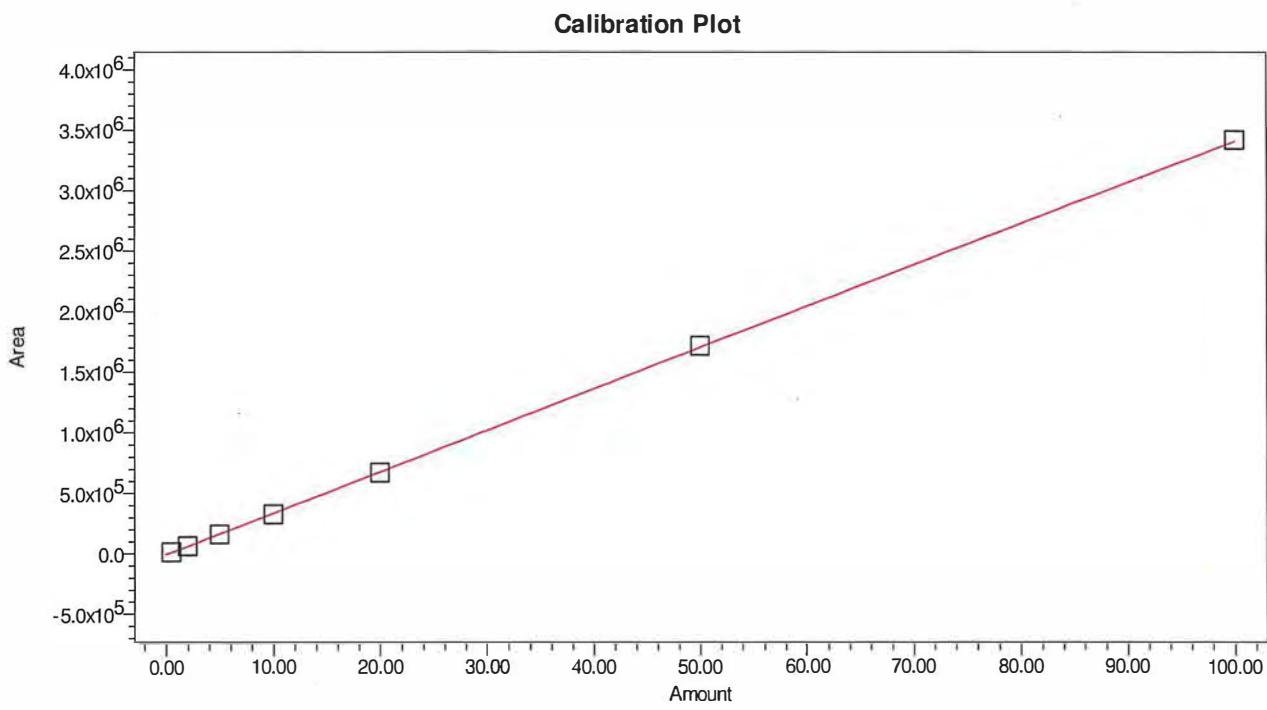
Date Printed:

3/23/2022

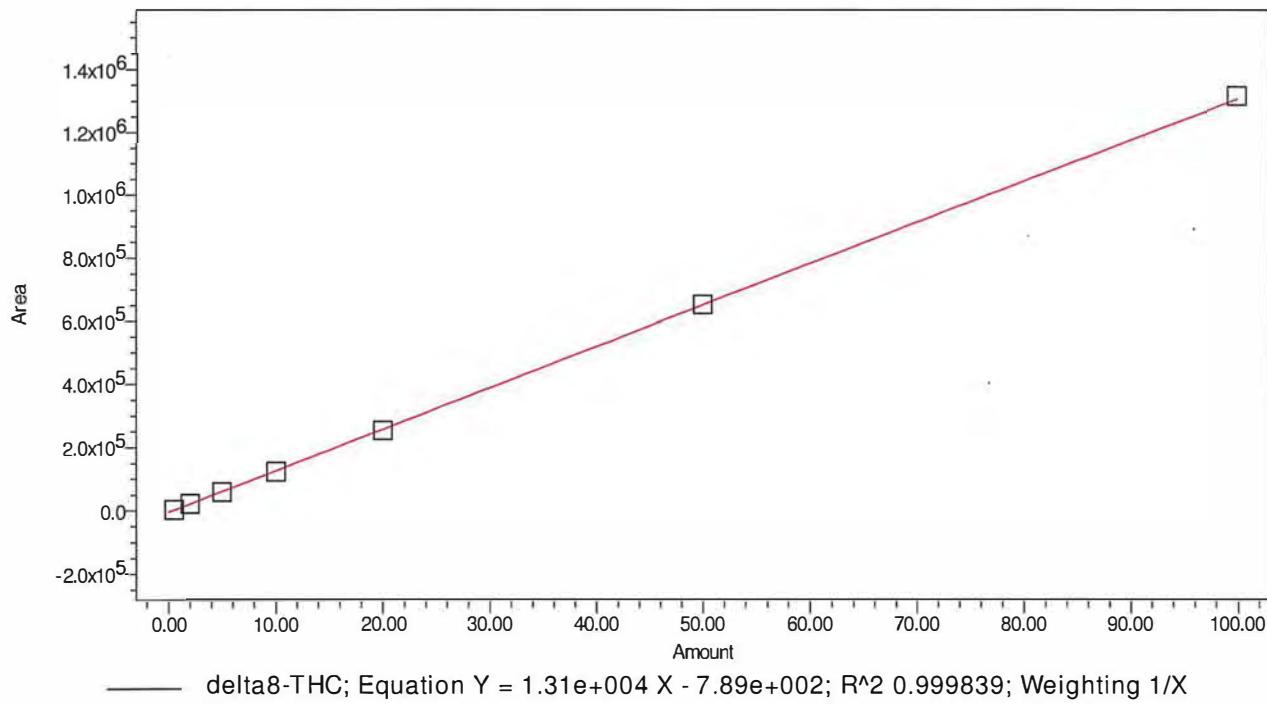
12:10:49 PM US/Pacific



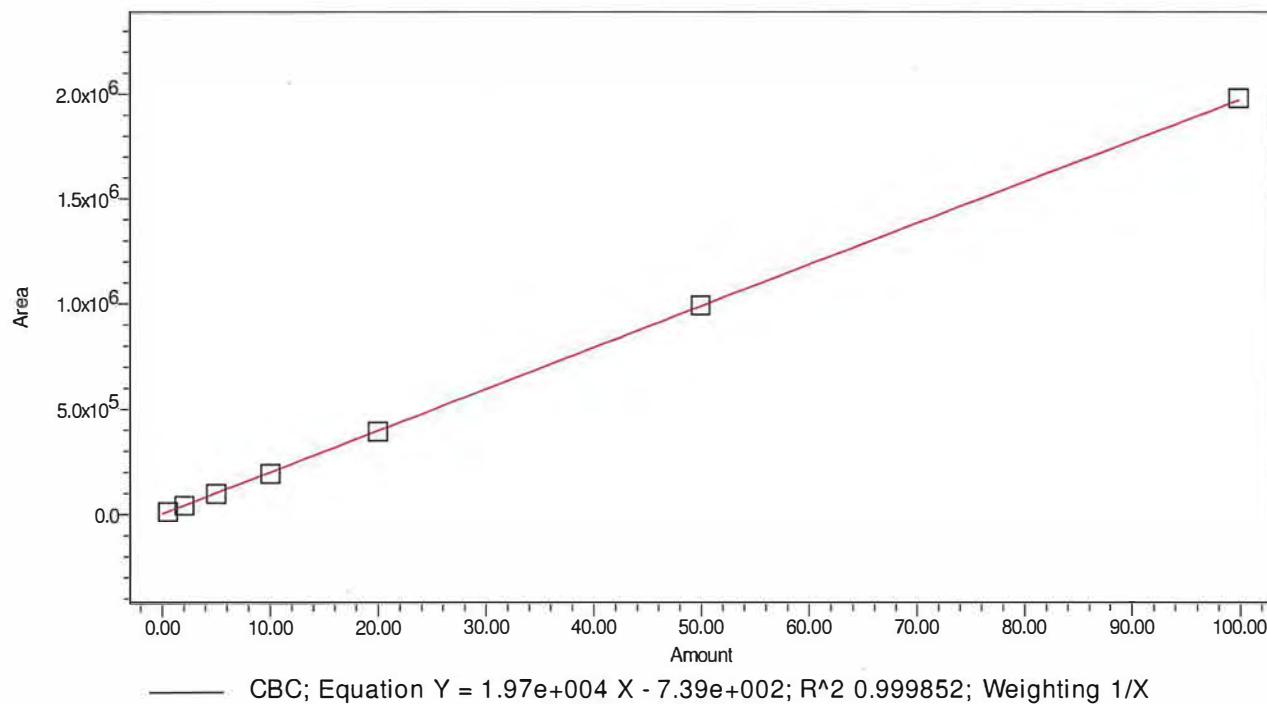


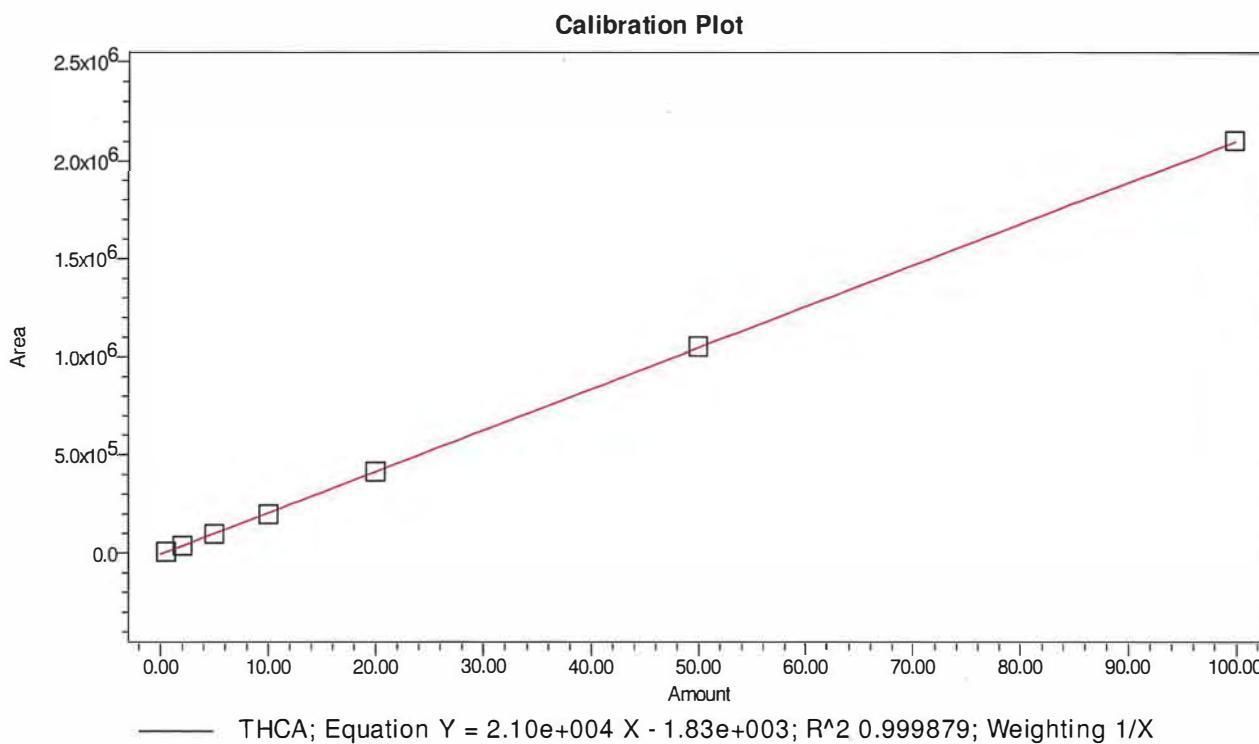


Calibration Plot



Calibration Plot





Peak CBDA

	Name	Level	Retention Time (min)	Area ($\mu V \cdot sec$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	CBDA	Level 1	2.159	11102	11.600	4078	0.500000	0.535528	ppm	7.106	No
2	CBDA	Level 2	2.160	43562	12.600	16604	2.000000	1.969461	ppm	-1.527	No
3	CBDA	Level 3	2.160	108871	12.700	42198	5.000000	4.854565	ppm	-2.909	No
4	CBDA	Level 4	2.162	218344	12.800	85026	10.000000	9.690629	ppm	-3.094	No
5	CBDA	Level 5	2.157	449764	12.200	178168	20.000000	19.913799	ppm	-0.431	No
6	CBDA	Level 6	2.155	1138034	12.700	460058	50.000000	50.318766	ppm	0.638	No
7	CBDA	Level 7	2.155	2267575	12.600	928797	100.000000	100.217252	ppm	0.217	No

Peak CBG

	Name	Level	Retention Time (min)	Area ($\mu V \cdot sec$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	CBG	Level 1	2.374	8199	10.000	3086	0.500000	0.529493	ppm	5.899	No
2	CBG	Level 2	2.375	33866	9.100	12572	2.000000	1.985973	ppm	-0.701	No
3	CBG	Level 3	2.377	84880	10.100	31651	5.000000	4.880809	ppm	-2.384	No
4	CBG	Level 4	2.379	169752	9.600	63419	10.000000	9.696900	ppm	-3.031	No
5	CBG	Level 5	2.374	349317	9.600	131606	20.000000	19.886364	ppm	-0.568	No
6	CBG	Level 6	2.373	884671	9.500	336257	50.000000	50.265183	ppm	0.530	No
7	CBG	Level 7	2.375	1765627	9.400	676017	100.000000	100.255277	ppm	0.255	No

Reported by User: System

Report Method: Calibration curves

Report Method ID: 12679

Page: 5 of 7

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

11:09:12 AM US/Pacific

Peak CBD

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	CBD	Level 1	2.512	8307	10.200	2999	0.500000	0.537219	ppm	7.444	No
2	CBD	Level 2	2.513	33509	10.500	12305	2.000000	1.957366	ppm	-2.132	No
3	CBD	Level 3	2.515	85484	10.500	31130	5.000000	4.886217	ppm	-2.276	No
4	CBD	Level 4	2.517	170373	10.300	62295	10.000000	9.669849	ppm	-3.302	No
5	CBD	Level 5	2.512	351678	11.200	128867	20.000000	19.886699	ppm	-0.567	No
6	CBD	Level 6	2.511	890836	11.000	326817	50.000000	50.269038	ppm	0.538	No
7	CBD	Level 7	2.512	1778559	10.600	652555	100.000000	100.293613	ppm	0.294	No

Peak THCV

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	THCV	Level 1	2.714	8740	13.600	2939	0.500000	0.546964	ppm	9.393	No
2	THCV	Level 2	2.714	32541	13.600	11706	2.000000	1.918119	ppm	-4.094	No
3	THCV	Level 3	2.716	83871	17.900	29711	5.000000	4.875162	ppm	-2.497	No
4	THCV	Level 4	2.718	167306	19.900	59376	10.000000	9.681694	ppm	-3.183	No
5	THCV	Level 5	2.713	344912	23.400	122711	20.000000	19.913291	ppm	-0.434	No
6	THCV	Level 6	2.712	871515	22.000	311522	50.000000	50.249965	ppm	0.500	No
7	THCV	Level 7	2.714	1740570	26.100	620332	100.000000	100.314806	ppm	0.315	No

Peak CBN

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	CBN	Level 1	3.651	15634	11.200	4450	0.500000	0.533060	ppm	6.612	No
2	CBN	Level 2	3.651	64803	17.100	18269	2.000000	1.972969	ppm	-1.352	No
3	CBN	Level 3	3.654	164065	19.400	46317	5.000000	4.879841	ppm	-2.403	No
4	CBN	Level 4	3.656	329234	22.600	92498	10.000000	9.716804	ppm	-2.832	No
5	CBN	Level 5	3.649	674090	25.700	190378	20.000000	19.815914	ppm	-0.920	No
6	CBN	Level 6	3.647	1715503	30.300	483880	50.000000	50.313624	ppm	0.627	No
7	CBN	Level 7	3.650	3421299	36.700	967157	100.000000	100.267788	ppm	0.268	No

Peak delta9-THC

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	delta9-THC	Level 1	4.569	8151	10.600	1856	0.500000	0.540097	ppm	8.019	No
2	delta9-THC	Level 2	4.568	31228	11.300	7381	2.000000	1.948096	ppm	-2.595	No
3	delta9-THC	Level 3	4.570	79533	13.000	18688	5.000000	4.895290	ppm	-2.094	No
4	delta9-THC	Level 4	4.573	157797	16.600	37220	10.000000	9.670346	ppm	-3.297	No
5	delta9-THC	Level 5	4.565	324056	14.100	76776	20.000000	19.814173	ppm	-0.929	No
6	delta9-THC	Level 6	4.561	823130	15.100	195382	50.000000	50.263765	ppm	0.528	No

Reported by User: System

Report Method: Calibration curves

Report Method ID: 12679

Page: 6 of 7

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

11:09:12 AM US/Pacific

Peak delta9-THC

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
7	delta9-THC	Level 7	4.565	1644350	16.600	392420	100.000000	100.368234	ppm	0.368	No

Peak delta8-THC

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	delta8-THC	Level 1	4.717	6282	12.700	1390	0.500000	0.540875	ppm	8.175	No
2	delta8-THC	Level 2	4.719	25020	14.900	5547	2.000000	1.974098	ppm	-1.295	No
3	delta8-THC	Level 3	4.721	62531	16.700	13978	5.000000	4.843132	ppm	-3.137	No
4	delta8-THC	Level 4	4.725	126046	18.800	28001	10.000000	9.701138	ppm	-2.989	No
5	delta8-THC	Level 5	4.716	256695	19.200	57546	20.000000	19.694032	ppm	-1.530	No
6	delta8-THC	Level 6	4.712	653304	19.700	146561	50.000000	50.029150	ppm	0.058	No
7	delta8-THC	Level 7	4.717	1316017	27.200	292214	100.000000	100.717575	ppm	0.718	No

Peak CBC

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	CBC	Level 1	5.674	9694	18.400	1809	0.500000	0.530603	ppm	6.121	No
2	CBC	Level 2	5.675	38809	26.600	7224	2.000000	2.011298	ppm	0.565	No
3	CBC	Level 3	5.677	94887	24.700	18198	5.000000	4.863279	ppm	-2.734	No
4	CBC	Level 4	5.680	188600	26.700	36381	10.000000	9.629275	ppm	-3.707	No
5	CBC	Level 5	5.667	388050	24.400	74888	20.000000	19.772757	ppm	-1.136	No
6	CBC	Level 6	5.662	986331	23.900	191429	50.000000	50.199647	ppm	0.399	No
7	CBC	Level 7	5.669	1975246	23.200	383686	100.000000	100.493142	ppm	0.493	No

Peak THCA

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	THCA	Level 1	6.150	9308	17.200	1475	0.500000	0.530982	ppm	6.196	No
2	THCA	Level 2	6.149	39786	24.400	6302	2.000000	1.983353	ppm	-0.832	No
3	THCA	Level 3	6.143	100835	27.900	16060	5.000000	4.892562	ppm	-2.149	No
4	THCA	Level 4	6.137	200227	28.300	32213	10.000000	9.628914	ppm	-3.711	No
5	THCA	Level 5	6.111	416479	30.100	67490	20.000000	19.934070	ppm	-0.330	No
6	THCA	Level 6	6.086	1053603	31.600	172519	50.000000	50.295123	ppm	0.590	No
7	THCA	Level 7	6.080	2101586	31.900	347002	100.000000	100.234995	ppm	0.235	No

Reported by User: System

Report Method: Calibration curves

Report Method ID: 12679

Page: 7 of 7

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

11:09:12 AM US/Pacific

Sample Name	Weight (g)	Concentration in 1:10 dilution of 40 ml ACN:MeOH 80:20 Extract (mg/L)									Concentration in sample (mg/g) calculated from 1:10 dilution									
		CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC	
F2-1_10x	0.2006	0.000	0.000	0.000	0.799	1.935	28.748	1.678	49.916	0.527	0.000	0.000	0.000	1.593	3.858	57.324	3.346	99.533	1.051	
F2-2_10x	0.2000	0.000	0.000	0.000	1.150	1.883	27.881	1.480	48.219	0.512	0.000	0.000	0.000	2.300	3.766	55.762	2.960	96.438	1.024	
Concentration in 40 ml ACN:MeOH 80:20 Extract (mg/L)																				
MS1	0.2001	2.577	2.447	2.371	2.395	2.395	2.534	2.521	2.615	2.580	0.103	0.098	0.095	0.096	0.096	0.101	0.101	0.105	0.103	
Amount spiked											0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
Recovery											103%	98%	95%	96%	96%	101%	101%	105%	103%	
Concentration in 1:20 dilution of 40 ml Sample Extract (mg/L)																				
Post-dilution Spike		41.626	41.162	39.297	39.679	39.554	54.909	41.789	64.778	41.116										
Amount spiked		40	40	40	40	40	40	40	40	40										
Unspiked sample		0.000	0	0	1.15	1.883	27.881	1.48	48.219	0.512										
Recovery		104%	103%	98%	98%	97%	102%	103%	102%	102%										
Concentration in 40 ml ACN:MeOH 80:20 Extract (mg/L)																				
Method blank		CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC	
Matrix blank 1	0.2033	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	0	0	0	0	0	0	0	0	0	

Sample Name	Weight (g)	Concentration in 1:1 dilution of 40 ml Sample Extract (mg/L)									Concentration in sample (mg/g) calculated from 1:1 dilution								
		CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
F2-1_1x	0.2006	2.287	2.117	0.000	11.497	19.673	292.051	18.254	509.029	4.676	0.456	0.422	0.000	2.293	3.923	58.235	3.640	101.501	0.932
F2-2_1x	0.2000	2.269	2.123	0.000	11.396	19.137	284.020	17.724	493.654	4.559	0.454	0.425	0.000	2.279	3.827	56.804	3.545	98.731	0.912

day 2

Note: For Δ9-THC and THCA
For all the other cannabinoids

Concentration in sample (mg/g) = (Concentration in 1: 10 of 40ml sample extract ug/L) x 10 x 40 / Weight (g) / 1000 / 1000
Concentration in sample (mg/g) = (Concentration in 1: 1 of 40ml sample extract ug/L) x 1 x 40 / Weight (g) / 1000 / 1000

	Cannabinoids Concentration in Sample (mg/g)								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
F2-1	0.456	0.422	0.000	2.293	3.923	57.324	3.640	99.533	0.932
F2-2	0.454	0.425	0.000	2.279	3.827	55.762	3.545	96.438	0.912
RL	0.100	0.100	0.100	0.100	0.100	1.000	0.100	1.000	0.100
AVG	0.455	0.423	<RL	2.286	3.875	56.543	3.592	97.986	0.922
RPD	0.5%	0.6%		0.6%	2.5%	2.8%	2.6%	3.2%	2.2%
	Cannabinoids Concentration in Sample (%)								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
F2-1	0.046	0.042	0.000	0.229	0.392	5.732	0.364	9.953	0.093
F2-2	0.045	0.042	0.000	0.228	0.383	5.576	0.354	9.644	0.091

Sample Name	Retention Time (min)								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
9Mix_0.5ppm_Std	2.17	2.73	2.53	2.39	3.67	4.60	4.75	6.18	5.71
9Mix_2ppm_Std	2.17	2.73	2.53	2.39	3.68	4.60	4.75	6.18	5.71
9Mix_5ppm_Std	2.17	2.73	2.53	2.39	3.67	4.59	4.74	6.17	5.71
9Mix_10ppm_Std	2.17	2.73	2.53	2.39	3.67	4.59	4.74	6.15	5.70
9Mix_20ppm_Std	2.17	2.72	2.52	2.39	3.67	4.59	4.74	6.14	5.70
9Mix_50ppm_Std	2.16	2.72	2.52	2.39	3.67	4.58	4.74	6.12	5.70
9Mix_100ppm_Std	2.16	2.72	2.52	2.38	3.67	4.58	4.74	6.10	5.69
Average	2.17	2.73	2.53	2.39	3.67	4.59	4.74	6.15	5.70
MS_1x	2.16	2.72	2.52	2.38	3.66	4.58	4.73	6.15	5.68
F2-1_10x	2.16	2.71	2.51	2.38	3.66	4.57	4.76	6.10	5.68
F2-2_10x	2.16	2.71	2.51	2.39	3.67	4.59	4.77	6.12	5.70
F2-2_PDS_20x	2.16	2.72	2.52	2.38	3.67	4.59	4.74	6.12	5.70
F2-1_1x	2.17	2.72	2.51	2.39	3.67	4.58	4.73	6.06	5.70
F2-2_1x	2.17	2.72	2.51	2.39	3.67	4.58	4.73	6.06	5.70

**Method Validation
Quality Control Report**
for Initial and Continuing Calibration Verification Standard, Method Blanks, Method Standard, and Laboratory Control Sample

Date of Analysis: 3/18/2022
 Matrix: Cannabis flower, Cellulose powder (LCS)
 CTLB Nos.: 19-01597-CE

Analytical Method: Cannabinoids Concentration by UPLC

Analyte	Sample Name	Initial and Continuing Calibration Verification Standard				Method Blanks		Matrix Blanks		Method Standard			
		Found	True Value	Recovery	Control Limits	Repl. 1	Repl. 2	Repl. 1	Repl. 2	Found	True Value	Recovery	Control Limits
		mg/L	mg/L	%	%	mg/L	mg/L	mg/L	mg/L	mg	mg	%	%
CBDA	ICV_10ppm	9.7	10.0	97.0	80-120	ND		ND				#DIV/0!	80-120
THCV		9.8	10.0	97.7	80-120	ND		ND				#DIV/0!	80-120
CBD		9.5	10.0	94.9	80-120	ND		ND				#DIV/0!	80-120
CBG		9.5	10.0	95.0	80-120	ND		ND				#DIV/0!	80-120
CBN		9.3	10.0	93.2	80-120	ND		ND				#DIV/0!	80-120
Δ9-THC		9.7	10.0	97.4	80-120	ND		ND				#DIV/0!	80-120
Δ8-THC		9.8	10.0	98.2	80-120	ND		ND				#DIV/0!	80-120
THCA		9.4	10.0	94.4	80-120	ND		ND				#DIV/0!	80-120
CBC		9.8	10.0	98.4	80-120	ND		ND				#DIV/0!	80-120
CBDA	CCV_50ppm_001	50.5	50.0	101.0	80-120								
THCV		50.3	50.0	100.7	80-120								
CBD		50.3	50.0	100.7	80-120								
CBG		50.4	50.0	100.8	80-120								
CBN		50.5	50.0	100.9	80-120								
Δ9-THC		50.3	50.0	100.7	80-120								
Δ8-THC		50.3	50.0	100.6	80-120								
THCA		50.5	50.0	100.9	80-120								
CBC		50.3	50.0	100.7	80-120								
CBDA	CCV_50ppm_002	51.1	50.0	102.2	80-120								
THCV		50.8	50.0	101.6	80-120								
CBD		50.9	50.0	101.8	80-120								
CBG		51.0	50.0	102.0	80-120								
CBN		50.8	50.0	101.6	80-120								
Δ9-THC		50.7	50.0	101.4	80-120								
Δ8-THC		50.6	51.0	99.2	80-120								
THCA		50.7	50.0	101.4	80-120								
CBC		50.7	50.0	101.4	80-120								

Notes:

Miaotian Sun

Analyst

3/24/2022

Date



3-30-22

Supervisor

**Method Validation
Quality Control Report
for Matrix Spike Recovery**

Date of Analysis: 3/18/2022
 Matrix: Cannabis flower, Cellulose powder (LCS)
 I.S. Nos.: 19-01597-CE
 CTLB Nos.: 19-01597-CE
 Analytical Method: Cannabinoids Concentration by UPLC

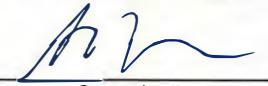
Page 2 of 2

Analyte	Matrix Spikes 1				Matrix Spikes 2				Matrix Spikes 3			
	Weight (g)	0.2001		Control Limits	Weight (g)		Control Limits	Weight (g)		Control Limits		
	Found	Amount Added	Recovery		Found	Amount Added		Found	Amount Added			
	mg	mg	%		mg	mg		mg	mg			
CBDA	0.103	0.100	103.1	70-130			#DIV/0!	70-130			#DIV/0!	70-130
THCV	0.098	0.100	97.9	70-130			#DIV/0!	70-130			#DIV/0!	70-130
CBD	0.095	0.100	94.8	70-130			#DIV/0!	70-130			#DIV/0!	70-130
CBG	0.096	0.100	95.8	70-130			#DIV/0!	70-130			#DIV/0!	70-130
CBN	0.096	0.100	95.8	70-130			#DIV/0!	70-130			#DIV/0!	70-130
Δ9-THC	0.101	0.100	101.4	70-130			#DIV/0!	70-130			#DIV/0!	70-130
Δ8-THC	0.101	0.100	100.8	70-130			#DIV/0!	70-130			#DIV/0!	70-130
THCA	0.105	0.100	104.6	70-130			#DIV/0!	70-130			#DIV/0!	70-130
CBC	0.103	0.100	103.2	70-130			#DIV/0!	70-130			#DIV/0!	70-130
Unspiked Sample				Post Dilution Spike								
	mg/L	mg/L	mg/L	RPD	mg/L	mg/L	%	%				
CBDA	0.0		0.0	#DIV/0!	41.6	40.0	104.1	70-130				
THCV	0.0		0.0	#DIV/0!	41.2	40.0	102.9	70-130				
CBD	0.0		0.0	#DIV/0!	39.3	40.0	98.2	70-130				
CBG	1.2		1.2	100.0%	39.7	40.0	97.8	70-130				
CBN	1.9		1.9	100.0%	39.6	40.0	96.5	70-130				
Δ9-THC	27.9		27.9	100.0%	54.9	40.0	102.4	70-130				
Δ8-THC	1.5		1.5	100.0%	41.8	40.0	102.6	70-130				
THCA	48.2		48.2	100.0%	64.8	40.0	101.7	70-130				
CBC	0.5		0.5	100.0%	41.1	40.0	102.2	70-130				

Notes: Recovery of Post Dilution Spike (PDS) = (Concentration in PDS (mg/L) - Concentration in Unspiked Sample (mg/L) / 2) / Amount Spiked (mg/L)
 Dilution factor of PDS is twice as of the Unspiked Sample.

3-30-22

Miaotian Sun 3/24/2022
 Analyst Date


 Supervisor

Date

20220318 In 2021\Method Development Miao as System/Administrator - Sample Set Method Editor

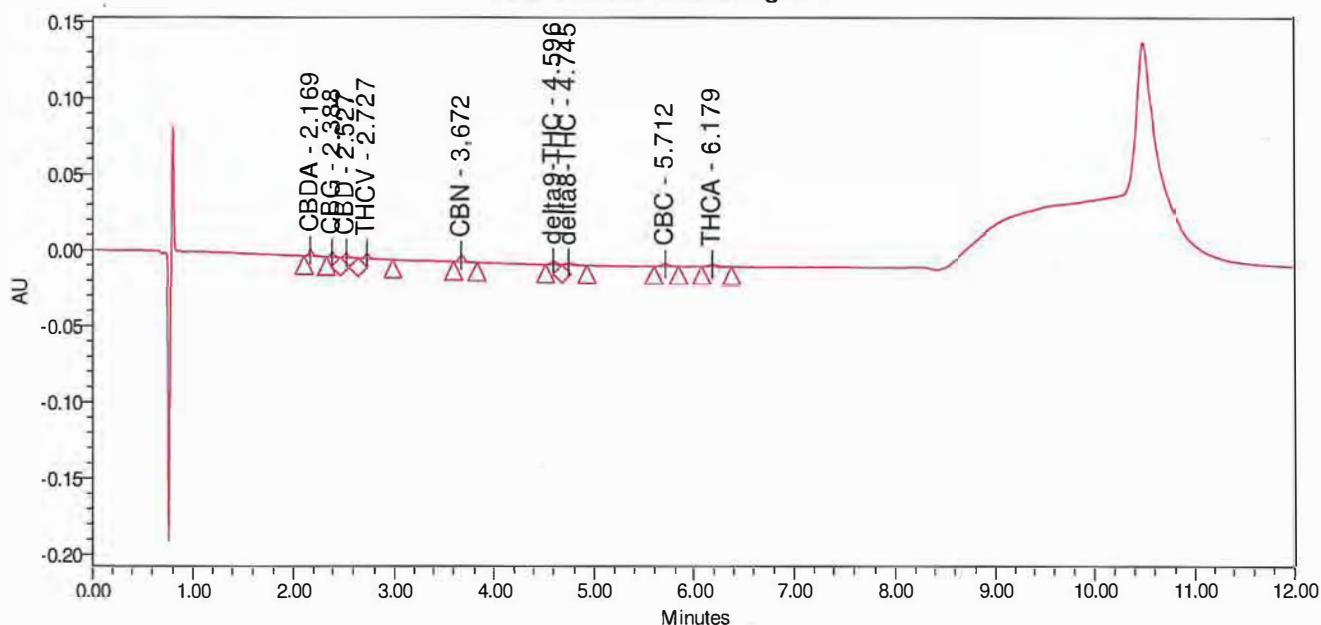
	Vial	Inj Vol (uL)	# of Injs	Label	SampleName	Level	Function	Method Set / Report or Export Method	Label Reference	Processing	Run Time (Minutes)
1							Clear Calibration	Cannabinoids_20220318		Normal	
2							Refresh Syringe	Cannabinoids_20220318			
3							Wash Needle	Cannabinoids_20220318			
4							Purge Inj	Cannabinoids_20220318			10.00
5	1	2.0	3	03162022	SolvBlk		Inject Samples	Cannabinoids_20220318		Normal	12.00
6	2	2.0	1	03162022	9Mix_0.5ppm_Std	Level 1	Inject Standards	Cannabinoids_20220318		Normal	12.00
7	3	2.0	1	03162022	9Mix_2ppm_Std	Level 2	Inject Standards	Cannabinoids_20220318		Normal	12.00
8	4	2.0	1	03162022	9Mix_5ppm_Std	Level 3	Inject Standards	Cannabinoids_20220318		Normal	12.00
9	5	2.0	1	03162022	9Mix_10ppm_Std	Level 4	Inject Standards	Cannabinoids_20220318		Normal	12.00
10	6	2.0	1	03162022	9Mix_20ppm_Std	Level 5	Inject Standards	Cannabinoids_20220318		Normal	12.00
11	7	2.0	1	03162022	9Mix_50ppm_Std	Level 6	Inject Standards	Cannabinoids_20220318		Normal	12.00
12	8	2.0	1	03162022	9Mix_100ppm_Std	Level 7	Inject Standards	Cannabinoids_20220318		Normal	12.00
13							Purge Inj	Cannabinoids_20220318			10.00
14	1	2.0	1	03162022	SolvBlk		Inject Samples	Cannabinoids_20220318		Normal	12.00
15	9	2.0	1	03162022	ICV_10ppm		Inject Samples	Cannabinoids_20220318		Normal	12.00
16	10	2.0	1	Smp	MethBlk_1x		Inject Samples	Cannabinoids_20220318		Normal	12.00
17	11	2.0	1	Smp	MatrixBlk_1x		Inject Samples	Cannabinoids_20220318		Normal	12.00
18	12	2.0	1	Smp	MS_1x		Inject Samples	Cannabinoids_20220318		Normal	12.00
19	13	2.0	1	Smp	F2-1_10x		Inject Samples	Cannabinoids_20220318		Normal	12.00
20	14	2.0	1	Smp	F2-2_10x		Inject Samples	Cannabinoids_20220318		Normal	12.00
21	15	2.0	1	Smp	F2-2_PDS_20x		Inject Samples	Cannabinoids_20220318		Normal	12.00
22							Purge Inj	Cannabinoids_20220318			10.00
23	1	2.0	1	03162022	SolvBlk		Inject Samples	Cannabinoids_20220318		Normal	12.00
24	7	2.0	1	03162022	CCV_50ppm		Inject Samples	Cannabinoids_20220318		Normal	12.00
25	16	2.0	1	Smp	F2-1_1x		Inject Samples	Cannabinoids_20220318		Normal	12.00
26	17	2.0	1	Smp	F2-2_1x		Inject Samples	Cannabinoids_20220318		Normal	12.00
27							Purge Inj	Cannabinoids_20220318			10.00
28	7	2.0	1	03162022	CCV_50ppm		Inject Samples	Cannabinoids_20220318		Normal	12.00
29	1	2.0	3	03162022	SolvBlk		Inject Samples	Cannabinoids_20220318		Normal	12.00
30							Equillbrate	End			12.00

SAMPLE INFORMATION

Sample Name: 9Mix_0.5ppm_Std Acquired By: System
Sample Type: Standard Sample Set Name: ValidationDay2_20220318
Vial: 2 Acq. Method Set: Cannabinoids_20220318
Injection #: 1 Processing Method: Cannabinoids_20220318
Injection Volume: 2.00 ul Channel Name: PDA Ch1 220nm@4.8nm
Run Time: 12.0 Minutes Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/18/2022 4:10:09 PM PDT
Date Processed: 3/23/2022 12:57:16 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.169	11265	4097	0.500	ppm
2	CBG	2.388	8456	3082	0.500	ppm
3	CBD	2.527	8717	3064	0.500	ppm
4	THCV	2.727	9735	3013	0.500	ppm
5	CBN	3.672	16125	4495	0.500	ppm
6	delta9-THC	4.596	8008	1847	0.500	ppm
7	delta8-THC	4.745	6693	1424	0.500	ppm
8	CBC	5.712	9576	1836	0.500	ppm
9	THCA	6.179	9920	1578	0.500	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 1 of 16

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

1:10:27 PM US/Pacific

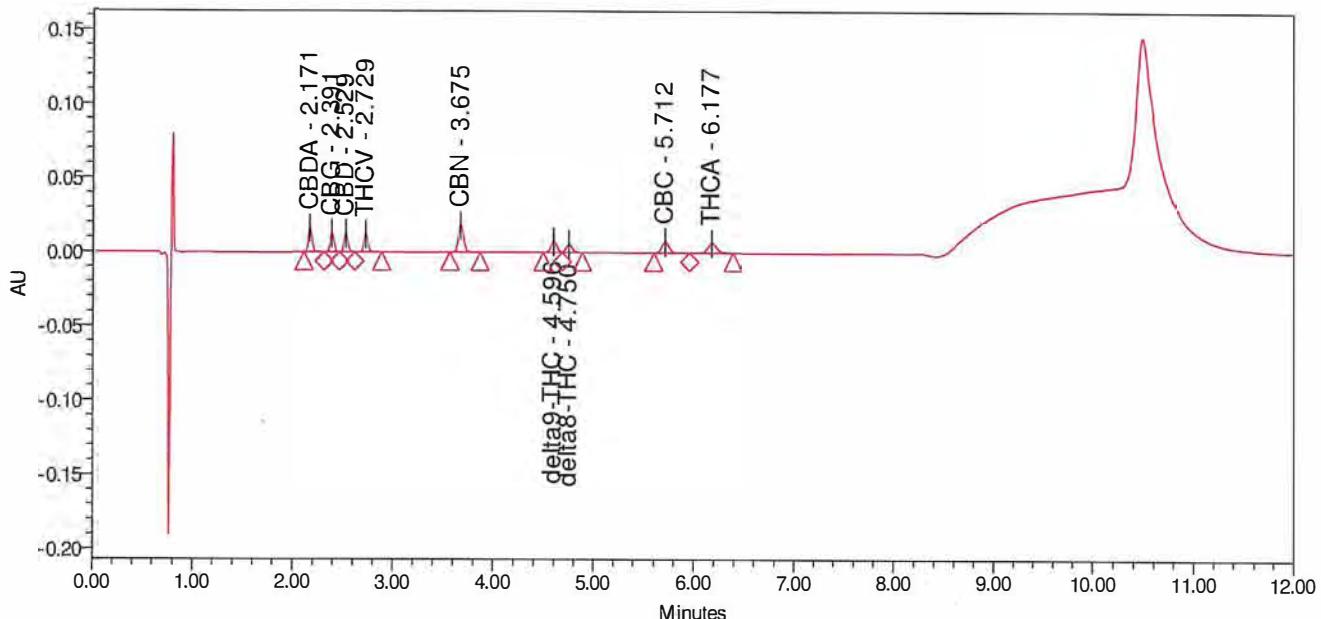
SAMPLE INFORMATION

Sample Name: 9Mix_2ppm_Std
 Sample Type: Standard
 Vial: 3
 Injection #: 1
 Injection Volume: 2.00 μ l
 Run Time: 12.0 Minutes

 Acquired By: System
 Sample Set Name: ValidationDay2_20220318
 Acq. Method Set: Cannabinoids_20220318
 Processing Method: Cannabinoids_20220318
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

 Date Acquired: 3/18/2022 4:22:46 PM PDT
 Date Processed: 3/23/2022 12:57:17 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.171	43909	16780	2.000	ppm
2	CBG	2.391	33842	12549	2.000	ppm
3	CBD	2.529	34216	12441	2.000	ppm
4	THCV	2.729	34298	11944	2.000	ppm
5	CBN	3.675	65603	18381	2.000	ppm
6	delta9-THC	4.596	31657	7421	2.000	ppm
7	delta8-THC	4.750	24666	5508	2.000	ppm
8	CBC	5.712	38609	7272	2.000	ppm
9	THCA	6.177	41491	6468	2.000	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 2 of 16

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

1:10:27 PM US/Pacific

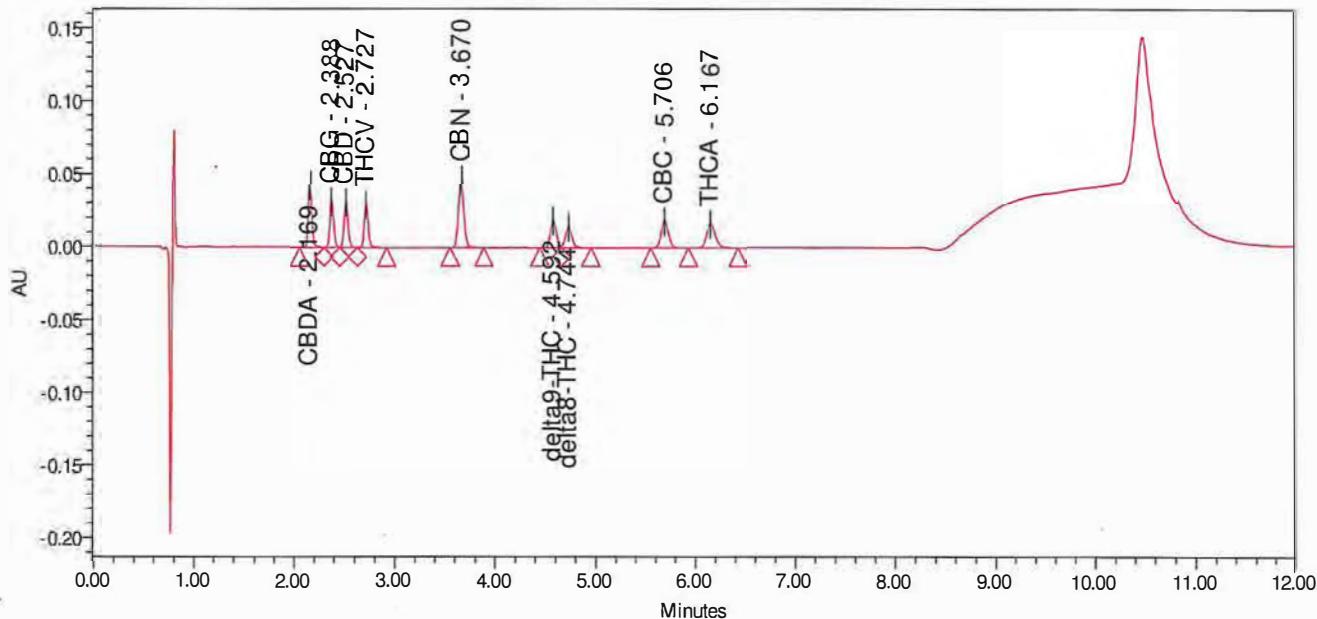
SAMPLE INFORMATION

Sample Name: 9Mix_5ppm_Std
 Sample Type: Standard
 Vial: 4
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

 Acquired By: System
 Sample Set Name: ValidationDay2_20220318
 Acq. Method Set: Cannabinoids_20220318
 Processing Method: Cannabinoids_20220318
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

 Date Acquired: 3/18/2022 4:35:18 PM PDT
 Date Processed: 3/23/2022 12:57:17 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.169	109890	42623	5.000	ppm
2	CBG	2.388	84767	31639	5.000	ppm
3	CBD	2.527	85549	31234	5.000	ppm
4	THCV	2.727	83996	29866	5.000	ppm
5	CBN	3.670	165606	46372	5.000	ppm
6	delta ⁹ -THC	4.592	79731	18696	5.000	ppm
7	delta ⁸ -THC	4.744	63408	14132	5.000	ppm
8	CBC	5.706	94345	18154	5.000	ppm
9	THCA	6.167	102514	16413	5.000	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 3 of 16

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

1:10:27 PM US/Pacific

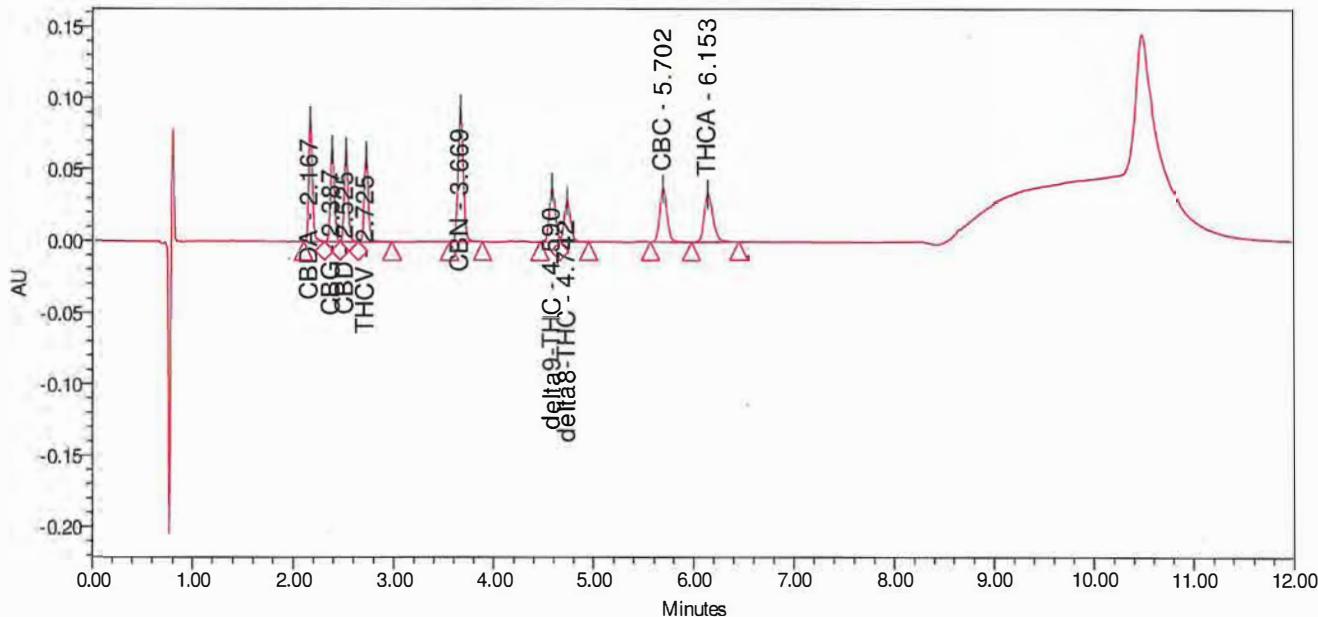
SAMPLE INFORMATION

Sample Name: 9Mix_10ppm_Std
 Sample Type: Standard
 Vial: 5
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

 Acquired By: System
 Sample Set Name: ValidationDay2_20220318
 Acq. Method Set: Cannabinoids_20220318
 Processing Method: Cannabinoids_20220318
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

 Date Acquired: 3/18/2022 4:47:50 PM PDT
 Date Processed: 3/23/2022 12:57:18 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.167	220259	85778	10.000	ppm
2	CBG	2.387	171365	63926	10.000	ppm
3	CBD	2.525	173013	62811	10.000	ppm
4	THCV	2.725	170205	59964	10.000	ppm
5	CBN	3.669	330610	92804	10.000	ppm
6	delta ⁹ -THC	4.590	159487	37530	10.000	ppm
7	delta ⁸ -THC	4.742	127022	28330	10.000	ppm
8	CBC	5.702	190604	36566	10.000	ppm
9	THCA	6.153	203525	32859	10.000	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 4 of 16

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

1:10:27 PM US/Pacific

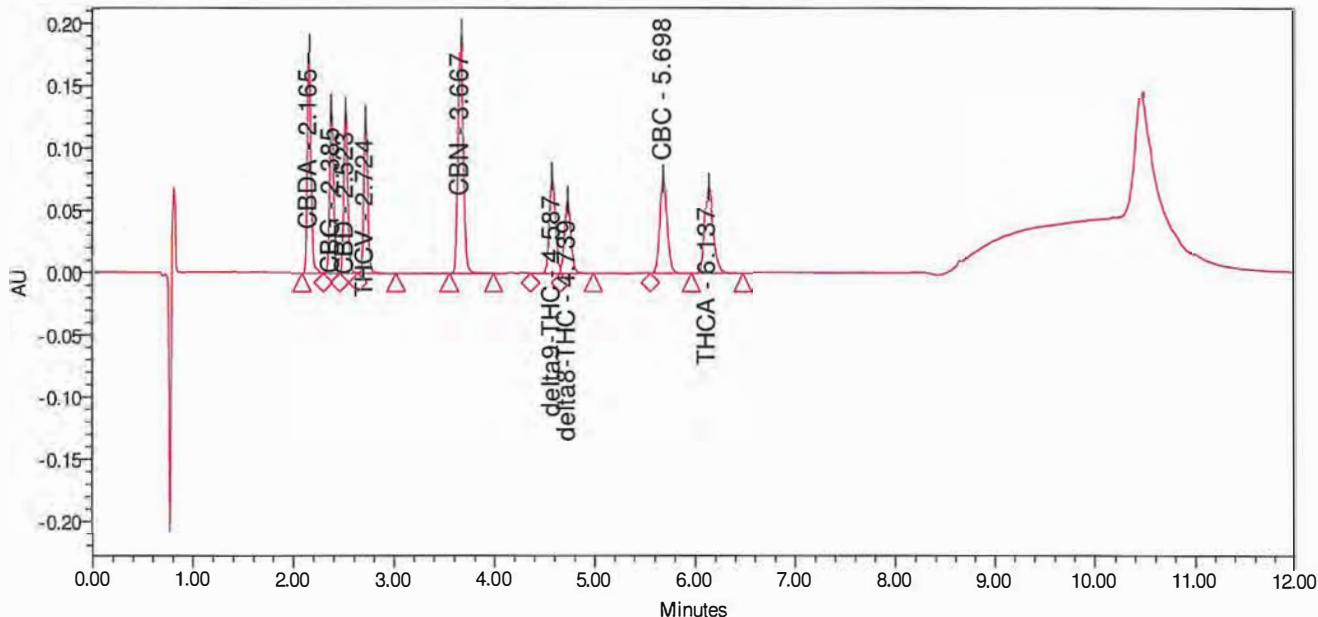
SAMPLE INFORMATION

Sample Name: 9Mix_20ppm_Std
 Sample Type: Standard
 Vial: 6
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

 Acquired By: System
 Sample Set Name: ValidationDay2_20220318
 Acq. Method Set: Cannabinoids_20220318
 Processing Method: Cannabinoids_20220318
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

 Date Acquired: 3/18/2022 5:00:27 PM PDT
 Date Processed: 3/23/2022 12:57:18 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.165	456199	180263	20.000	ppm
2	CBG	2.385	354653	132897	20.000	ppm
3	CBD	2.523	357096	129859	20.000	ppm
4	THCV	2.724	350004	124106	20.000	ppm
5	CBN	3.667	686318	192608	20.000	ppm
6	delta9-THC	4.587	332095	78175	20.000	ppm
7	delta8-THC	4.739	263018	58584	20.000	ppm
8	CBC	5.698	395107	76005	20.000	ppm
9	THCA	6.137	422167	68760	20.000	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 5 of 16

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

1:10:27 PM US/Pacific

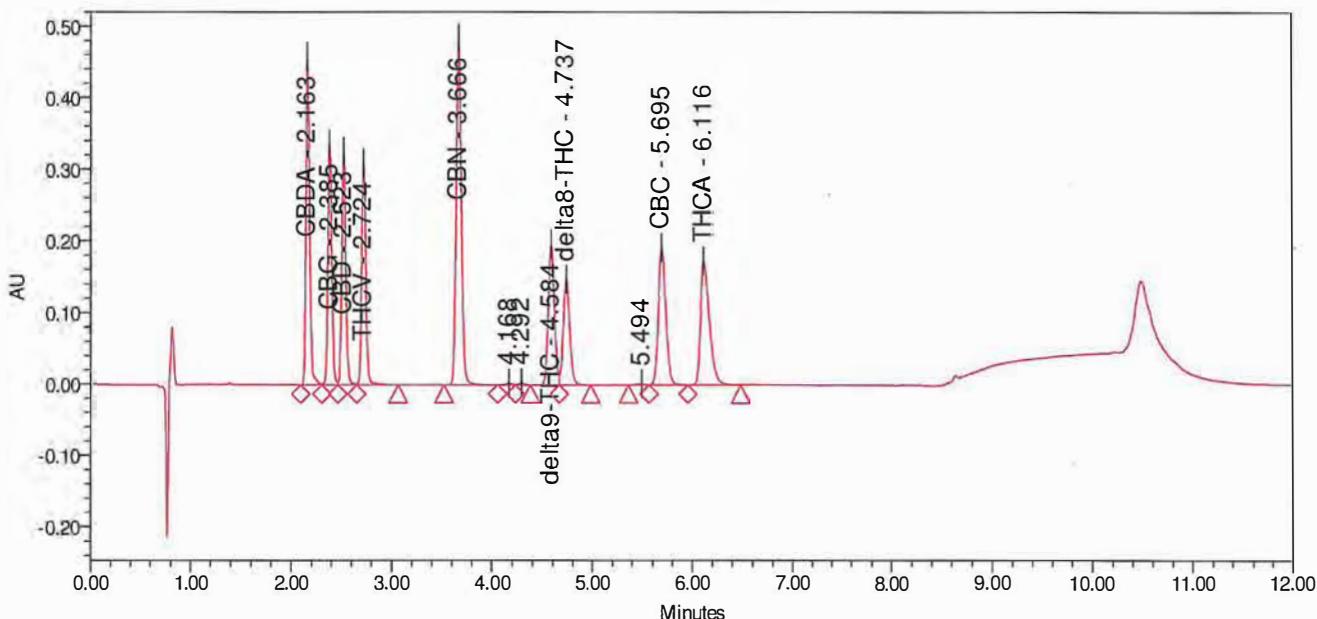
SAMPLE INFORMATION

Sample Name: 9Mix_50ppm_Std
 Sample Type: Standard
 Vial: 7
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

 Acquired By: System
 Sample Set Name: ValidationDay2_20220318
 Acq. Method Set: Cannabinoids_20220318
 Processing Method: Cannabinoids_20220318
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

 Date Acquired: 3/18/2022 5:12:59 PM PDT
 Date Processed: 3/23/2022 12:57:19 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.163	1142977	458923	50.000	ppm
2	CBG	2.385	892948	335869	50.000	ppm
3	CBD	2.523	899302	326962	50.000	ppm
4	THCV	2.724	879520	311831	50.000	ppm
5	CBN	3.666	1729619	485899	50.000	ppm
6	delta9-THC	4.584	832380	196692	50.000	ppm
7	delta8-THC	4.737	660803	147121	50.000	ppm
8	CBC	5.695	991865	191155	50.000	ppm
9	THCA	6.116	1050309	172720	50.000	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 6 of 16

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

1:10:27 PM US/Pacific

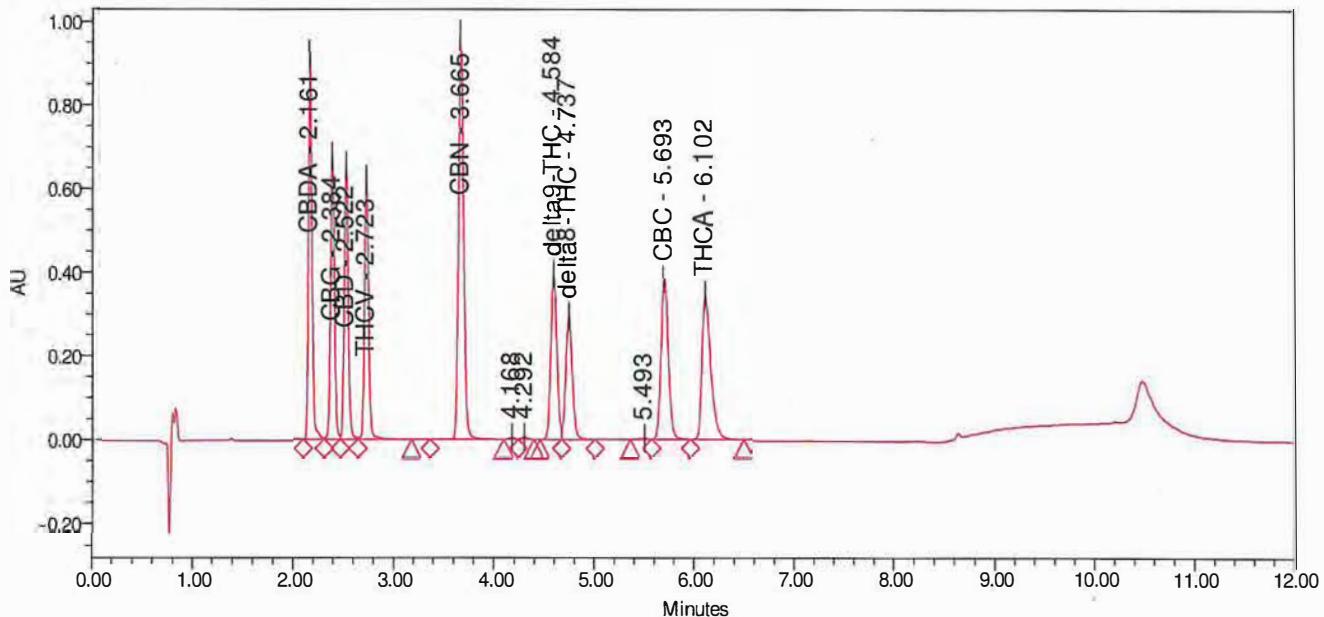
SAMPLE INFORMATION

Sample Name: 9Mix_100ppm_Std
 Sample Type: Standard
 Vial: 8
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay2_20220318
 Acq. Method Set: Cannabinoids_20220318
 Processing Method: Cannabinoids_20220318
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/18/2022 5:25:31 PM PDT
 Date Processed: 3/23/2022 12:57:20 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.161	2273077	924051	100.000	ppm
2	CBG	2.384	1784746	677035	100.000	ppm
3	CBD	2.522	1799463	654057	100.000	ppm
4	THCV	2.723	1763986	622143	100.000	ppm
5	CBN	3.665	3452205	970541	100.000	ppm
6	delta9-THC	4.584	1662177	394602	100.000	ppm
7	delta8-THC	4.737	1326127	293607	100.000	ppm
8	CBC	5.693	1989835	383760	100.000	ppm
9	THCA	6.102	2089421	344726	100.000	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 7 of 16

Project Name: 2021\Method Development Miao

Date Printed:

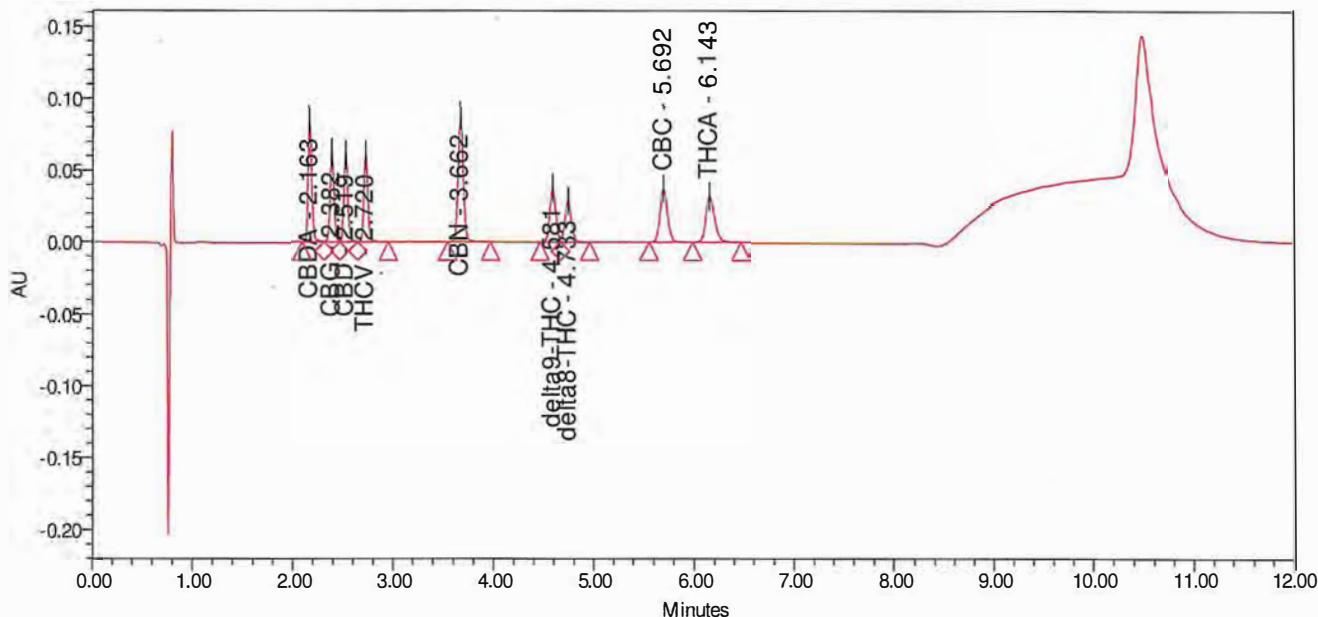
3/23/2022

1:10:27 PM US/Pacific

SAMPLE INFORMATION

Sample Name:	ICV_10ppm	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ValidationDay2_20220318
Vial:	9	Acq. Method Set:	Cannabinoids_20220318
Injection #:	1	Processing Method:	Cannabinoids_20220318
Injection Volume:	2.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm
Date Acquired:	3/18/2022 5:50:57 PM PDT		
Date Processed:	3/23/2022 12:57:21 PM PDT		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.163	219773	86179	9.701	ppm
2	CBG	2.382	167977	62495	9.497	ppm
3	CBD	2.519	169366	61302	9.494	ppm
4	THCV	2.720	171637	61005	9.773	ppm
5	CBN	3.662	319003	89020	9.322	ppm
6	delta9-THC	4.581	160802	38000	9.743	ppm
7	delta8-THC	4.733	129114	28837	9.823	ppm
8	CBC	5.692	194149	37265	9.844	ppm
9	THCA	6.143	196929	31790	9.443	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 8 of 16

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

1:10:27 PM US/Pacific

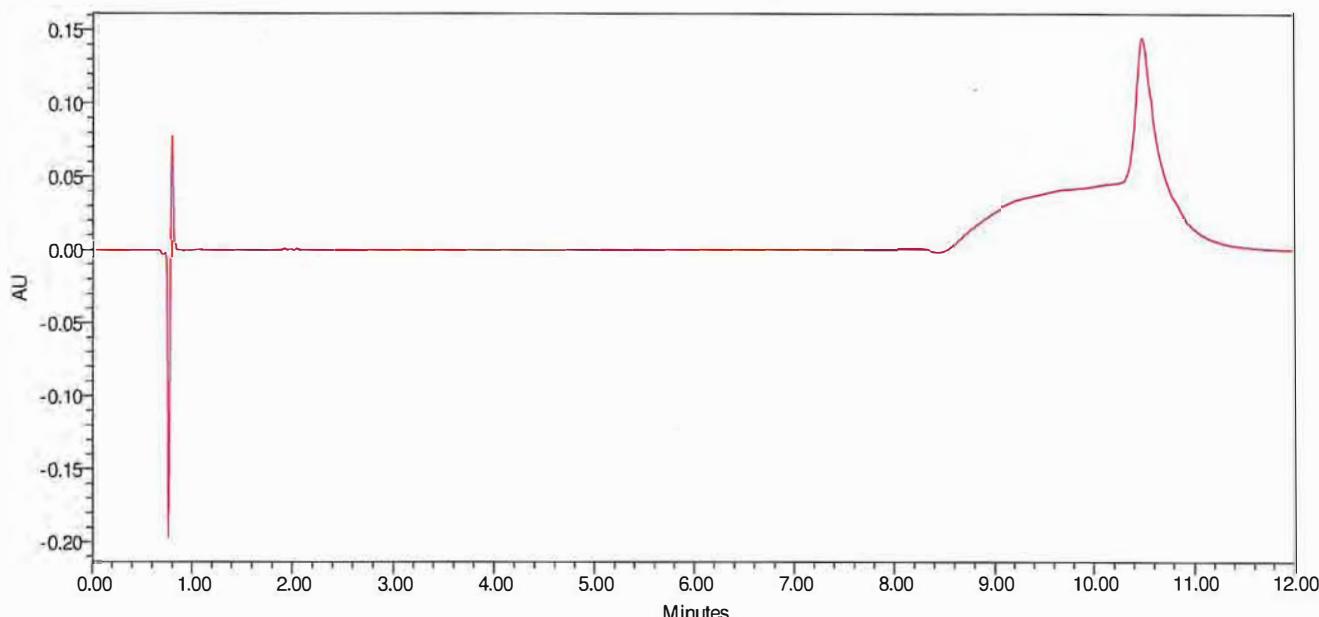
SAMPLE INFORMATION

Sample Name: MethBlk_1x
 Sample Type: Unknown
 Vial: 10
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

 Acquired By: System
 Sample Set Name: ValidationDay2_20220318
 Acq. Method Set: Cannabinoids_20220318
 Processing Method: Cannabinoids_20220318
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

 Date Acquired: 3/18/2022 6:03:30 PM PDT
 Date Processed: 3/23/2022 12:57:22 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.158				
2	CBG	2.369				
3	CBD	2.506				
4	THCV	2.706				
5	CBN	3.633				
6	delta9-THC	4.546				
7	delta8-THC	4.694				
8	CBC	5.636				
9	THCA	6.131				

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 9 of 16

Project Name: 2021\Method Development Miao

Date Printed:

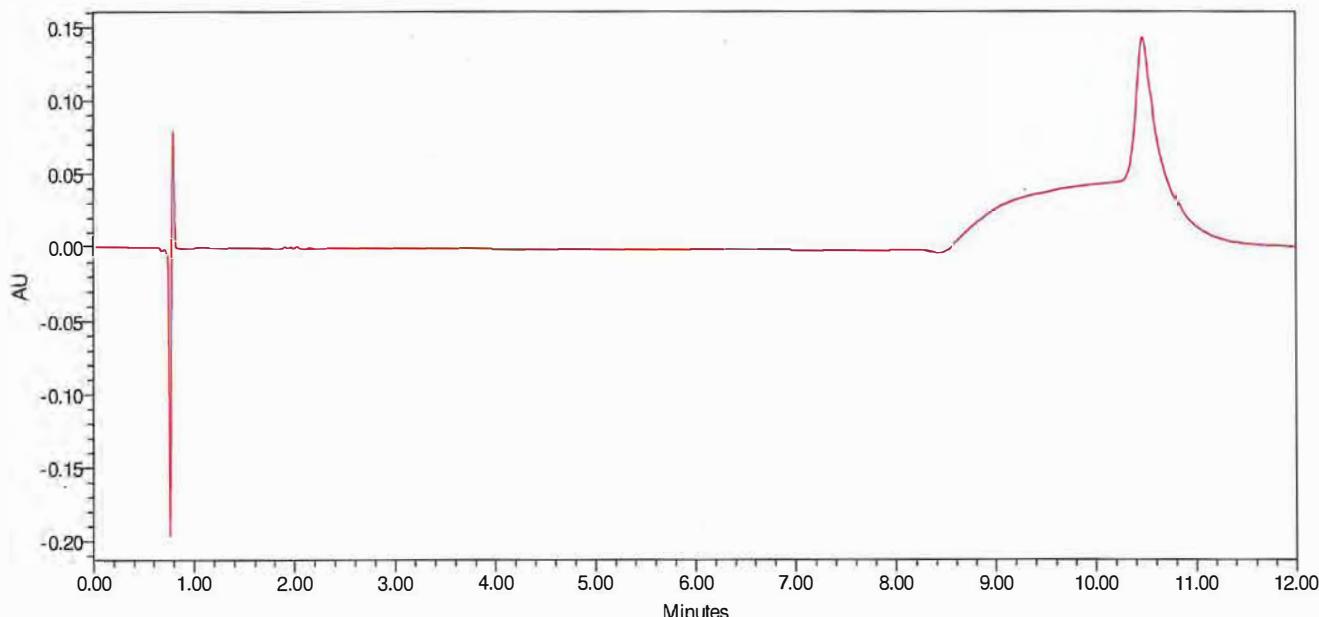
3/23/2022

1:10:27 PM US/Pacific

SAMPLE INFORMATION

Sample Name:	MatrixBLk_1x	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ValidationDay2_20220318
Vial:	11	Acq. Method Set:	Cannabinoids_20220318
Injection #:	1	Processing Method:	Cannabinoids_20220318
Injection Volume:	2.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm
Date Acquired:	3/18/2022 6:16:06 PM PDT		
Date Processed:	3/23/2022 12:57:22 PM PDT		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.158				
2	CBG	2.369				
3	CBD	2.506				
4	THCV	2.706				
5	CBN	3.633				
6	delta9-THC	4.546				
7	delta8-THC	4.694				
8	CBC	5.636				
9	THCA	6.131				

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 10 of 16

Project Name: 2021\Method Development Miao

Date Printed:

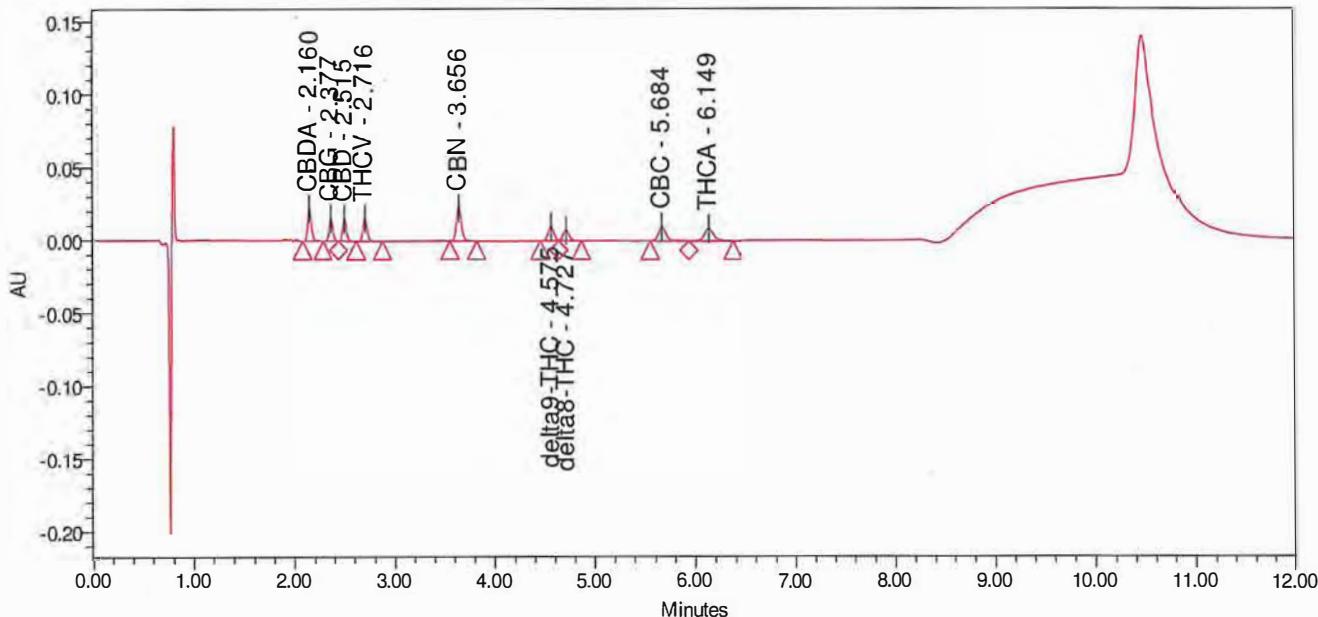
3/23/2022

1:10:27 PM US/Pacific

SAMPLE INFORMATION

Sample Name:	MS_1x	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ValidationDay2_20220318
Vial:	12	Acq. Method Set:	Cannabinoids_20220318
Injection #:	1	Processing Method:	Cannabinoids_20220318
Injection Volume:	2.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm
Date Acquired:	3/18/2022 6:28:39 PM PDT		
Date Processed:	3/23/2022 12:57:23 PM PDT		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.160	57797	22082	2.577	ppm
2	CBG	2.377	41507	15462	2.395	ppm
3	CBD	2.515	41566	15159	2.371	ppm
4	THCV	2.716	43050	15330	2.447	ppm
5	CBN	3.656	80268	22566	2.395	ppm
6	delta9-THC	4.575	41162	9636	2.534	ppm
7	delta8-THC	4.727	32695	7227	2.521	ppm
8	CBC	5.684	50146	9432	2.580	ppm
9	THCA	6.149	54012	8373	2.615	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 11 of 16

Project Name: 2021\Method Development Miao

Date Printed:

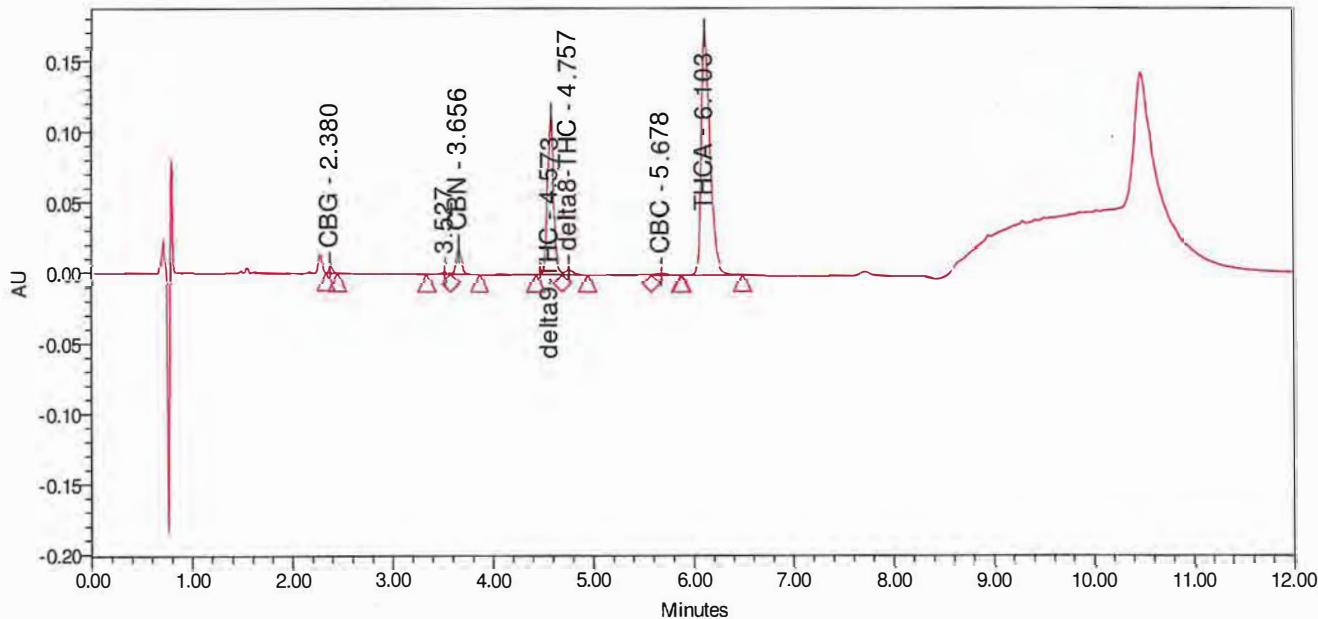
3/23/2022

1:10:27 PM US/Pacific

SAMPLE INFORMATION

Sample Name:	F2-1_10x	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ValidationDay2_20220318
Vial:	13	Acq. Method Set:	Cannabinoids_20220318
Injection #:	1	Processing Method:	Cannabinoids_20220318
Injection Volume:	2.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm
Date Acquired:	3/18/2022 6:41:15 PM PDT		
Date Processed:	3/23/2022 1:03:06 PM PDT		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.158				
2	CBG	2.380	13078	5043	0.799	ppm
3	CBD	2.506				
4	THCV	2.706				
5	CBN	3.656	64400	17999	1.935	ppm
6	delta9-THC	4.573	476207	110676	28.748	ppm
7	delta8-THC	4.757	21573	3515	1.678	ppm
8	CBC	5.678	9437	1527	0.527	ppm
9	THCA	6.103	1044023	170163	49.916	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 12 of 16

Project Name: 2021\Method Development Miao

Date Printed:

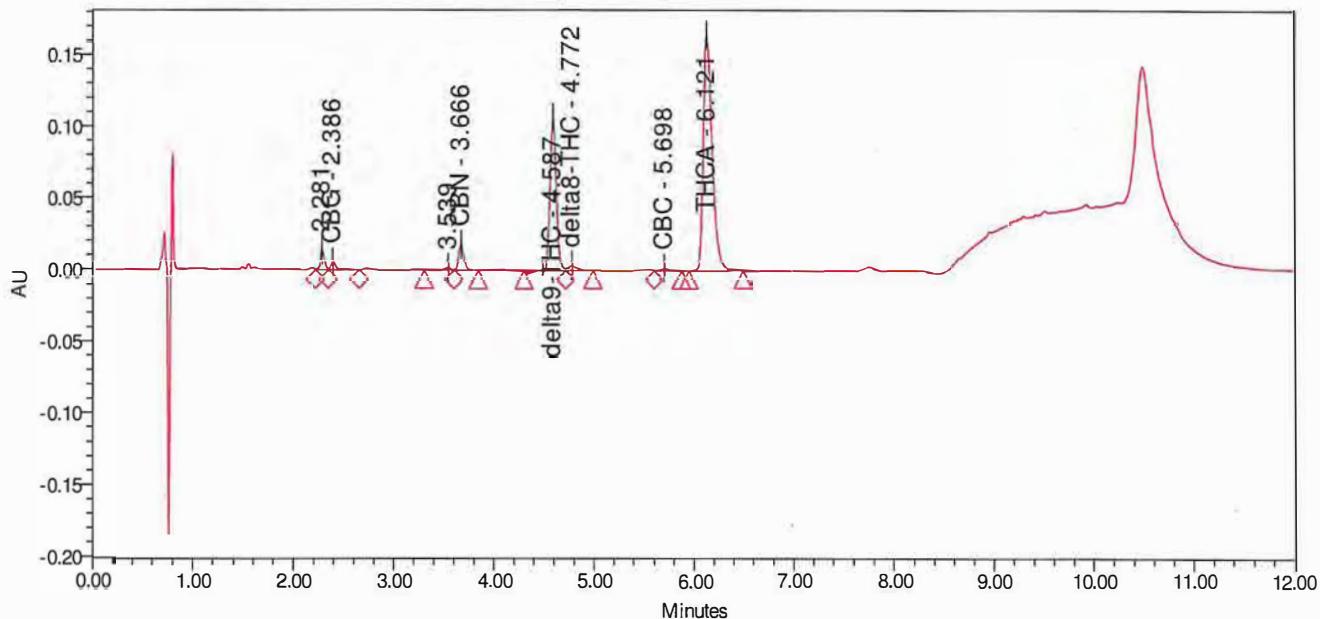
3/23/2022

1:10:27 PM US/Pacific

SAMPLE INFORMATION

Sample Name:	F2-2_10x	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ValidationDay2_20220318
Vial:	14	Acq. Method Set:	Cannabinoids_20220318
Injection #:	1	Processing Method:	Cannabinoids_20220318
Injection Volume:	2.00 μ l	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm
Date Acquired:	3/18/2022 6:53:47 PM PDT		
Date Processed:	3/23/2022 12:57:24 PM PDT		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.158				
2	CBG	2.386	19333	5482	1.150	ppm
3	CBD	2.506				
4	THCV	2.706				
5	CBN	3.666	62626	17570	1.883	ppm
6	delta9-THC	4.587	461826	106921	27.881	ppm
7	delta8-THC	4.772	18954	3257	1.480	ppm
8	CBC	5.698	9138	1520	0.512	ppm
9	THCA	6.121	1008511	164296	48.219	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 13 of 16

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

1:10:27 PM US/Pacific

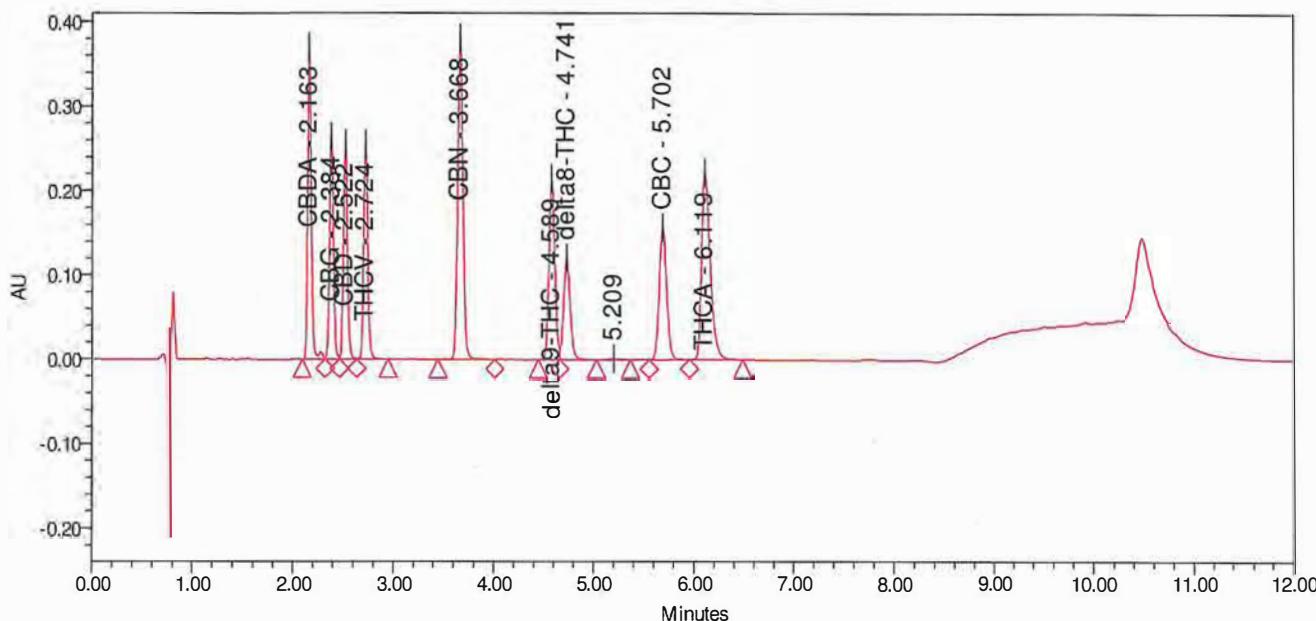
SAMPLE INFORMATION

Sample Name: F2-2_PDS_20x
 Sample Type: Unknown
 Vial: 15
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

 Acquired By: System
 Sample Set Name: ValidationDay2_20220318
 Acq. Method Set: Cannabinoids_20220318
 Processing Method: Cannabinoids_20220318
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

 Date Acquired: 3/18/2022 7:06:20 PM PDT
 Date Processed: 3/23/2022 12:57:24 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.163	945630	372482	41.626	ppm
2	CBG	2.384	705421	264853	39.679	ppm
3	CBD	2.522	704107	256194	39.297	ppm
4	THCV	2.724	722587	255879	41.162	ppm
5	CBN	3.668	1360907	381085	39.554	ppm
6	delta9-THC	4.589	910378	214702	54.909	ppm
7	delta8-THC	4.741	551224	120956	41.789	ppm
8	CBC	5.702	814076	156903	41.116	ppm
9	THCA	6.119	1355074	221359	64.778	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 14 of 16

Project Name: 2021\Method Development Miao

Date Printed:

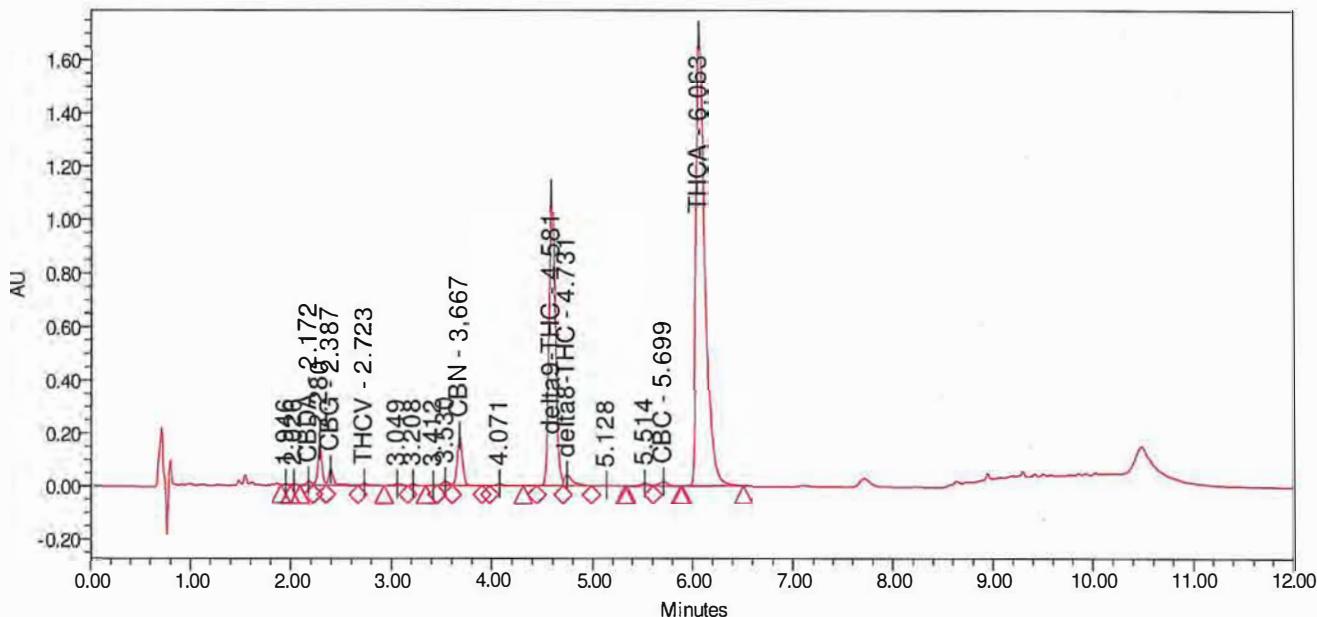
3/23/2022

1:10:27 PM US/Pacific

SAMPLE INFORMATION

Sample Name:	F2-1_1x	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ValidationDay2_20220318
Vial:	16	Acq. Method Set:	Cannabinoids_20220318
Injection #:	1	Processing Method:	Cannabinoids_20220318
Injection Volume:	2.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm
Date Acquired:	3/18/2022 7:44:16 PM PDT		
Date Processed:	3/23/2022 12:57:26 PM PDT		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.172	51202	15698	2.287	ppm
2	CBG	2.387	203579	59311	11.497	ppm
3	CBD	2.506				
4	THCV	2.723	37270	9653	2.117	ppm
5	CBN	3.667	675744	188099	19.673	ppm
6	delta9-THC	4.581	4846003	1100843	292.051	ppm
7	delta8-THC	4.731	240442	39750	18.254	ppm
8	CBC	5.699	91702	15675	4.676	ppm
9	THCA	6.063	10653198	1693367	509.029	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 15 of 16

Project Name: 2021\Method Development Miao

Date Printed:

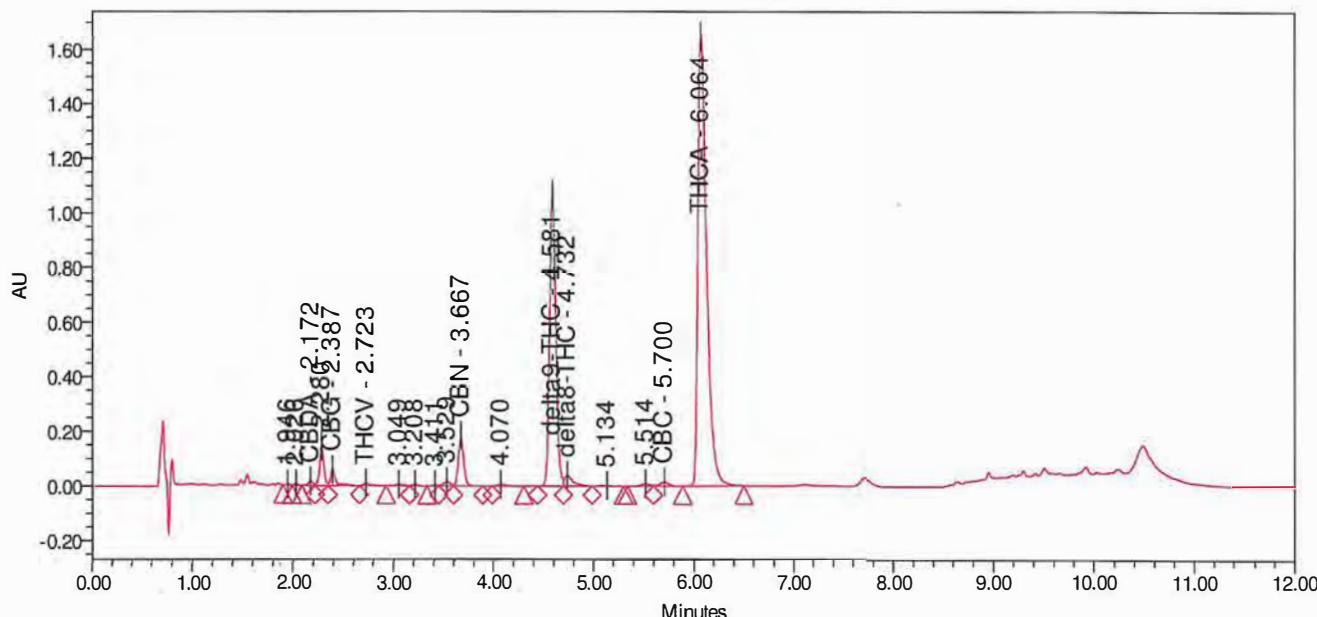
3/23/2022

1:10:27 PM US/Pacific

SAMPLE INFORMATION

Sample Name:	F2-2_1x	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ValidationDay2_20220318
Vial:	17	Acq. Method Set:	Cannabinoids_20220318
Injection #:	1	Processing Method:	Cannabinoids_20220318
Injection Volume:	2.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm
Date Acquired:	3/18/2022 7:56:52 PM PDT		
Date Processed:	3/23/2022 12:57:27 PM PDT		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.172	50802	15422	2.269	ppm
2	CBG	2.387	201777	57403	11.396	ppm
3	CBD	2.506				
4	THCV	2.723	37363	9446	2.123	ppm
5	CBN	3.667	657251	183357	19.137	ppm
6	delta9-THC	4.581	4712706	1069800	284.020	ppm
7	delta8-THC	4.732	233453	38650	17.724	ppm
8	CBC	5.700	89379	15270	4.559	ppm
9	THCA	6.064	10331406	1648185	493.654	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 16 of 16

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

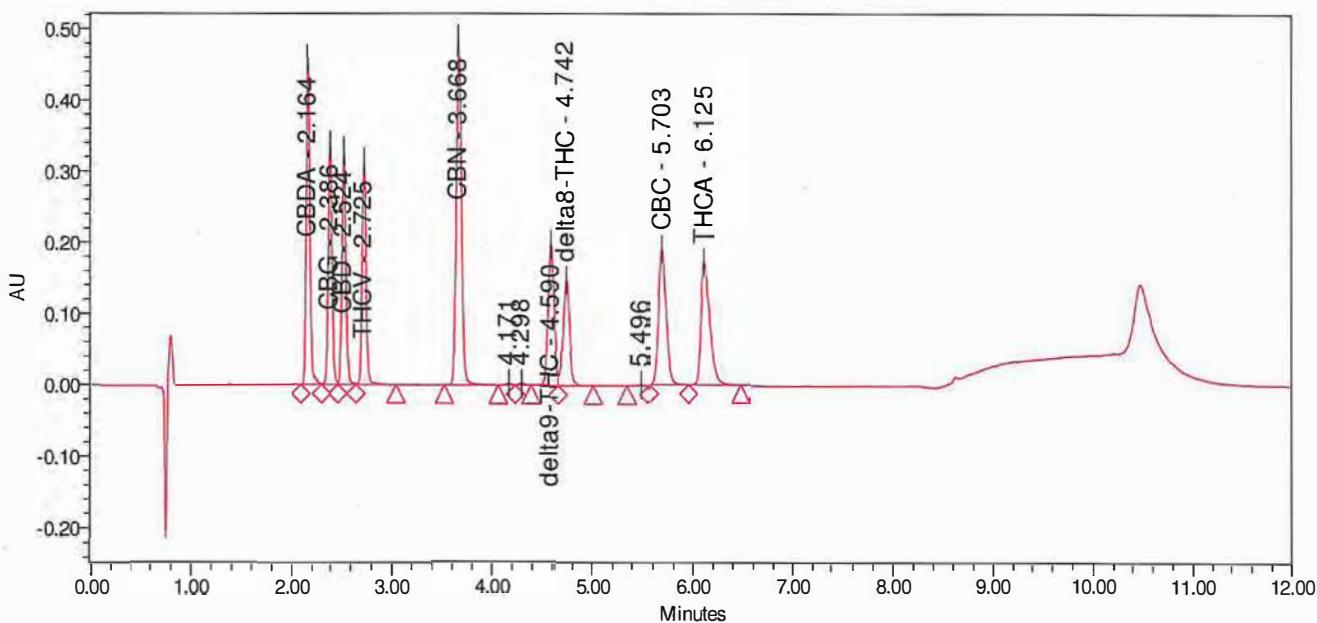
1:10:27 PM US/Pacific

SAMPLE INFORMATION

Sample Name: CCV_50ppm
Sample Type: Unknown
Vial: 7
Injection #: 1
Injection Volume: 2.00 ul
Run Time: 12.0 Minutes
Acquired By: System
Sample Set Name: ValidationDay2_20220318
Acq. Method Set: Cannabinoids_20220318
Processing Method: Cannabinoids_20220318
Channel Name: PDA Ch1 220nm@4.8nm
Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/18/2022 7:31:43 PM PDT
Date Processed: 3/23/2022 12:57:25 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.164	1147117	459944	50.487	ppm
2	CBG	2.386	896742	336957	50.424	ppm
3	CBD	2.524	902177	328098	50.336	ppm
4	THCV	2.725	883713	313157	50.342	ppm
5	CBN	3.668	1736607	487357	50.455	ppm
6	delta9-THC	4.590	834639	197489	50.345	ppm
7	delta8-THC	4.742	663910	147635	50.323	ppm
8	CBC	5.703	996633	191591	50.325	ppm
9	THCA	6.125	1055356	173248	50.458	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 1 of 1

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

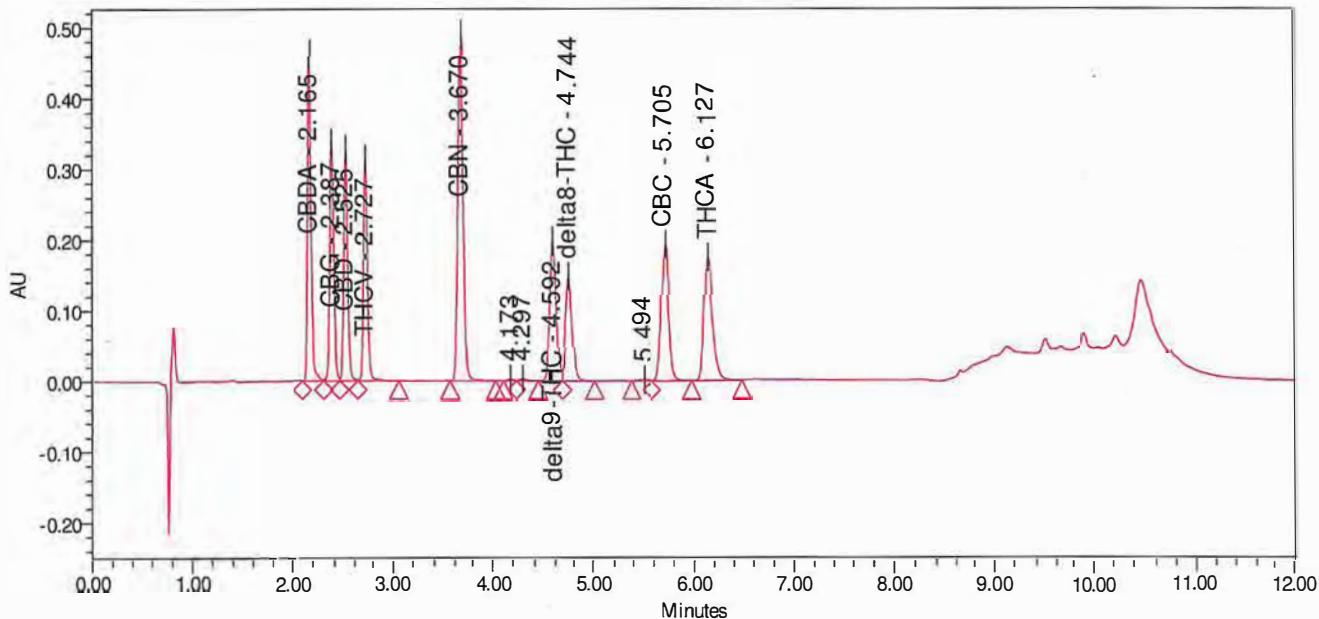
1:11:31 PM US/Pacific

SAMPLE INFORMATION

Sample Name: CCV_50ppm
Sample Type: Unknown
Vial: 7
Injection #: 1
Injection Volume: 2.00 ul
Run Time: 12.0 Minutes
Acquired By: System
Sample Set Name: ValidationDay2_20220318
Acq. Method Set: Cannabinoids_20220318
Processing Method: Cannabinoids_20220318
Channel Name: PDA Ch1 220nm@4.8nm
Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/18/2022 8:09:42 PM PDT
Date Processed: 3/23/2022 12:57:27 PM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.165	1161364	464012	51.114	ppm
2	CBG	2.387	907081	340022	51.004	ppm
3	CBD	2.525	911892	330464	50.878	ppm
4	THCV	2.727	891542	315080	50.788	ppm
5	CBN	3.670	1748715	490930	50.806	ppm
6	delta9-THC	4.592	840632	198146	50.706	ppm
7	delta8-THC	4.744	667348	148288	50.584	ppm
8	CBC	5.705	1003614	193060	50.677	ppm
9	THCA	6.127	1059959	174431	50.677	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 1 of 1

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

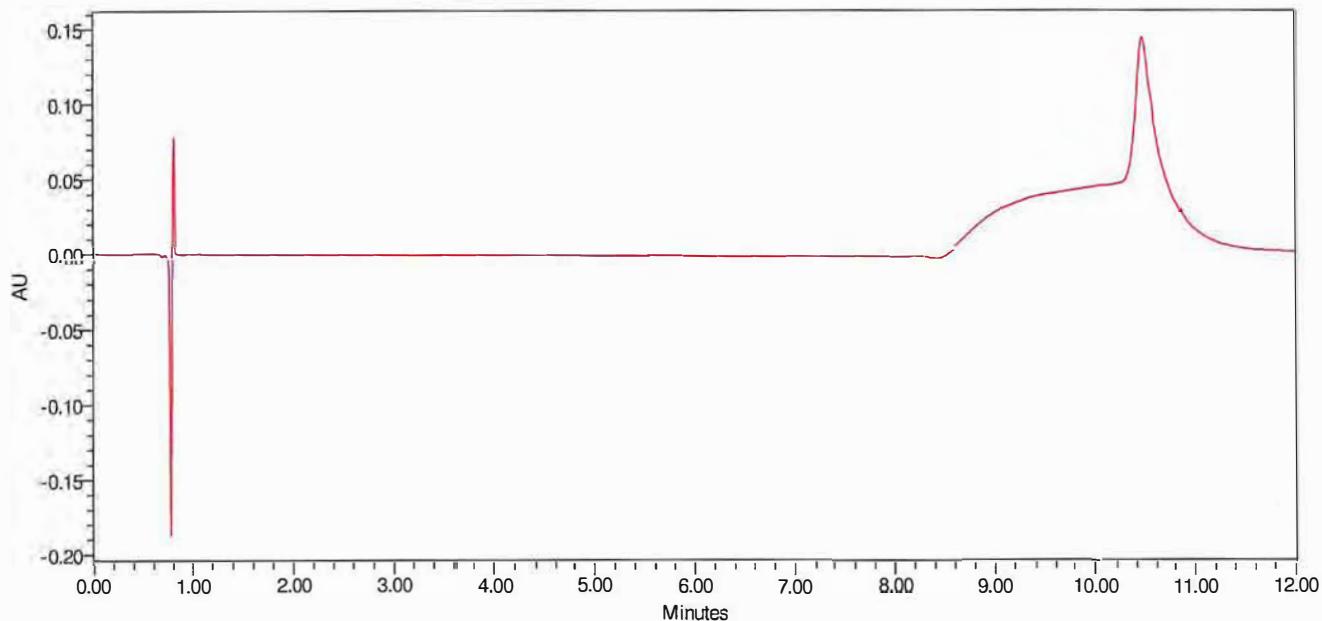
1:11:51 PM US/Pacific

SAMPLE INFORMATION

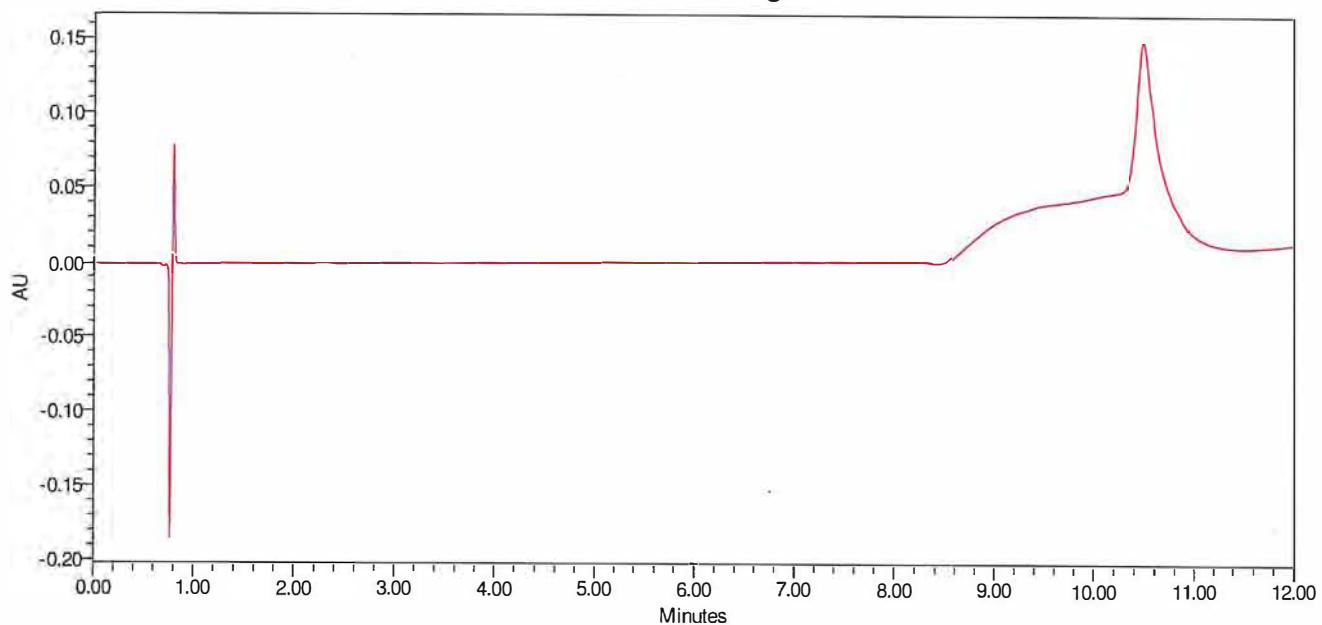
Sample Name:	SolvBik	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ValidationDay2_20220318
Vial:	1	Acq. Method Set:	Cannabinoids_20220318
Injection #:	1, 2, 3	Processing Method	Cannabinoids_20220318
Injection Volume:	2.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm

Date Acquired: 3/18/2022 3:32:33 PM PDT, 3/18/2022 3:45:05 PM PDT, 3/18/2022 3:57:37 PM PDT,
Date Processed: 3/23/2022 12:57:15 PM PDT, 3/23/2022 12:57:16 PM PDT, 3/23/2022 12:57:20 PM

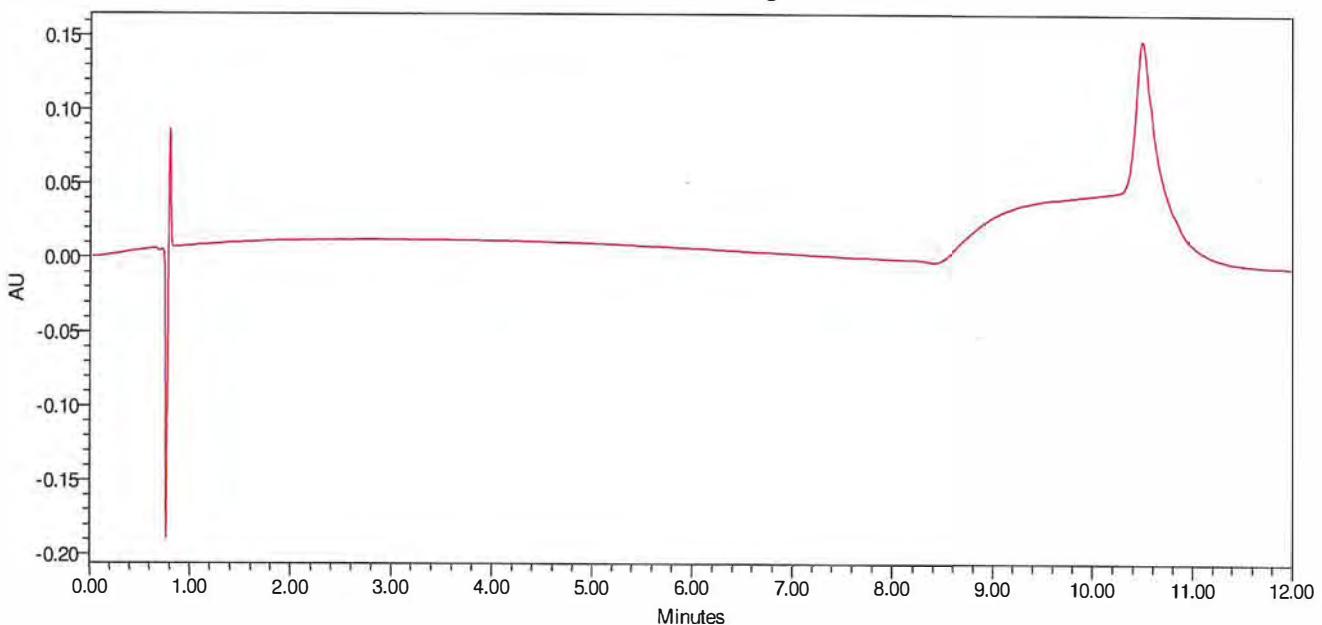
Auto-Scaled Chromatogram



Auto-Scaled Chromatogram



Auto-Scaled Chromatogram



Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 2 of 7

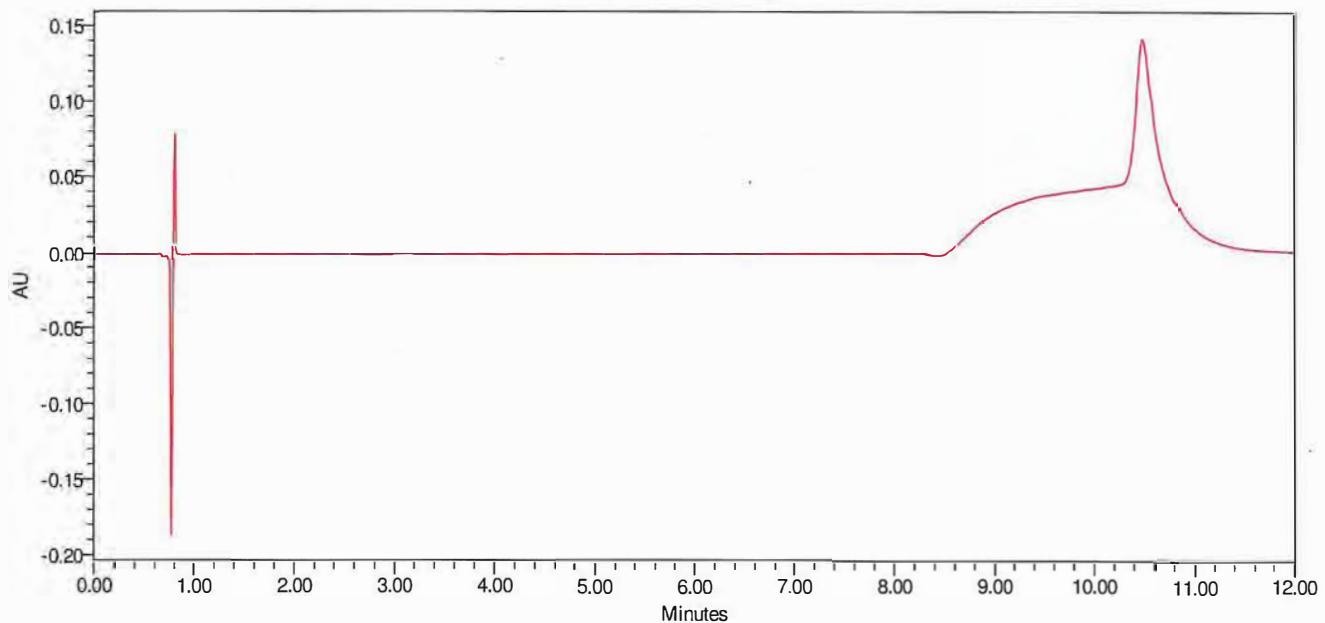
Project Name: 2021\Method Development Miao

Date Printed:

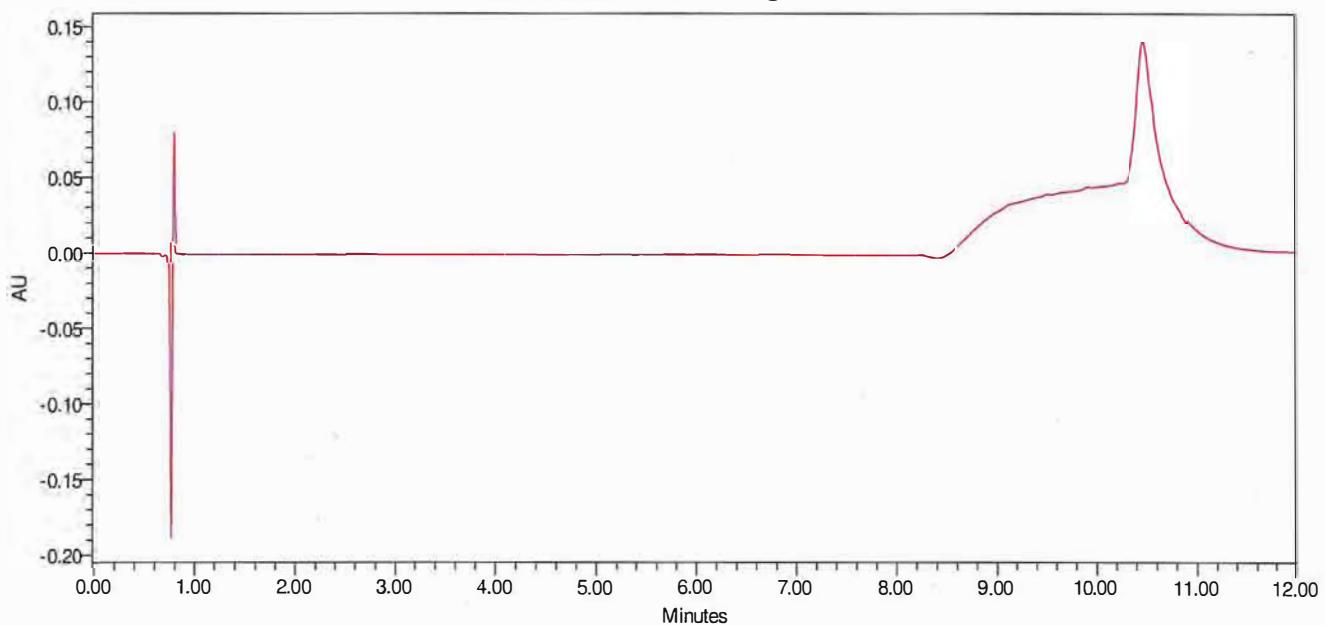
3/23/2022

1:12:26 PM US/Pacific

Auto-Scaled Chromatogram



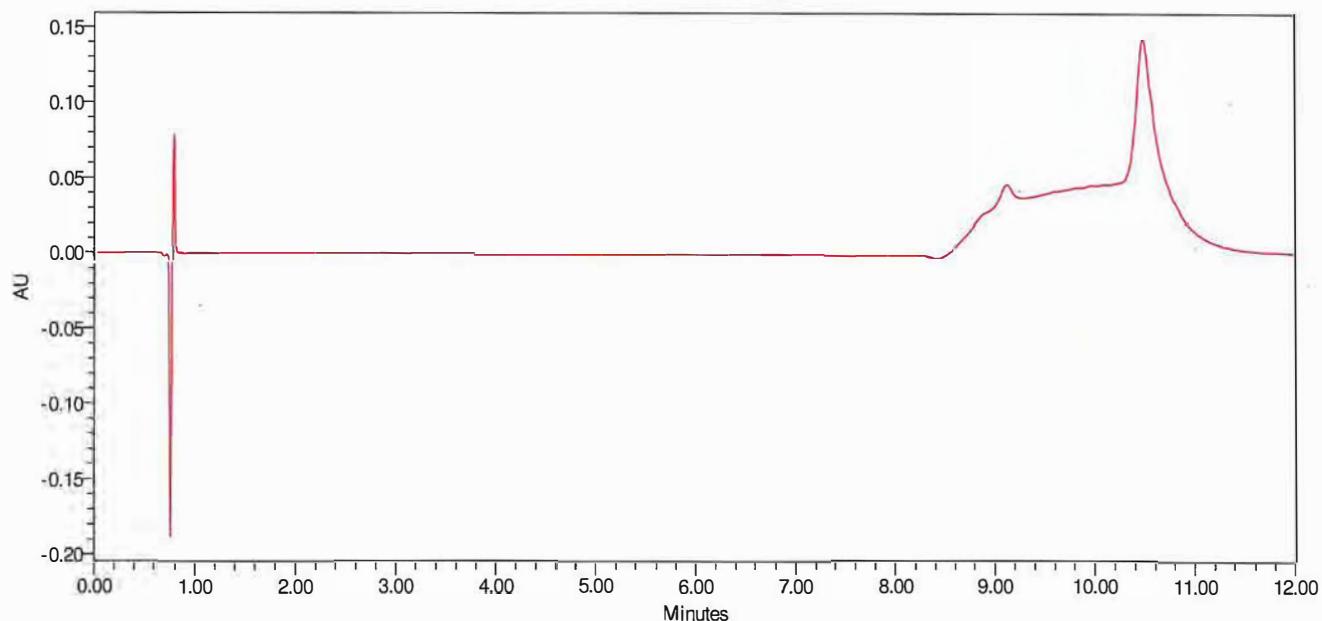
Auto-Scaled Chromatogram



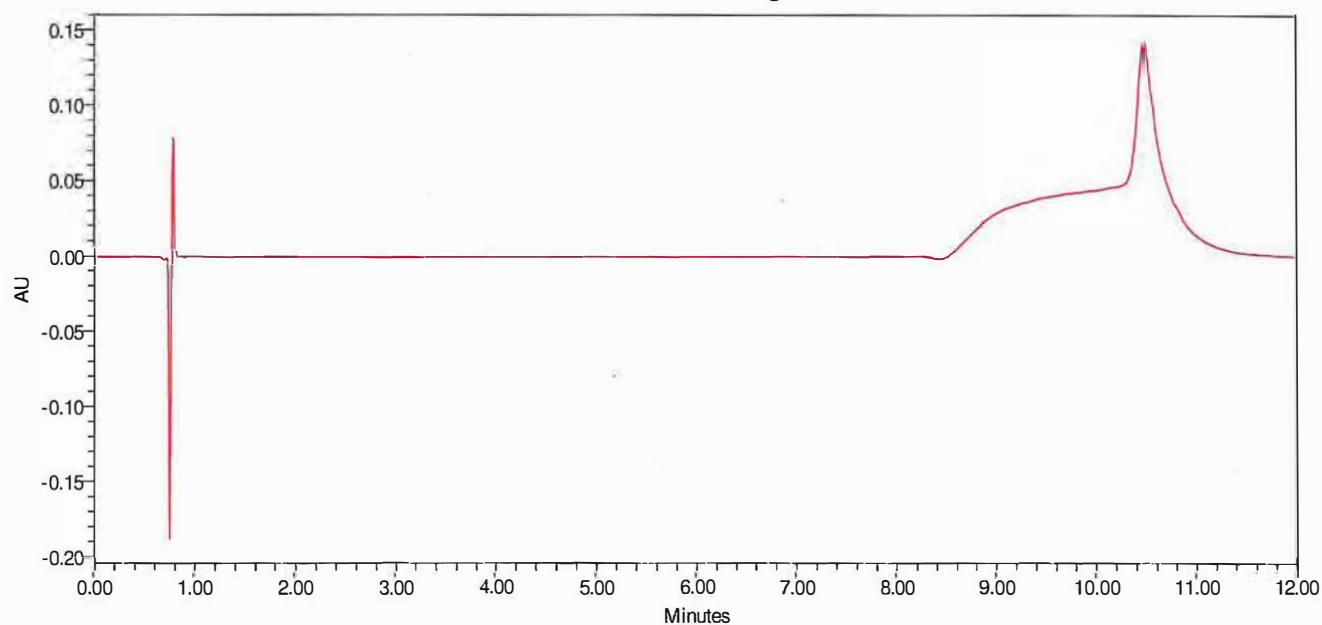
Reported by User: System
Report Method: Cannabinoids Quan Rep
Report Method ID: 13447
Page: 3 of 7

Project Name: 2021\Method Development Miao
Date Printed:
3/23/2022
1:12:26 PM US/Pacific

Auto-Scaled Chromatogram



Auto-Scaled Chromatogram



Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

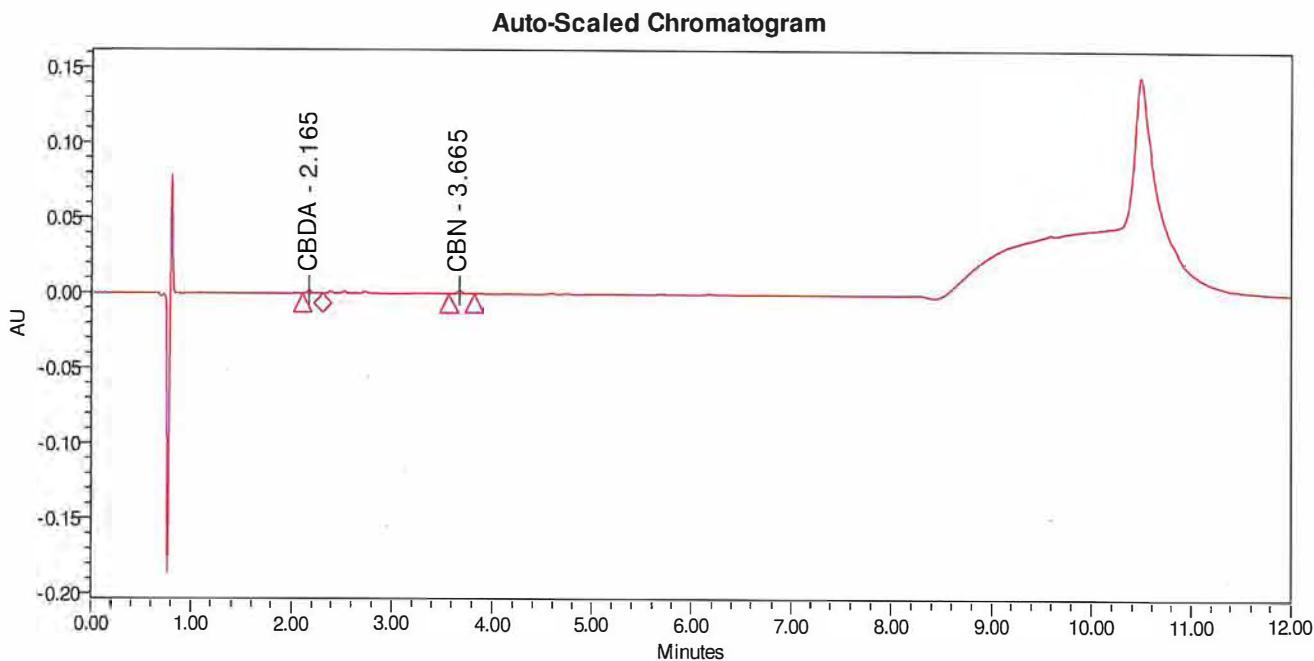
Page: 4 of 7

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

1:12:26 PM US/Pacific



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.158				
2	CBDA	2.158				
3	CBDA	2.158				
4	CBDA	2.158				
5	CBDA	2.158				
6	CBDA	2.158				
7	CBDA	2.158				
8	CBDA	2.165	6008	2161	0.299	ppm
9	CBG	2.369				
10	CBG	2.369				
11	CBG	2.369				
12	CBG	2.369				
13	CBG	2.369				
14	CBG	2.369				
15	CBG	2.369				
16	CBG	2.369				
17	CBD	2.506				
18	CBD	2.506				
19	CBD	2.506				
20	CBD	2.506				
21	CBD	2.506				
22	CBD	2.506				
23	CBD	2.506				

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 5 of 7

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

1:12:26 PM US/Pacific

Peak Results

	Name	RT	Area	Height	Amount	Units
24	CBD	2.506				
25	THCV	2.706				
26	THCV	2.706				
27	THCV	2.706				
28	THCV	2.706				
29	THCV	2.706				
30	THCV	2.706				
31	THCV	2.706				
32	THCV	2.706				
33	CBN	3.633				
34	CBN	3.633				
35	CBN	3.633				
36	CBN	3.633				
37	CBN	3.633				
38	CBN	3.633				
39	CBN	3.633				
40	CBN	3.665	7554	2090	0.286	ppm
41	delta9-THC	4.546				
42	delta9-THC	4.546				
43	delta9-THC	4.546				
44	delta9-THC	4.546				
45	delta9-THC	4.546				
46	delta9-THC	4.546				
47	delta9-THC	4.546				
48	delta9-THC	4.546				
49	delta8-THC	4.694				
50	delta8-THC	4.694				
51	delta8-THC	4.694				
52	delta8-THC	4.694				
53	delta8-THC	4.694				
54	delta8-THC	4.694				
55	delta8-THC	4.694				
56	delta8-THC	4.694				
57	CBC	5.636				
58	CBC	5.636				
59	CBC	5.636				
60	CBC	5.636				
61	CBC	5.636				
62	CBC	5.636				
63	CBC	5.636				
64	CBC	5.636				

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 6 of 7

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

1:12:26 PM US/Pacific

Peak Results

	Name	RT	Area	Height	Amount	Units
65	THCA	6.131				
66	THCA	6.131				
67	THCA	6.131				
68	THCA	6.131				
69	THCA	6.131				
70	THCA	6.131				
71	THCA	6.131				
72	THCA	6.131				

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 7 of 7

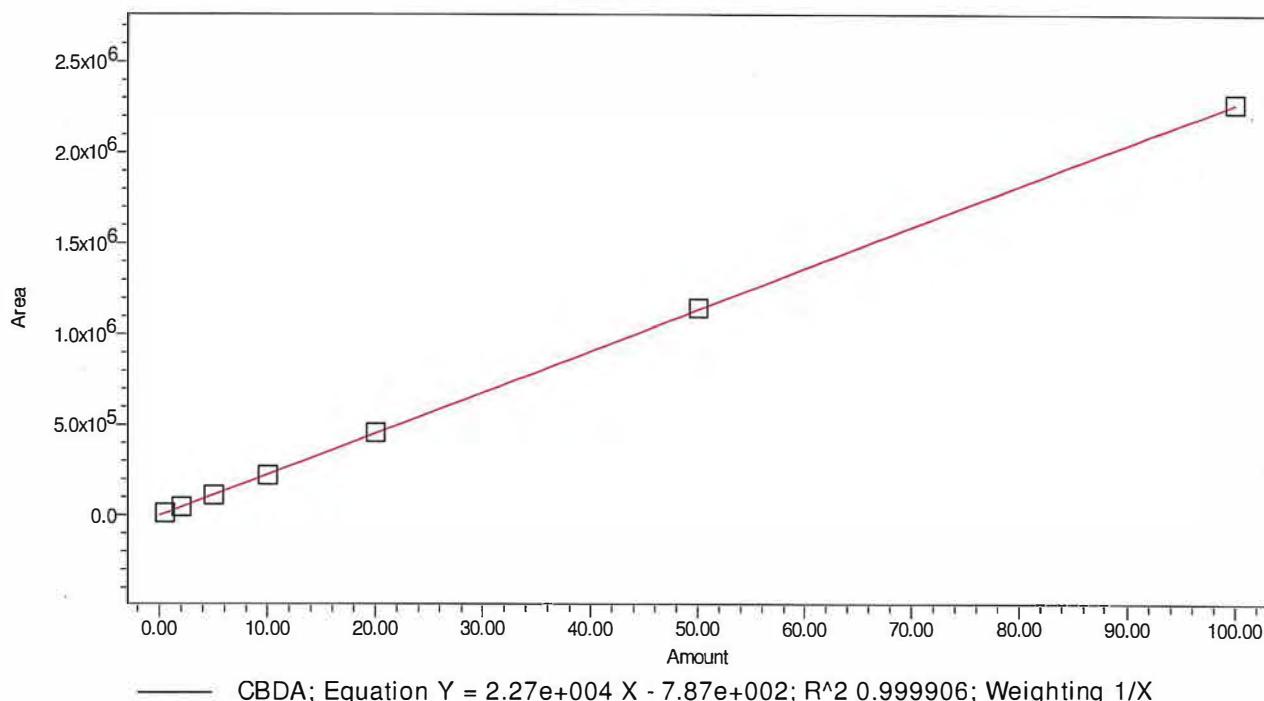
Project Name: 2021\Method Development Miao

Date Printed:

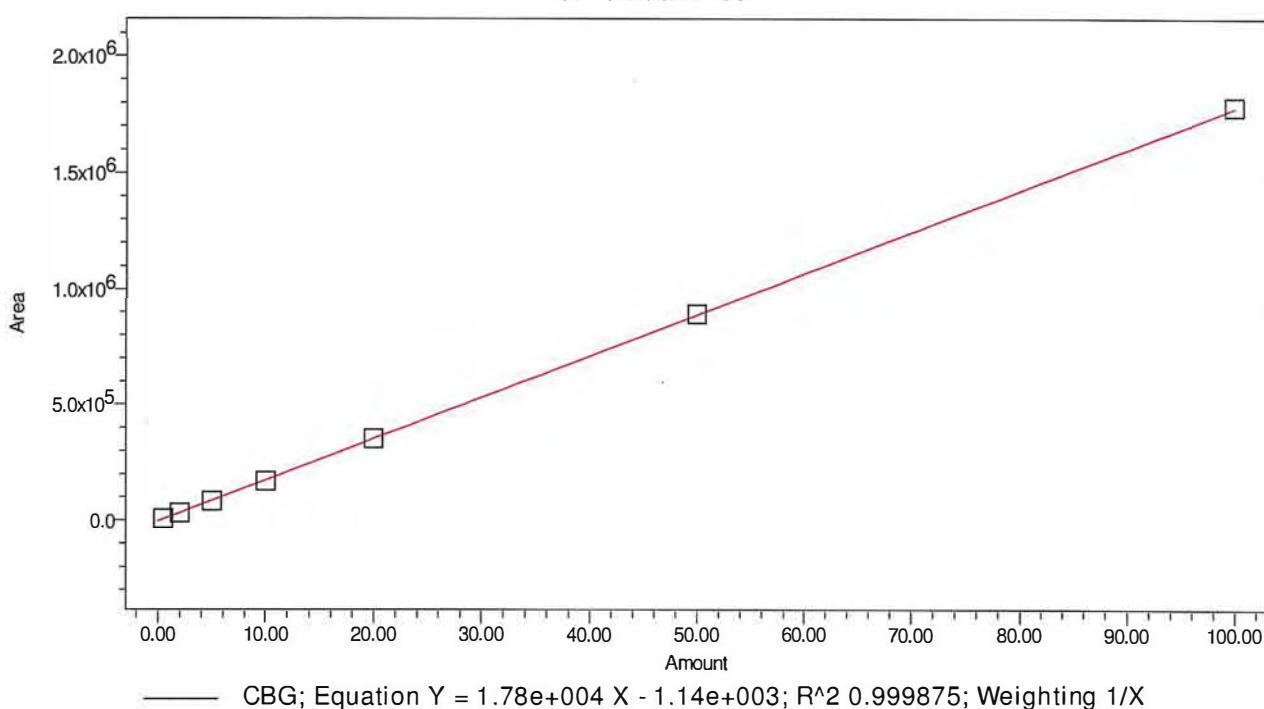
3/23/2022

1:12:26 PM US/Pacific

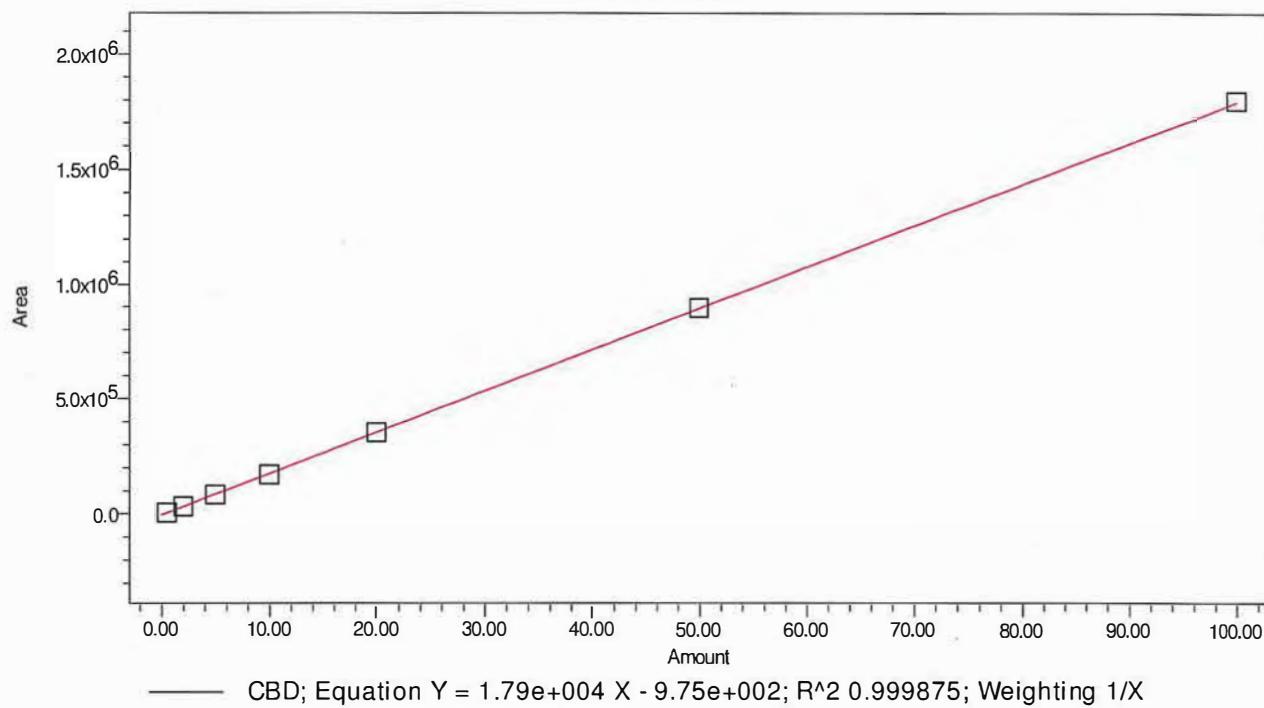
Calibration Plot



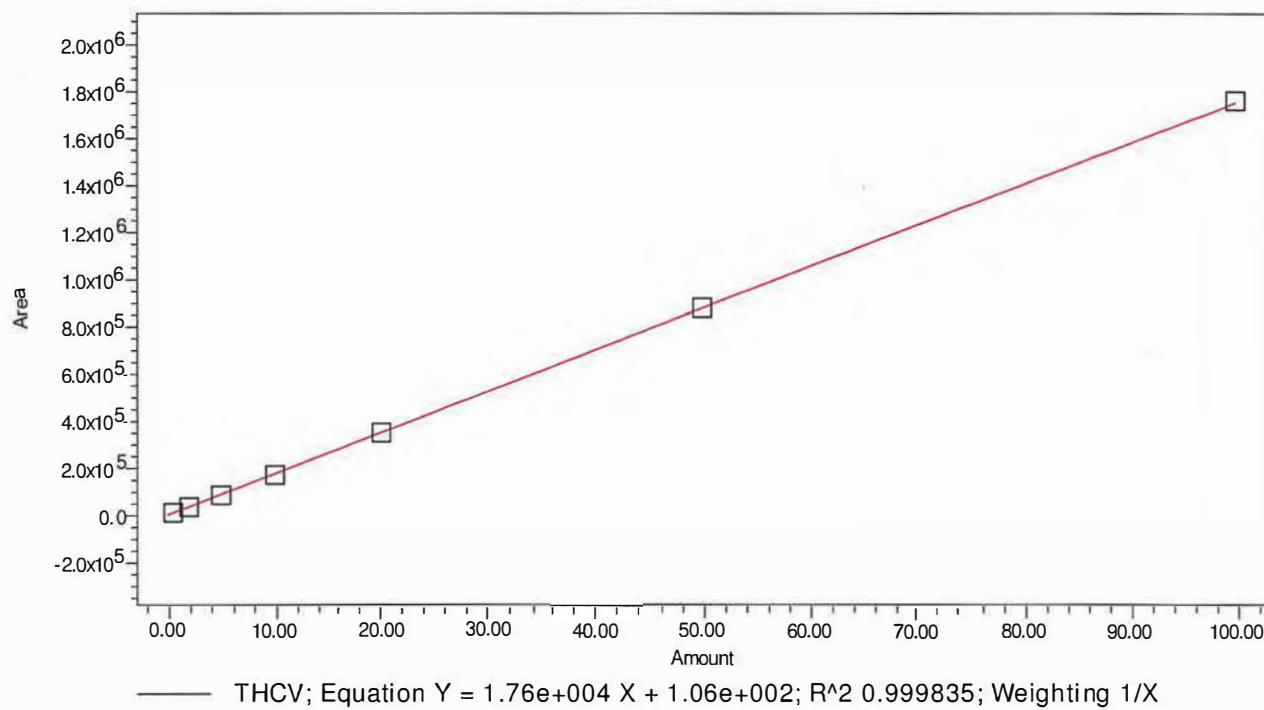
Calibration Plot



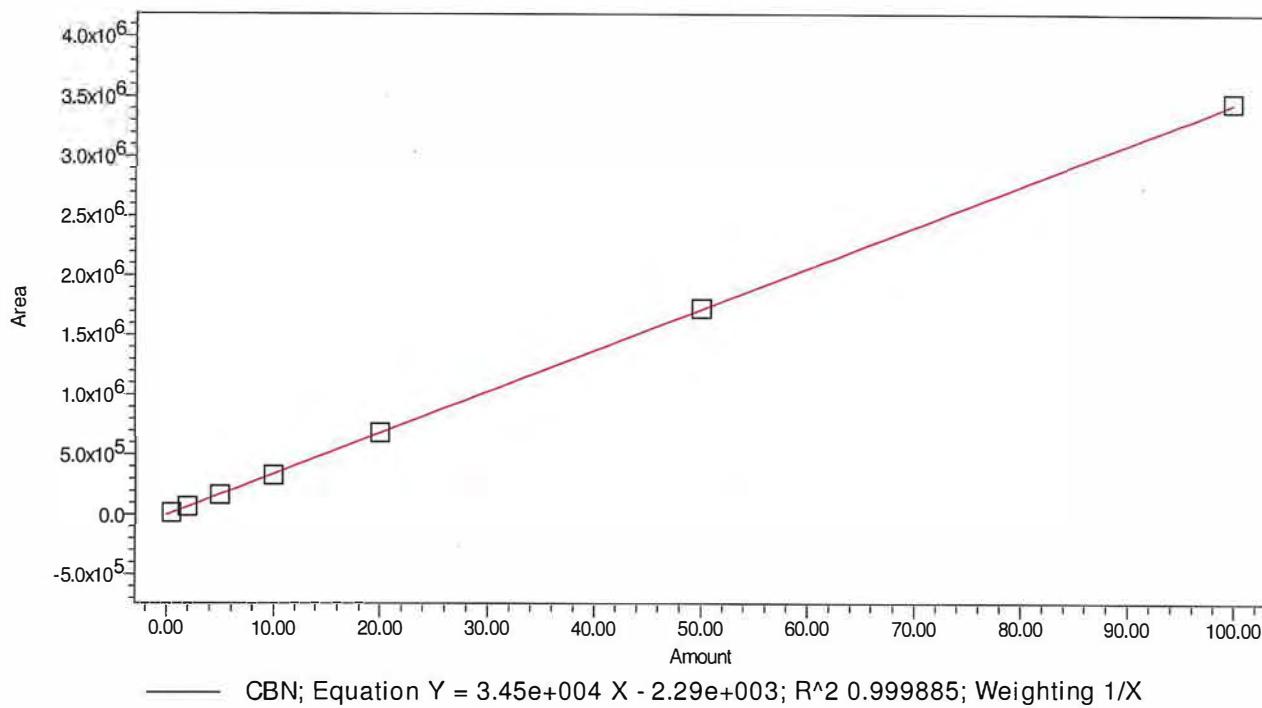
Calibration Plot



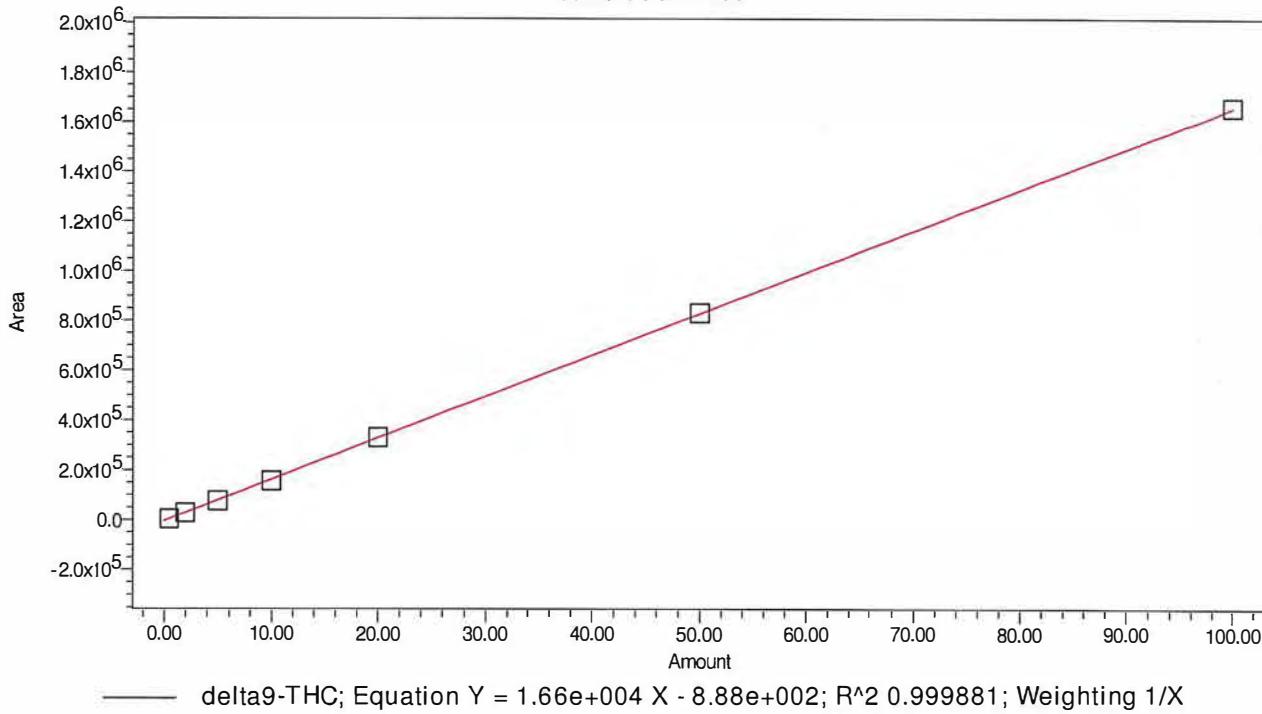
Calibration Plot



Calibration Plot



Calibration Plot



Reported by User: System

Report Method: Calibration curves

Report Method ID: 12679

Page: 3 of 7

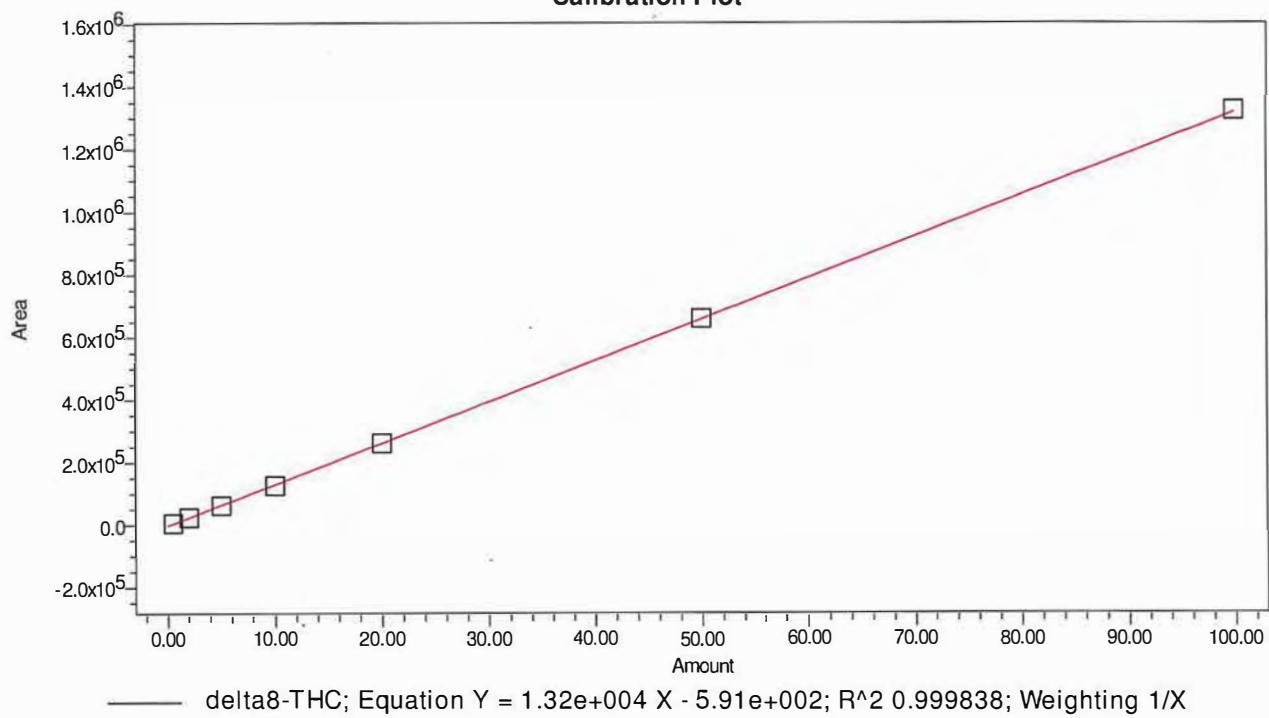
Project Name: 2021\Method Development Miao

Date Printed:

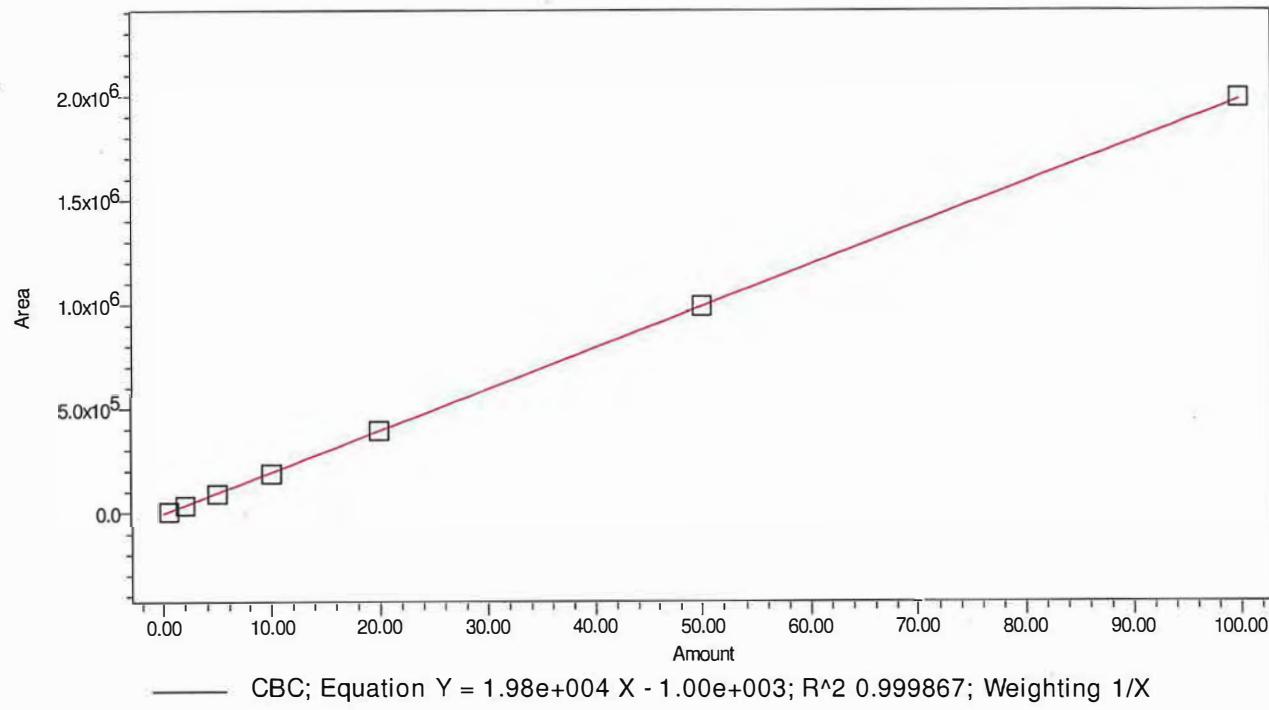
3/24/2022

11:10:11 AM US/Pacific

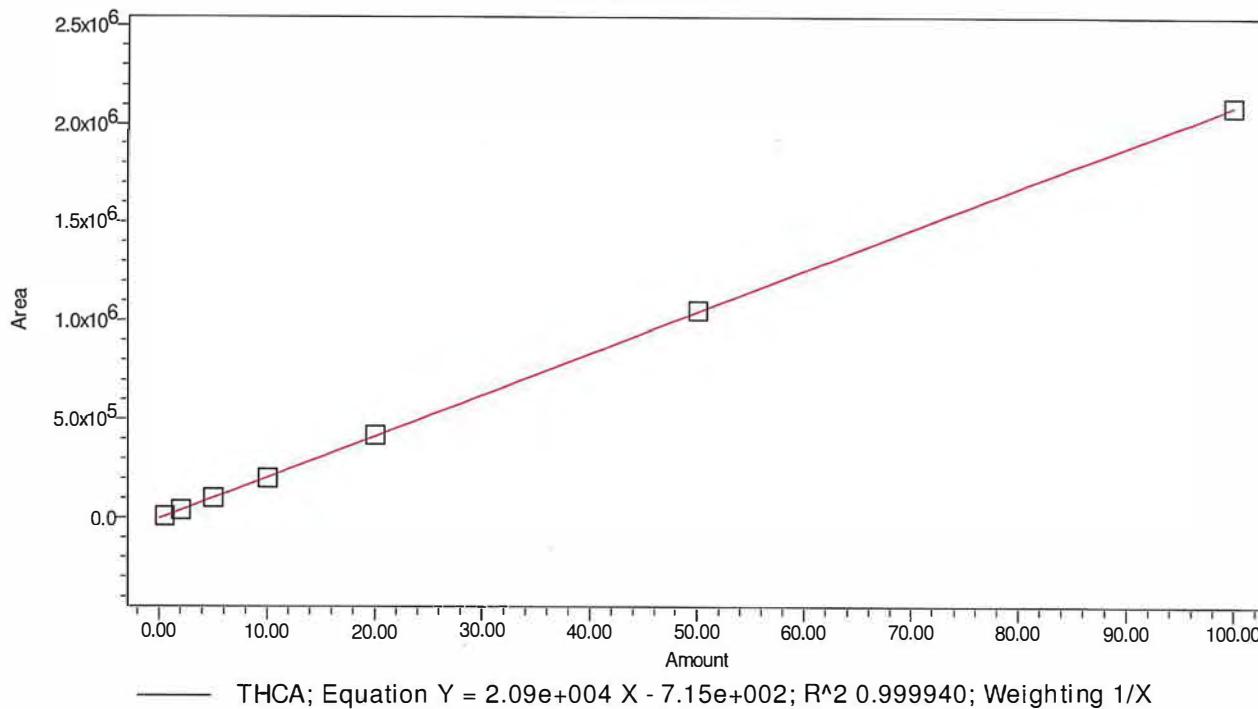
Calibration Plot



Calibration Plot



Calibration Plot



Peak CBDA

	Name	Level	Retention Time (min)	Area ($\mu V \cdot sec$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	CBDA	Level 1	2.169	11265	13.500	4097	0.500000	0.530071	ppm	6.014	No
2	CBDA	Level 2	2.171	43909	12.000	16780	2.000000	1.965824	ppm	-1.709	No
3	CBDA	Level 3	2.169	109890	14.900	42623	5.000000	4.867852	ppm	-2.643	No
4	CBDA	Level 4	2.167	220259	12.500	85778	10.000000	9.722104	ppm	-2.779	No
5	CBDA	Level 5	2.165	456199	12.700	180263	20.000000	20.099255	ppm	0.496	No
6	CBDA	Level 6	2.163	1142977	12.600	458923	50.000000	50.305300	ppm	0.611	No
7	CBDA	Level 7	2.161	2273077	12.600	924051	100.000000	100.009593	ppm	0.010	No

Peak: CBG

	Name	Level	Retention Time (min)	Area ($\mu V \cdot sec$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	CBG	Level 1	2.388	8456	8.500	3082	0.500000	0.538935	ppm	7.787	No
2	CBG	Level 2	2.391	33842	9.400	12549	2.000000	1.964577	ppm	-1.771	No
3	CBG	Level 3	2.388	84767	9.200	31639	5.000000	4.824448	ppm	-3.511	No
4	CBG	Level 4	2.387	171365	9.400	63926	10.000000	9.687668	ppm	-3.123	No
5	CBG	Level 5	2.385	354653	9.400	132897	20.000000	19.980867	ppm	-0.096	No
6	CBG	Level 6	2.385	892948	9.500	335869	50.000000	50.210692	ppm	0.421	No
7	CBG	Level 7	2.384	1784746	9.400	677035	100.000000	100.292813	ppm	0.293	No

Reported by User: System

Report Method: Calibration curves

Report Method ID: 12679

Page: 5 of 7

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

11:10:11 AM US/Pacific

Peak: CBD

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	CBD	Level 1	2.527	8717	10.300	3064	0.500000	0.540163	ppm	8.033	No
2	CBD	Level 2	2.529	34216	9.000	12441	2.000000	1.961343	ppm	-1.933	No
3	CBD	Level 3	2.527	85549	10.400	31234	5.000000	4.822345	ppm	-3.553	No
4	CBD	Level 4	2.525	173013	11.100	62811	10.000000	9.697087	ppm	-3.029	No
5	CBD	Level 5	2.523	357096	11.000	129859	20.000000	19.956773	ppm	-0.216	No
6	CBD	Level 6	2.523	899302	11.300	326962	50.000000	50.176238	ppm	0.352	No
7	CBD	Level 7	2.522	1799463	10.600	654057	100.000000	100.346050	ppm	0.346	No

Peak: THCV

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	THCV	Level 1	2.727	9735	20.700	3013	0.500000	0.548607	ppm	9.721	No
2	THCV	Level 2	2.729	34298	16.400	11944	2.000000	1.948017	ppm	-2.599	No
3	THCV	Level 3	2.727	83996	17.500	29866	5.000000	4.779521	ppm	-4.410	No
4	THCV	Level 4	2.725	170205	20.000	59964	10.000000	9.691150	ppm	-3.088	No
5	THCV	Level 5	2.724	350004	22.900	124106	20.000000	19.934932	ppm	-0.325	No
6	THCV	Level 6	2.724	879520	24.700	311831	50.000000	50.103335	ppm	0.207	No
7	THCV	Level 7	2.723	1763986	31.900	622143	100.000000	100.494438	ppm	0.494	No

Peak: CBN

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	CBN	Level 1	3.672	16125	13.700	4495	0.500000	0.534237	ppm	6.847	No
2	CBN	Level 2	3.675	65603	17.900	18381	2.000000	1.969876	ppm	-1.506	No
3	CBN	Level 3	3.670	165606	19.900	46372	5.000000	4.871491	ppm	-2.570	No
4	CBN	Level 4	3.669	330610	19.900	92804	10.000000	9.659132	ppm	-3.409	No
5	CBN	Level 5	3.667	686318	26.400	192608	20.000000	19.980123	ppm	-0.099	No
6	CBN	Level 6	3.666	1729619	32.200	485899	50.000000	50.251869	ppm	0.504	No
7	CBN	Level 7	3.665	3452205	43.400	970541	100.000000	100.233272	ppm	0.233	No

Peak: delta9-THC

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	delta9-THC	Level 1	4.596	8008	9.900	1847	0.500000	0.536058	ppm	7.212	No
2	delta9-THC	Level 2	4.596	31657	11.400	7421	2.000000	1.961038	ppm	-1.948	No
3	delta9-THC	Level 3	4.592	79731	12.900	18696	5.000000	4.857746	ppm	-2.845	No
4	delta9-THC	Level 4	4.590	159487	12.300	37530	10.000000	9.663497	ppm	-3.365	No
5	delta9-THC	Level 5	4.587	332095	17.800	78175	20.000000	20.064011	ppm	0.320	No
6	delta9-THC	Level 6	4.584	832380	17.100	196692	50.000000	50.208948	ppm	0.418	No

Reported by User: System

Report Method: Calibration curves

Report Method ID: 12679

Page: 6 of 7

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

11:10:11 AM US/Pacific

Peak: delta9-THC

	Name	Level	Retention Time (min)	Area (μV^*sec)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
7	delta9-THC	Level 7	4.584	1662177	13.000	394602	100.000000	100.208702	ppm	0.209	No

Peak: delta8-THC

	Name	Level	Retention Time (min)	Area (μV^*sec)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	delta8-THC	Level 1	4.745	6693	15.100	1424	0.500000	0.551624	ppm	10.325	No
2	delta8-THC	Level 2	4.750	24666	12.200	5508	2.000000	1.912671	ppm	-4.366	No
3	delta8-THC	Level 3	4.744	63408	17.300	14132	5.000000	4.846664	ppm	-3.067	No
4	delta8-THC	Level 4	4.742	127022	17.300	28330	10.000000	9.664222	ppm	-3.358	No
5	delta8-THC	Level 5	4.739	263018	19.600	58584	20.000000	19.963360	ppm	-0.183	No
6	delta8-THC	Level 6	4.737	660803	19.000	147121	50.000000	50.087922	ppm	0.176	No
7	delta8-THC	Level 7	4.737	1326127	20.100	293607	100.000000	100.473537	ppm	0.474	No

Peak: CBC

	Name	Level	Retention Time (min)	Area (μV^*sec)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	CBC	Level 1	5.712	9576	14.600	1836	0.500000	0.533666	ppm	6.733	No
2	CBC	Level 2	5.712	38609	21.500	7272	2.000000	1.998254	ppm	-0.087	No
3	CBC	Level 3	5.706	94345	22.800	18154	5.000000	4.809777	ppm	-3.804	No
4	CBC	Level 4	5.702	190604	24.900	36566	10.000000	9.665504	ppm	-3.345	No
5	CBC	Level 5	5.698	395107	24.200	76005	20.000000	19.981543	ppm	-0.092	No
6	CBC	Level 6	5.695	991865	23.300	191155	50.000000	50.084644	ppm	0.169	No
7	CBC	Level 7	5.693	1989835	23.300	383760	100.000000	100.426613	ppm	0.427	No

Peak: THCA

	Name	Level	Retention Time (min)	Area (μV^*sec)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	THCA	Level 1	6.179	9920	17.900	1578	0.500000	0.508136	ppm	1.627	No
2	THCA	Level 2	6.177	41491	25.900	6468	2.000000	2.016541	ppm	0.827	No
3	THCA	Level 3	6.167	102514	30.000	16413	5.000000	4.932130	ppm	-1.357	No
4	THCA	Level 4	6.153	203525	28.800	32859	10.000000	9.758311	ppm	-2.417	No
5	THCA	Level 5	6.137	422167	31.100	68760	20.000000	20.204684	ppm	1.023	No
6	THCA	Level 6	6.116	1050309	31.800	172720	50.000000	50.216446	ppm	0.433	No
7	THCA	Level 7	6.102	2089421	31.800	344726	100.000000	99.863751	ppm	-0.136	No

Reported by User: System

Report Method: Calibration curves

Report Method ID: 12679

Page: 7 of 7

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

11:10:11 AM US/Pacific

Sample Name	Weight (g)	Concentration in 1:10 dilution of 40 ml ACN:MeOH 80:20 Extract (mg/L)									Concentration in sample (mg/g) calculated from 1:10 dilution								
		CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
F3-1_10x	0.2023	0.000	0.000	0.000	1.112	1.915	28.153	1.635	49.750	0.468	0.000	0.000	0.000	2.199	3.786	55.666	3.233	98.369	0.925
F3-2_10x	0.2016	0.000	0.000	0.000	1.195	1.886	27.457	1.614	49.042	0.490	0.000	0.000	0.000	2.371	3.742	54.478	3.202	97.306	0.972
Concentration in 40 ml ACN:MeOH 80:20 Extract (mg/L)																			
MS1	0.2009	2.530	2.483	2.354	2.382	2.330	2.466	2.419	2.408	2.491	0.101	0.099	0.094	0.095	0.093	0.099	0.097	0.096	0.100
Amount spiked											0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
Recovery											101%	99%	94%	95%	93%	99%	97%	96%	100%
Concentration in 1: 20 dilution of 40 ml Sample Extract (mg/L)																			
Post-dilution Spike		42.088	41.464	39.378	39.729	39.333	54.073	41.508	64.759	41.094									
Amount spiked		40	40	40	40	40	40	40	40	40									
Unspiked sample		0.000	0	0	1.195	1.886	27.457	1.614	49.042	0.49									
Recovery		105%	104%	98%	98%	96%	101%	102%	101%	102%									
Concentration in 40 ml ACN:MeOH 80:20 Extract (mg/L)																			
Method blank		CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
Matrix blank 1	0.1982	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	0	0	0	0	0	0	0	0	0

Sample Name	Weight (g)	Concentration in 1:1 dilution of 40 ml Sample Extract (mg/L)									Concentration in sample (mg/g) calculated from 1:1 dilution								
		CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
F3-1_1x	0.2023	2.264	2.129	0.000	11.286	19.563	286.696	20.593	514.198	4.627	0.448	0.421	0.000	2.232	3.868	56.687	4.072	101.670	0.915
F3-2_1x	0.2016	2.237	2.317	0.000	11.337	19.233	281.129	18.128	505.305	4.444	0.444	0.460	0.000	2.249	3.816	55.780	3.597	100.259	0.882

day 3

Note: For Δ9-THC and THCA
For all the other cannabinoids

Concentration in sample (mg/g) = (Concentration in 1: 10 of 40ml sample extract ug/L) x 10 x 40 / Weight (g) / 1000/ 1000
Concentration in sample (mg/g) = (Concentration in 1: 1 of 40ml sample extract ug/L) x 1 x 40 / Weight (g) / 1000/ 1000

	Cannabinoids Concentration in Sample (mg/g)								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
F3-1	0.448	0.421	0.000	2.232	3.868	55.666	4.072	98.369	0.915
F3-2	0.444	0.460	0.000	2.249	3.816	54.478	3.597	97.306	0.882
RL	0.100	0.100	0.100	0.100	0.100	1.000	0.100	1.000	0.100
AVG	0.446	0.440	<RL	2.240	3.842	55.072	3.834	97.837	0.898
RPD	0.9%	8.8%		0.8%	1.4%	2.2%	12.4%	1.1%	3.7%
	Cannabinoids Concentration in Sample (%)								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
F3-1	0.045	0.042	0.000	0.223	0.387	5.567	0.407	9.837	0.091
F3-2	0.044	0.046	0.000	0.225	0.382	5.448	0.360	9.731	0.088

Sample Name	Retention Time (min)								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
9Mix_0.5ppm_Std	2.16	2.72	2.52	2.38	3.66	4.58	4.74	6.16	5.70
9Mix_2ppm_Std	2.16	2.72	2.52	2.38	3.66	4.58	4.73	6.15	5.69
9Mix_5ppm_Std	2.16	2.72	2.52	2.38	3.67	4.59	4.74	6.15	5.70
9Mix_10ppm_Std	2.16	2.72	2.52	2.38	3.67	4.58	4.74	6.14	5.70
9Mix_20ppm_Std	2.16	2.72	2.52	2.39	3.67	4.59	4.74	6.14	5.70
9Mix_50ppm_Std	2.17	2.73	2.53	2.39	3.67	4.60	4.75	6.13	5.71
9Mix_100ppm_Std	2.16	2.73	2.52	2.39	3.67	4.59	4.74	6.11	5.70
Average	2.16	2.72	2.52	2.38	3.67	4.59	4.74	6.14	5.70
MS_1x	2.17	2.73	2.53	2.39	3.68	4.60	4.76	6.18	5.72
F3-1_10x	2.16	2.71	2.51	2.39	3.68	4.60	4.77	6.14	5.72
F3-2_10x	2.16	2.71	2.51	2.39	3.68	4.60	4.78	6.14	5.71
F3-2_PDS_20x	2.17	2.73	2.53	2.39	3.68	4.60	4.75	6.13	5.71
F3-1_1x	2.18	2.73	2.51	2.39	3.67	4.59	4.73	6.07	5.71
F3-2_1x	2.18	2.73	2.51	2.39	3.68	4.59	4.74	6.08	5.72

**Method Validation
Quality Control Report**
for Initial and Continuing Calibration Verification Standard, Method Blanks, Method Standard, and Laboratory Control Sample

Date of Analysis: 3/22/2022
 Matrix: Cannabis flower, Cellulose powder (LCS)
 CTLB Nos.: 19-01597-CE
 Analytical Method: Cannabinoids Concentration by UPLC

Analyte	Initial and Continuing Calibration Verification Standard				Method Blanks		Matrix Blanks		Method Standard				
	Sample Name	Found	True Value	Recovery	Control Limits	Repl. 1	Repl. 2	Repl. 1	Repl. 2	Found	True Value	Recovery	Control Limits
		mg/L	mg/L	%	%	mg/L	mg/L	mg/L	mg/L	mg	mg	%	%
CBDA	ICV_10ppm	9.6	10.0	96.2	80-120	ND		ND				#DIV/0!	80-120
THCV		9.7	10.0	97.1	80-120	ND		ND				#DIV/0!	80-120
CBD		9.3	10.0	93.3	80-120	ND		ND				#DIV/0!	80-120
CBG		9.3	10.0	93.3	80-120	ND		ND				#DIV/0!	80-120
CBN		9.2	10.0	91.8	80-120	ND		ND				#DIV/0!	80-120
Δ9-THC		9.7	10.0	96.5	80-120	ND		ND				#DIV/0!	80-120
Δ8-THC		9.7	10.0	97.2	80-120	ND		ND				#DIV/0!	80-120
THCA		9.5	10.0	95.0	80-120	ND		ND				#DIV/0!	80-120
CBC		9.7	10.0	97.2	80-120	ND		ND				#DIV/0!	80-120
CBDA	CCV_50ppm_001	50.3	50.0	100.6	80-120								
THCV		50.1	50.0	100.3	80-120								
CBD		50.2	50.0	100.3	80-120								
CBG		50.2	50.0	100.5	80-120								
CBN		50.1	50.0	100.3	80-120								
Δ9-THC		50.1	50.0	100.3	80-120								
Δ8-THC		49.9	50.0	99.9	80-120								
THCA		50.1	50.0	100.2	80-120								
CBC		50.0	50.0	100.0	80-120								
CBDA	CCV_50ppm_002	50.7	50.0	101.5	80-120								
THCV		50.8	50.0	101.6	80-120								
CBD		50.6	50.0	101.3	80-120								
CBG		50.7	50.0	101.5	80-120								
CBN		50.7	50.0	101.3	80-120								
Δ9-THC		50.7	50.0	101.3	80-120								
Δ8-THC		50.5	51.0	98.9	80-120								
THCA		50.5	50.0	101.1	80-120								
CBC		50.5	50.0	101.0	80-120								

Notes:

Miaotian Sun

Analyst

3/24/2022

Date



3-30-22
Supervisor

**Method Validation
Quality Control Report
for Matrix Spike Recovery**

Date of Analysis: 3/22/2022
 Matrix: Cannabis flower, Cellulose powder (LCS)
 I.S. Nos.: 19-01597-CE
 CTLB Nos.: 19-01597-CE
 Analytical Method: Cannabinoids Concentration by UPLC

Page 2 of 2

Analyte	Matrix Spikes 1			Matrix Spikes 2			Matrix Spikes 3			Control Limits
	Weight (g)	0.2009		Control Limits	Weight (g)		Control Limits	Weight (g)		
	Found mg	Amount Added mg	Recovery %		Found mg	Amount Added mg		Found mg	Amount Added mg	
CBDA	0.101	0.100	101.2	70-130			#DIV/0!	70-130		#DIV/0!
THCV	0.099	0.100	99.3	70-130			#DIV/0!	70-130		#DIV/0!
CBD	0.094	0.100	94.2	70-130			#DIV/0!	70-130		#DIV/0!
CBG	0.095	0.100	95.3	70-130			#DIV/0!	70-130		#DIV/0!
CBN	0.093	0.100	93.2	70-130			#DIV/0!	70-130		#DIV/0!
Δ9-THC	0.099	0.100	98.6	70-130			#DIV/0!	70-130		#DIV/0!
Δ8-THC	0.097	0.100	96.8	70-130			#DIV/0!	70-130		#DIV/0!
THCA	0.096	0.100	96.3	70-130			#DIV/0!	70-130		#DIV/0!
CBC	0.100	0.100	99.6	70-130			#DIV/0!	70-130		#DIV/0!
Unspiked Sample			Post Dilution Spike							
	mg/L	mg/L	mg/L	RPD	mg/L	mg/L	%	%		
CBDA	0.0		0.0	#DIV/0!	42.1	40.0	105.2	70-130		
THCV	0.0		0.0	#DIV/0!	41.5	40.0	103.7	70-130		
CBD	0.0		0.0	#DIV/0!	39.4	40.0	98.4	70-130		
CBG	1.2		1.2	100.0%	39.7	40.0	97.8	70-130		
CBN	1.9		1.9	100.0%	39.3	40.0	96.0	70-130		
Δ9-THC	27.5		27.5	100.0%	54.1	40.0	100.9	70-130		
Δ8-THC	1.6		1.6	100.0%	41.5	40.0	101.8	70-130		
THCA	49.0		49.0	100.0%	64.8	40.0	100.6	70-130		
CBC	0.5		0.5	100.0%	41.1	40.0	102.1	70-130		

Notes: Recovery of Post Dilution Spike (PDS) = (Concentration in PDS (mg/L) - Concentration in Unspiked Sample (mg/L) / 2) / Amount Spiked (mg/L)

Dilution factor of PDS is twice as of the Unspiked Sample.

Miaotian Sun
Analyst 3/24/2022
Date


Supervisor

3-30-22
Date

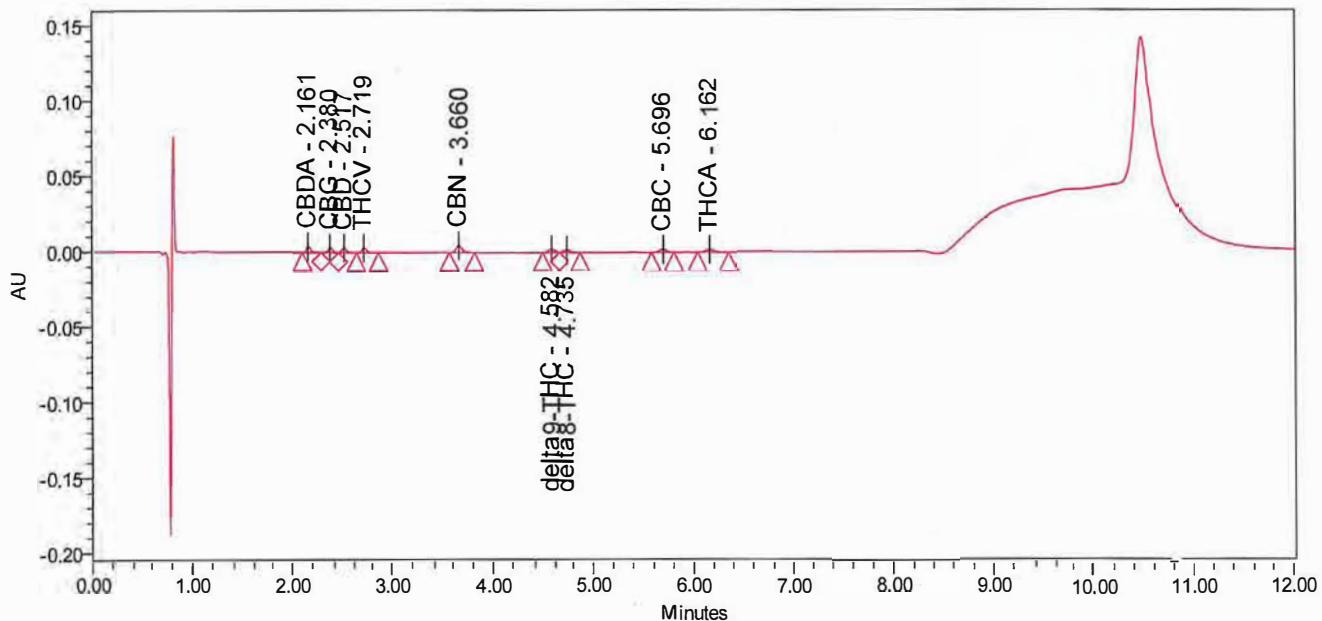
	Vial	Inj Vol (uL)	# of Injs	Label	SampleName	Level	Function	Method Set / Report or Export Method	Label Reference	Processing	Run Time (Minutes)
1							Clear Calibration	Cannabinoids_20220322_Day3		Normal	
2							Refresh Syringe	Cannabinoids_20220322_Day3			
3							Wash Needle	Cannabinoids_20220322_Day3			
4							Purge Inj	Cannabinoids_20220322_Day3			10.00
5	1	2.0	3	03162022	SolvBlk		Inject Samples	Cannabinoids_20220322_Day3		Normal	12.00
6	2	2.0	1	03162022	9Mix_0.5ppm_Std	Level 1	Inject Standards	Cannabinoids_20220322_Day3		Normal	12.00
7	3	2.0	1	03162022	9Mix_2ppm_Std	Level 2	Inject Standards	Cannabinoids_20220322_Day3		Normal	12.00
8	4	2.0	1	03162022	9Mix_5ppm_Std	Level 3	Inject Standards	Cannabinoids_20220322_Day3		Normal	12.00
9	5	2.0	1	03162022	9Mix_10ppm_Std	Level 4	Inject Standards	Cannabinoids_20220322_Day3		Normal	12.00
10	6	2.0	1	03162022	9Mix_20ppm_Std	Level 5	Inject Standards	Cannabinoids_20220322_Day3		Normal	12.00
11	7	2.0	1	03162022	9Mix_50ppm_Std	Level 6	Inject Standards	Cannabinoids_20220322_Day3		Normal	12.00
12	8	2.0	1	03162022	9Mix_100ppm_Std	Level 7	Inject Standards	Cannabinoids_20220322_Day3		Normal	12.00
13							Purge Inj	Cannabinoids_20220322_Day3			10.00
14	1	2.0	1	03162022	SolvBlk		Inject Samples	Cannabinoids_20220322_Day3		Normal	12.00
15	9	2.0	1	03162022	ICV_10ppm		Inject Samples	Cannabinoids_20220322_Day3		Normal	12.00
16	10	2.0	1	Smp	MethBlk_1x		Inject Controls	Cannabinoids_20220322_Day3		Normal	12.00
17	11	2.0	1	Smp	MatrixBlk_1x		Inject Samples	Cannabinoids_20220322_Day3		Normal	12.00
18	12	2.0	1	Smp	MS_1x		Inject Samples	Cannabinoids_20220322_Day3		Normal	12.00
19	13	2.0	1	Smp	F3-1_10x		Inject Samples	Cannabinoids_20220322_Day3		Normal	12.00
20	14	2.0	1	Smp	F3-2_10x		Inject Samples	Cannabinoids_20220322_Day3		Normal	12.00
21	15	2.0	1	Smp	F3-2_PDS_20x		Inject Samples	Cannabinoids_20220322_Day3		Normal	12.00
22							Purge Inj	Cannabinoids_20220322_Day3			10.00
23	1	2.0	1	03162022	SolvBlk		Inject Samples	Cannabinoids_20220322_Day3		Normal	12.00
24	7	2.0	1	03162022	CCV1_50ppm		Inject Samples	Cannabinoids_20220322_Day3		Normal	12.00
25	16	2.0	1	Smp	F3-1_1x		Inject Samples	Cannabinoids_20220322_Day3		Normal	12.00
26	17	2.0	1	Smp	F3-2_1x		Inject Samples	Cannabinoids_20220322_Day3		Normal	12.00
27	18	2.0	1	Smp	LOD-1		Inject Samples	Cannabinoids_20220322_Day3		Normal	12.00
28	19	2.0	1	Smp	LOD-2		Inject Samples	Cannabinoids_20220322_Day3		Normal	12.00
29	20	2.0	1	Smp	LOD-3		Inject Samples	Cannabinoids_20220322_Day3		Normal	12.00
30	21	2.0	1	Smp	LOD-4		Inject Samples	Cannabinoids_20220322_Day3		Normal	12.00
31	22	2.0	1	Smp	LOD-5		Inject Samples	Cannabinoids_20220322_Day3		Normal	12.00
32	23	2.0	1	Smp	LOD-6		Inject Samples	Cannabinoids_20220322_Day3		Normal	12.00
33	24	2.0	1	Smp	LOD-7		Inject Samples	Cannabinoids_20220322_Day3		Normal	12.00
34							Purge Inj	Cannabinoids_20220322_Day3			10.00
35	7	2.0	1	03162022	CCV2_50ppm		Inject Samples	Cannabinoids_20220322_Day3		Normal	12.00
36	1	2.0	3	03162022	SolvBlk		Inject Samples	Cannabinoids_20220322_Day3		Normal	12.00
37							Equilibrate	End			12.00

SAMPLE INFORMATION

Sample Name: 9Mix_0.5ppm_Std
 Sample Type: Standard
 Vial: 2
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes
 Acquired By: System
 Sample Set Name: ValidationDay3_20220322
 Acq. Method Set: Cannabinoids_20220322_Day3
 Processing Method: Cannabinoids_20220322_Day3
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 5:26:45 PM PDT
 Date Processed: 3/23/2022 11:38:39 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.161	10909	4084	0.500	ppm
2	CBG	2.380	8855	3185	0.500	ppm
3	CBD	2.517	8642	3080	0.500	ppm
4	THCV	2.719	8607	2963	0.500	ppm
5	CBN	3.660	16615	4560	0.500	ppm
6	delta9-THC	4.582	8390	1933	0.500	ppm
7	delta8-THC	4.735	7170	1494	0.500	ppm
8	CBC	5.696	9426	1809	0.500	ppm
9	THCA	6.162	10177	1651	0.500	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 1 of 23

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

12:01:13 PM US/Pacific

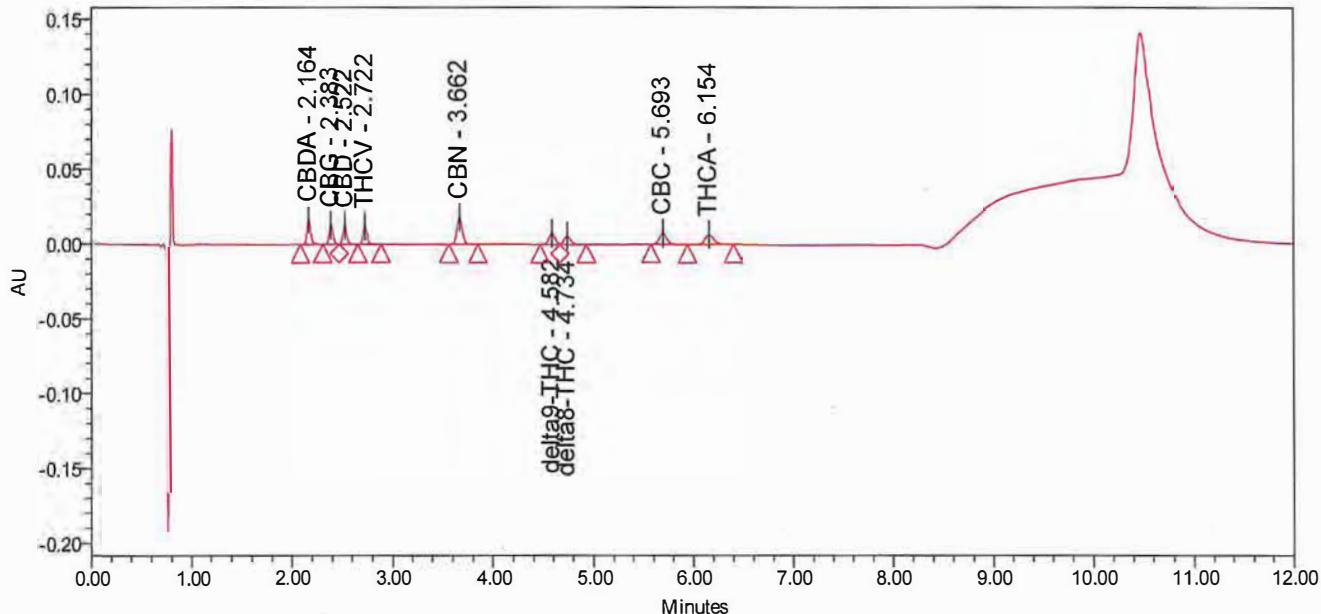
SAMPLE INFORMATION

Sample Name: 9Mix_2ppm_Std
 Sample Type: Standard
 Vial: 3
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay3_20220322
 Acq. Method Set: Cannabinoids_20220322_Day3
 Processing Method: Cannabinoids_20220322_Day3
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 5:39:18 PM PDT
 Date Processed: 3/23/2022 11:38:40 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.164	43919	16747	2.000	ppm
2	CBG	2.383	34304	12702	2.000	ppm
3	CBD	2.522	34405	12479	2.000	ppm
4	THCV	2.722	33507	12002	2.000	ppm
5	CBN	3.662	66407	18548	2.000	ppm
6	delta9-THC	4.582	32173	7522	2.000	ppm
7	delta8-THC	4.734	25673	5630	2.000	ppm
8	CBC	5.693	39223	7381	2.000	ppm
9	THCA	6.154	40490	6483	2.000	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 2 of 23

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

12:01:13 PM US/Pacific

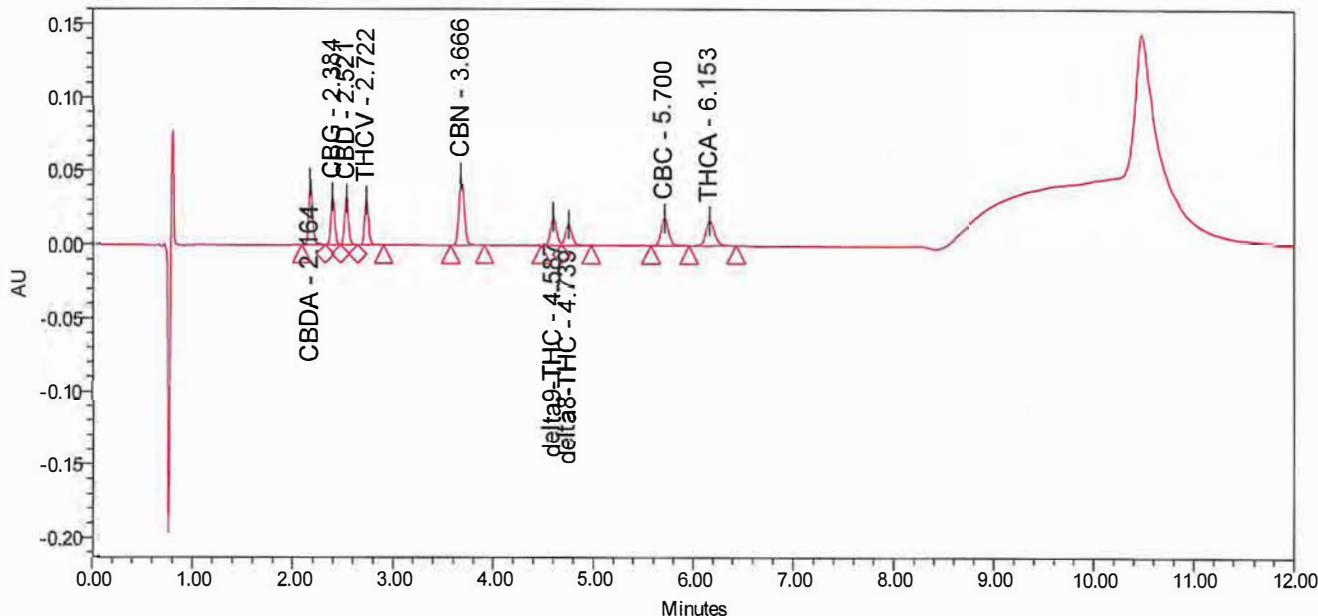
SAMPLE INFORMATION

Sample Name: 9Mix_5ppm_Std
 Sample Type: Standard
 Vial: 4
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

 Acquired By: System
 Sample Set Name: ValidationDay3_20220322
 Acq. Method Set: Cannabinoids_20220322_Day3
 Processing Method: Cannabinoids_20220322_Day3
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 5:51:54 PM PDT
 Date Processed: 3/23/2022 11:38:41 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.164	111078	42816	5.000	ppm
2	CBG	2.384	86905	32249	5.000	ppm
3	CBD	2.521	86722	31557	5.000	ppm
4	THCV	2.722	84535	30146	5.000	ppm
5	CBN	3.666	167935	46803	5.000	ppm
6	delta9-THC	4.587	81057	18958	5.000	ppm
7	delta8-THC	4.739	64528	14242	5.000	ppm
8	CBC	5.700	96978	18464	5.000	ppm
9	THCA	6.153	103532	16635	5.000	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 3 of 23

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

12:01:13 PM US/Pacific

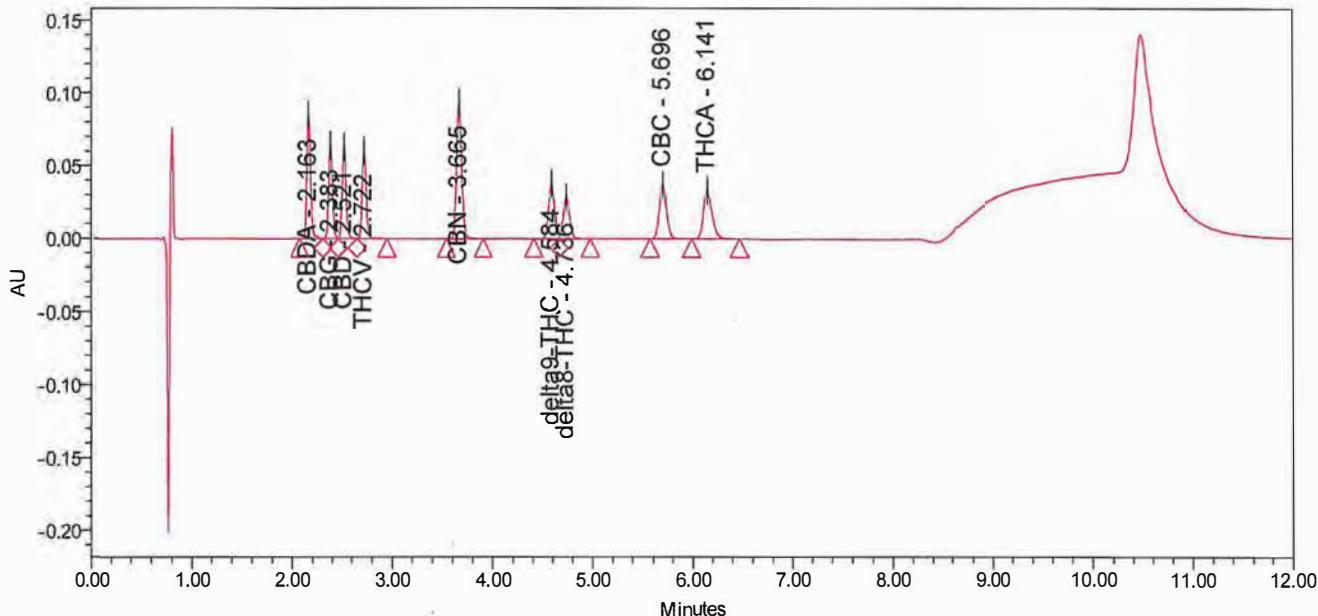
SAMPLE INFORMATION

Sample Name: 9Mix_10ppm_Std
 Sample Type: Standard
 Vial: 5
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay3_20220322
 Acq. Method Set: Cannabinoids_20220322_Day3
 Processing Method: Cannabinoids_20220322_Day3
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 6:04:29 PM PDT
 Date Processed: 3/23/2022 11:38:41 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.163	221016	85831	10.000	ppm
2	CBG	2.383	174107	64713	10.000	ppm
3	CBD	2.521	175843	63465	10.000	ppm
4	THCV	2.722	171916	60619	10.000	ppm
5	CBN	3.665	337103	93957	10.000	ppm
6	delta9-THC	4.584	162479	38135	10.000	ppm
7	delta8-THC	4.736	129763	28678	10.000	ppm
8	CBC	5.696	194063	37083	10.000	ppm
9	THCA	6.141	206645	33253	10.000	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 4 of 23

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

12:01:13 PM US/Pacific

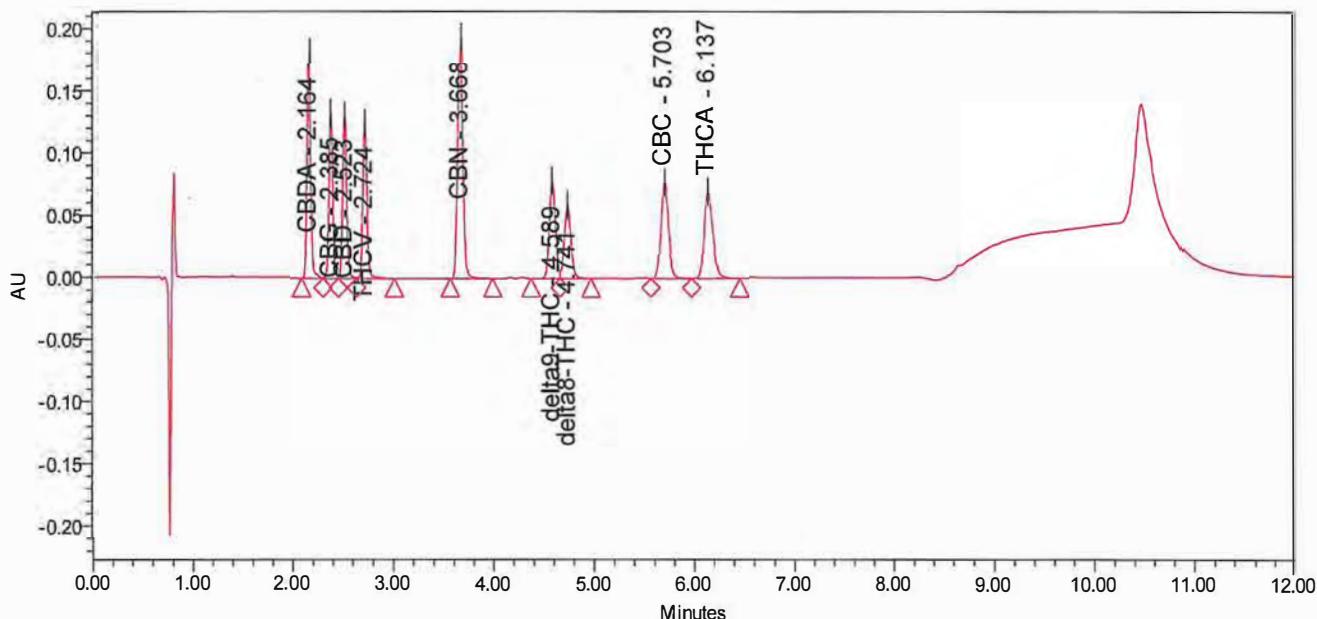
SAMPLE INFORMATION

Sample Name: 9Mix_20ppm_Std
 Sample Type: Standard
 Vial: 6
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay3_20220322
 Acq. Method Set: Cannabinoids_20220322_Day3
 Processing Method: Cannabinoids_20220322_Day3
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 6:17:02 PM PDT
 Date Processed: 3/23/2022 11:38:42 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.164	460423	181058	20.000	ppm
2	CBG	2.385	358922	133209	20.000	ppm
3	CBD	2.523	361232	130410	20.000	ppm
4	THCV	2.724	355530	124967	20.000	ppm
5	CBN	3.668	695960	193874	20.000	ppm
6	Δ^9 -THC	4.589	334081	78225	20.000	ppm
7	Δ^8 -THC	4.741	265348	58667	20.000	ppm
8	CBC	5.703	401266	76256	20.000	ppm
9	THCA	6.137	425267	68950	20.000	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 5 of 23

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

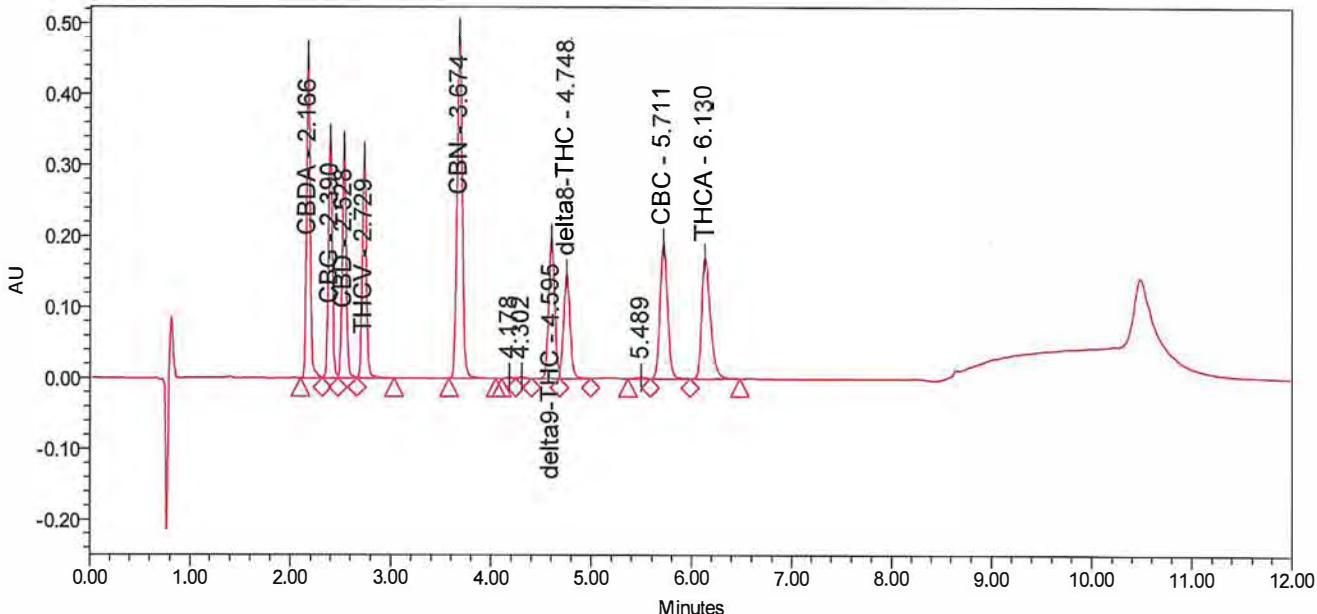
12:01:13 PM US/Pacific

SAMPLE INFORMATION

Sample Name: 9Mix_50ppm_Std
 Sample Type: Standard
 Vial: 7
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes
 Acquired By: System
 Sample Set Name: ValidationDay3_20220322
 Acq. Method Set: Cannabinoids_20220322_Day3
 Processing Method: Cannabinoids_20220322_Day3
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 6:29:38 PM PDT
 Date Processed: 3/23/2022 11:38:42 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.166	1142852	456304	50.000	ppm
2	CBG	2.390	905471	337542	50.000	ppm
3	CBD	2.528	910674	328300	50.000	ppm
4	THCV	2.729	891328	313601	50.000	ppm
5	CBN	3.674	1754222	488593	50.000	ppm
6	delta9-THC	4.309	843417	197859	50.000	ppm
7	delta8-THC	4.595	671959	147961	50.000	ppm
8	CBC	5.711	1007569	191642	50.000	ppm
9	THCA	6.130	1039687	170128	50.000	ppm

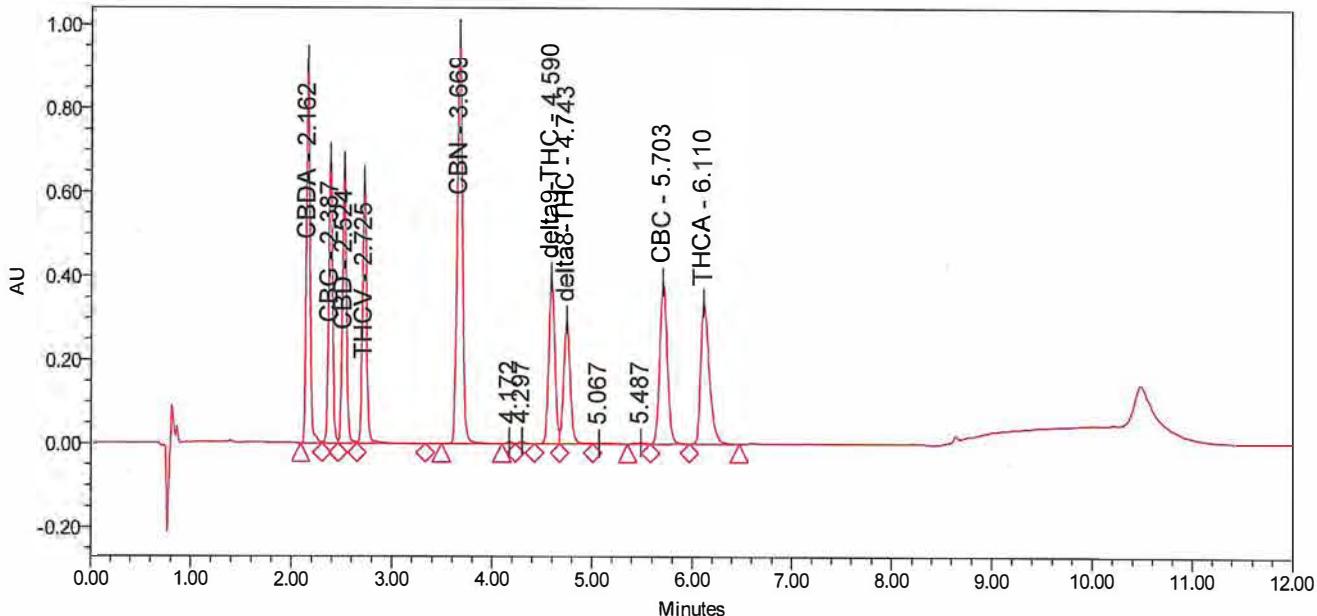
SAMPLE INFORMATION

Sample Name: 9Mix_100ppm_Std
 Sample Type: Standard
 Vial: 8
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

 Acquired By: System
 Sample Set Name: ValidationDay3_20220322
 Acq. Method Set: Cannabinoids_20220322_Day3
 Processing Method: Cannabinoids_20220322_Day3
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 6:42:10 PM PDT
 Date Processed: 3/23/2022 11:38:43 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.162	2268900	920201	100.000	ppm
2	CBG	2.387	1811576	682636	100.000	ppm
3	CBD	2.524	1829112	660697	100.000	ppm
4	THCV	2.725	1788875	628765	100.000	ppm
5	CBN	3.669	3511571	980743	100.000	ppm
6	delta9-THC	4.590	1690670	397508	100.000	ppm
7	delta8-THC	4.743	1352344	295924	100.000	ppm
8	CBC	5.703	2023470	386327	100.000	ppm
9	THCA	6.110	2059982	337149	100.000	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 7 of 23

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

12:01:13 PM US/Pacific

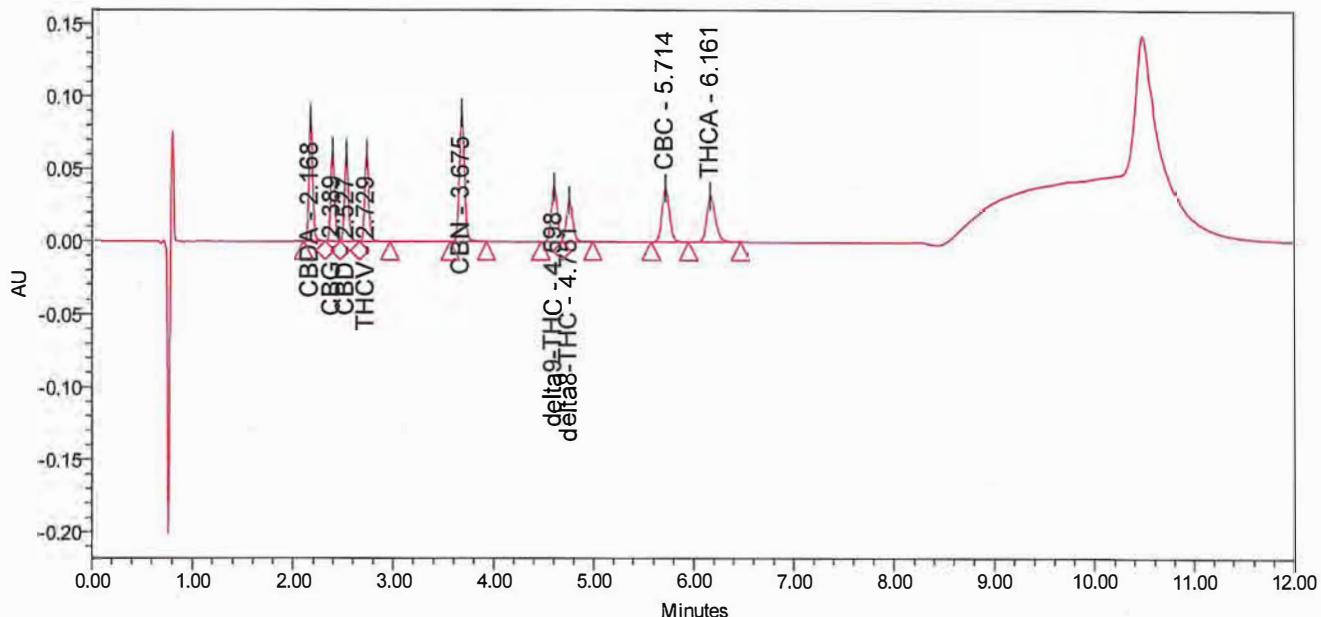
SAMPLE INFORMATION

Sample Name: ICV_10ppm
 Sample Type: Unknown
 Vial: 9
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

 Acquired By: System
 Sample Set Name: ValidationDay3_20220322
 Acq. Method Set: Cannabinoids_20220322_Day3
 Processing Method: Cannabinoids_20220322_Day3
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 7:07:33 PM PDT
 Date Processed: 3/23/2022 11:38:45 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.168	218466	85215	9.618	ppm
2	CBG	2.389	167987	62221	9.326	ppm
3	CBD	2.527	169266	61083	9.331	ppm
4	THCV	2.729	172225	60818	9.705	ppm
5	CBN	3.675	320445	89093	9.183	ppm
6	delta9-THC	4.598	162163	37922	9.650	ppm
7	delta8-THC	4.751	130792	28812	9.716	ppm
8	CBC	5.714	195261	37188	9.715	ppm
9	THCA	6.161	196760	31606	9.499	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 8 of 23

Project Name: 2021\Method Development Miao

Date Printed:

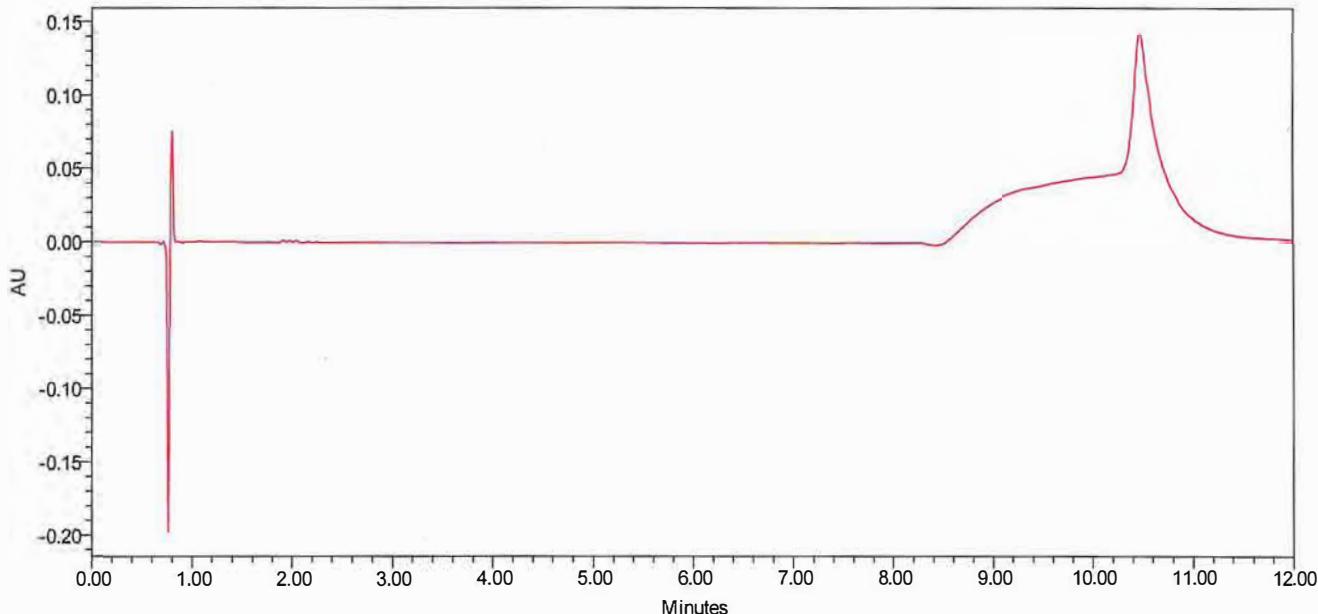
3/23/2022

12:01:13 PM US/Pacific

SAMPLE INFORMATION

Sample Name:	MethBlk_1x	Acquired By:	System
Sample Type:	Control	Sample Set Name:	ValidationDay3_20220322
Vial:	10	Acq. Method Set:	Cannabinoids_20220322_Day3
Injection #:	1	Processing Method:	Cannabinoids_20220322_Day3
Injection Volume:	2.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm
Date Acquired:	3/22/2022 7:20:10 PM PDT		
Date Processed:	3/23/2022 11:38:45 AM PDT		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.158				
2	CBG	2.369				
3	CBD	2.506				
4	THCV	2.706				
5	CBN	3.633				
6	delta9-THC	4.546				
7	delta8-THC	4.694				
8	CBC	5.636				
9	THCA	6.131				

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 9 of 23

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

12:01:13 PM US/Pacific

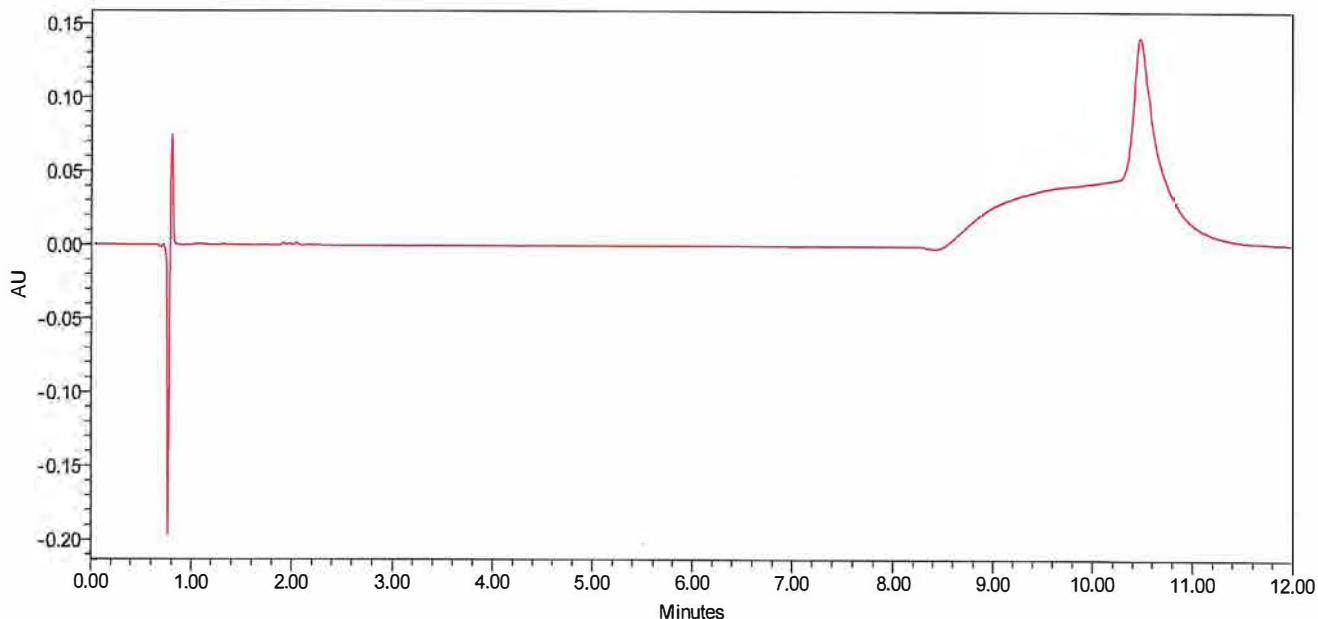
SAMPLE INFORMATION

Sample Name: MatrixBlk_1x
 Sample Type: Unknown
 Vial: 11
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

 Acquired By: System
 Sample Set Name: ValidationDay3_20220322
 Acq. Method Set: Cannabinoids_20220322_Day3
 Processing Method: Cannabinoids_20220322_Day3
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 7:32:41 PM PDT
 Date Processed: 3/23/2022 11:38:46 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.158				
2	CBG	2.369				
3	CBD	2.506				
4	THCV	2.706				
5	CBN	3.633				
6	delta9-THC	4.546				
7	delta8-THC	4.694				
8	CBC	5.636				
9	THCA	6.131				

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 10 of 23

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

12:01:13 PM US/Pacific

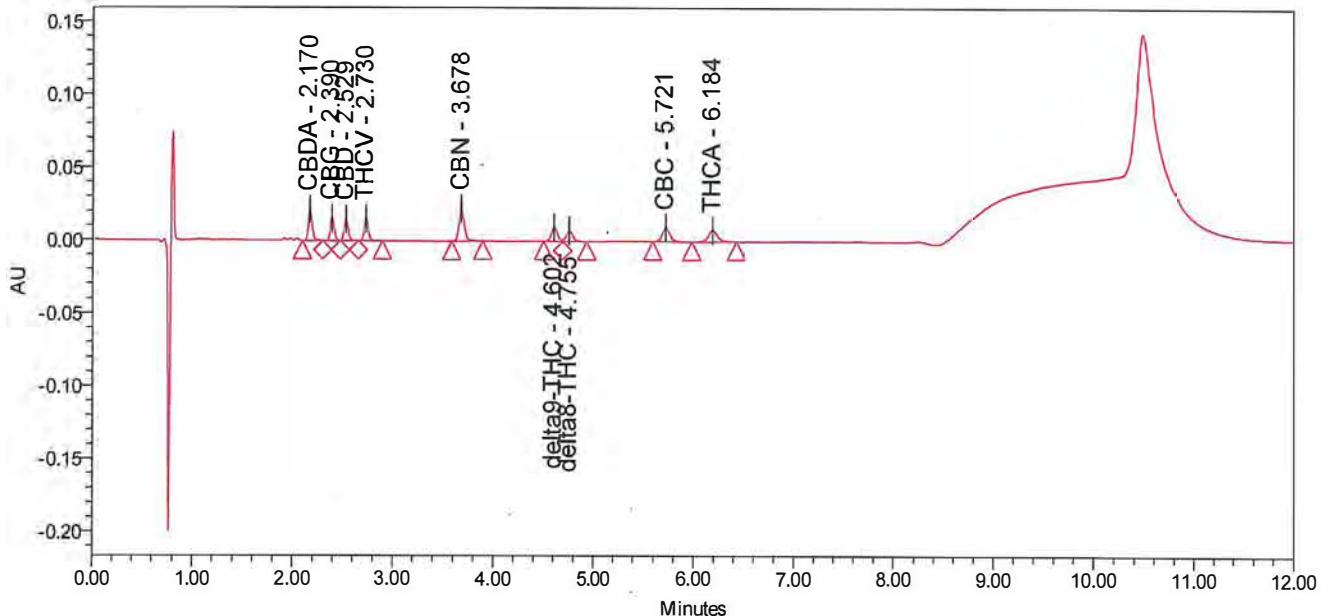
SAMPLE INFORMATION

Sample Name: MS_1x
 Sample Type: Unknown
 Vial: 12
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay3_20220322
 Acq. Method Set: Cannabinoids_20220322_Day3
 Processing Method: Cannabinoids_20220322_Day3
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 7:45:14 PM PDT
 Date Processed: 3/23/2022 11:38:46 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.170	56934	21459	2.530	ppm
2	CBG	2.390	42225	15402	2.382	ppm
3	CBD	2.529	41895	15008	2.354	ppm
4	THCV	2.730	43267	15145	2.483	ppm
5	CBN	3.678	79787	22042	2.330	ppm
6	delta9-THC	4.602	40698	9394	2.466	ppm
7	delta8-THC	4.755	32039	7074	2.419	ppm
8	CBC	5.721	49238	9172	2.491	ppm
9	THCA	6.184	49598	7732	2.408	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 11 of 23

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

12:01:13 PM US/Pacific

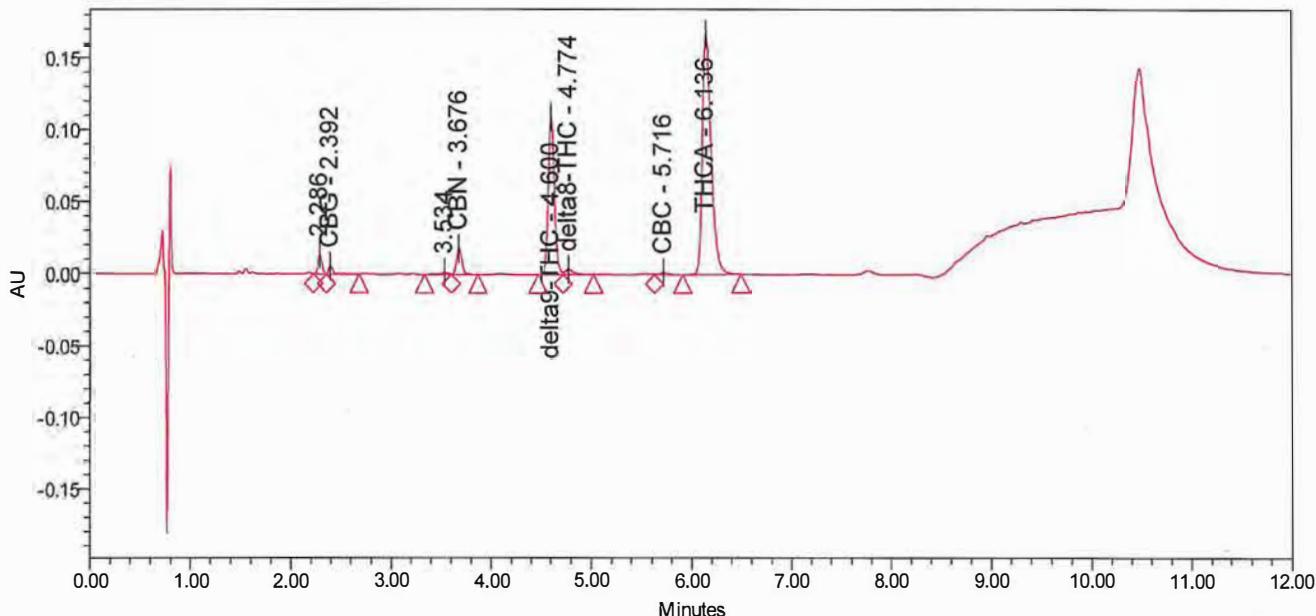
SAMPLE INFORMATION

Sample Name: F3-1_10x
 Sample Type: Unknown
 Vial: 13
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay3_20220322
 Acq. Method Set: Cannabinoids_20220322_Day3
 Processing Method: Cannabinoids_20220322_Day3
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 7:57:50 PM PDT
 Date Processed: 3/23/2022 11:38:47 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.158				
2	CBG	2.392	19218	5658	1.112	ppm
3	CBD	2.506				
4	THCV	2.706				
5	CBN	3.676	65233	18059	1.915	ppm
6	delta9-THC	4.600	474987	109329	28.153	ppm
7	delta8-THC	4.774	21428	3475	1.635	ppm
8	CBC	5.716	8344	1409	0.468	ppm
9	THCA	6.136	1032099	166722	49.750	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 12 of 23

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

12:01:13 PM US/Pacific

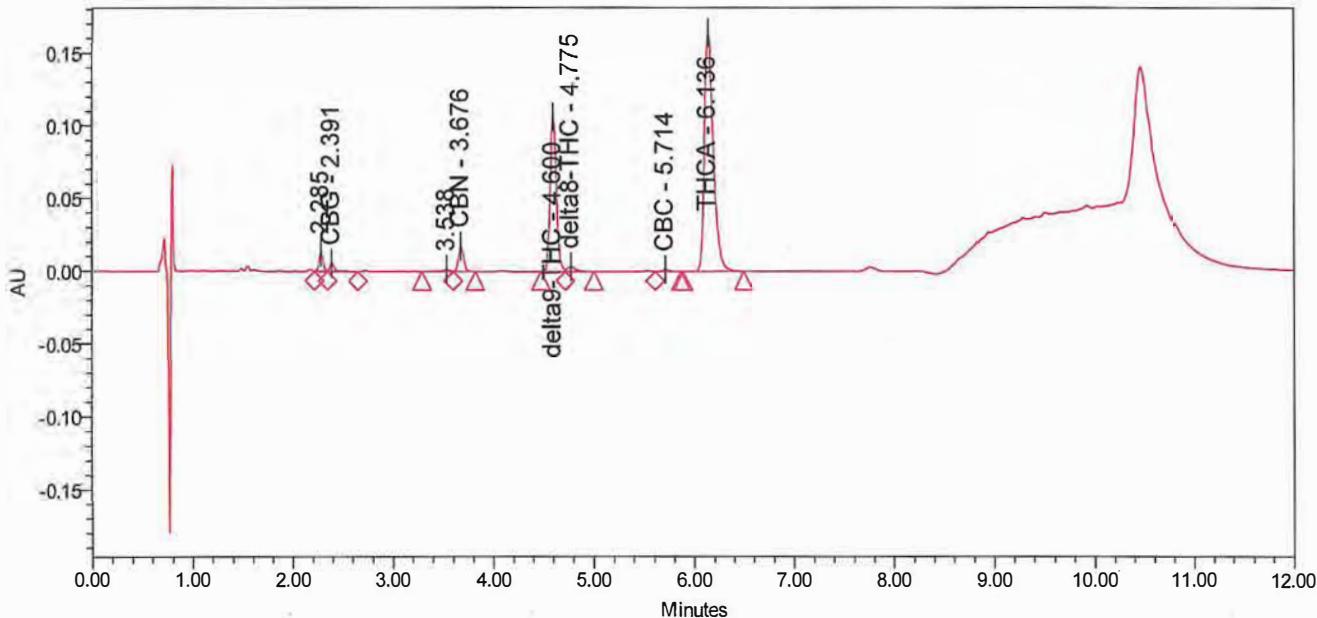
SAMPLE INFORMATION

Sample Name: F3-2_10x
 Sample Type: Unknown
 Vial: 14
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay3_20220322
 Acq. Method Set: Cannabinoids_20220322_Day3
 Processing Method: Cannabinoids_20220322_Day3
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 8:10:22 PM PDT
 Date Processed: 3/23/2022 11:38:47 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.158				
2	CBG	2.391	20723	5676	1.195	ppm
3	CBD	2.506				
4	THCV	2.706				
5	CBN	3.676	64198	17764	1.886	ppm
6	delta9-THC	4.600	463212	106620	27.457	ppm
7	delta8-THC	4.775	21139	3516	1.614	ppm
8	CBC	5.714	8802	1479	0.490	ppm
9	THCA	6.136	1017419	164348	49.042	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 13 of 23

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

12:01:13 PM US/Pacific

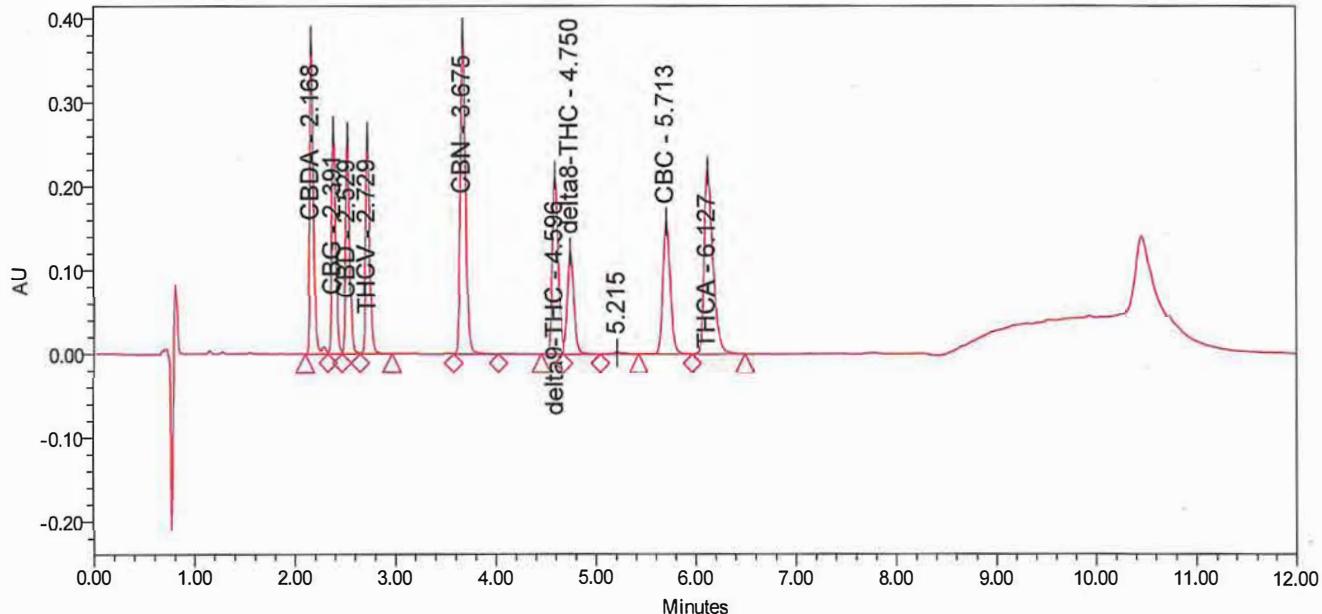
SAMPLE INFORMATION

Sample Name: F3-2_PDS_20x
 Sample Type: Unknown
 Vial: 15
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay3_20220322
 Acq. Method Set: Cannabinoids_20220322_Day3
 Processing Method: Cannabinoids_20220322_Day3
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 8:22:54 PM PDT
 Date Processed: 3/23/2022 11:38:48 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.168	958401	376257	42.088	ppm
2	CBG	2.391	718646	269074	39.729	ppm
3	CBD	2.529	717879	260561	39.378	ppm
4	THCV	2.729	739344	260415	41.464	ppm
5	CBN	3.675	1379257	385056	39.333	ppm
6	delta9-THC	4.596	913216	213775	54.073	ppm
7	delta8-THC	4.750	561068	122291	41.508	ppm
8	CBC	5.713	829518	158109	41.094	ppm
9	THCA	6.127	1343590	218162	64.759	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 14 of 23

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

12:01:13 PM US/Pacific

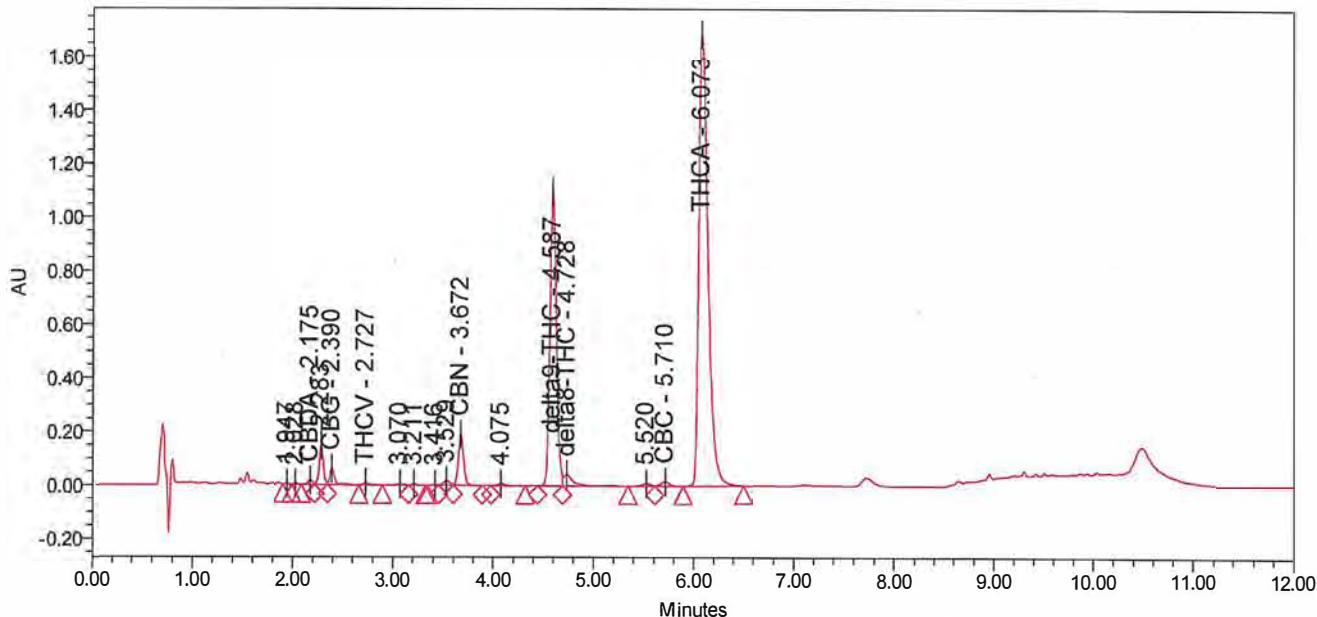
SAMPLE INFORMATION

Sample Name: F3-1_1x
 Sample Type: Unknown
 Vial: 16
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

 Acquired By: System
 Sample Set Name: ValidationDay3_20220322
 Acq. Method Set: Cannabinoids_20220322_Day3
 Processing Method: Cannabinoids_20220322_Day3
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 9:00:58 PM PDT
 Date Processed: 3/23/2022 11:42:28 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.175	50866	15647	2.264	ppm
2	CBG	2.390	203488	60147	11.286	ppm
3	CBD	2.506				
4	THCV	2.727	36935	9524	2.129	ppm
5	CBN	3.672	684956	189545	19.563	ppm
6	delta9-THC	4.587	4846137	1096461	286.696	ppm
7	delta8-THC	4.728	278010	41136	20.593	ppm
8	CBC	5.710	92417	15699	4.627	ppm
9	THCA	6.073	10670848	1686106	514.198	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 15 of 23

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

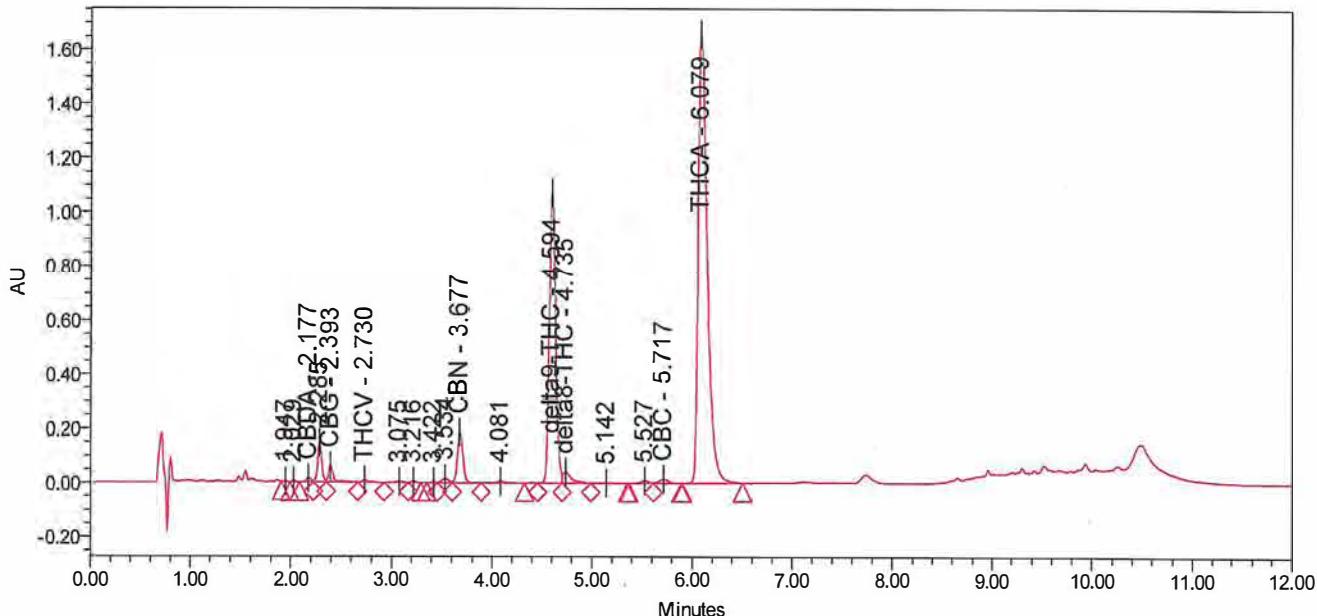
12:01:13 PM US/Pacific

SAMPLE INFORMATION

Sample Name:	F3-2_1x	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ValidationDay3_20220322
Vial:	17	Acq. Method Set:	Cannabinoids_20220322_Day3
Injection #:	1	Processing Method:	Cannabinoids_20220322_Day3
Injection Volume:	2.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 9:13:34 PM PDT
 Date Processed: 3/23/2022 11:43:12 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.177	50253	15300	2.237	ppm
2	CBG	2.393	204404	59314	11.337	ppm
3	CBD	2.506				
4	THCV	2.730	40295	9581	2.317	ppm
5	CBN	3.677	673367	186791	19.233	ppm
6	delta9-THC	4.594	4752027	1075007	281.129	ppm
7	delta8-THC	4.735	244650	40414	18.128	ppm
8	CBC	5.717	88719	15249	4.444	ppm
9	THCA	6.079	10486308	1660474	505.305	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 16 of 23

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

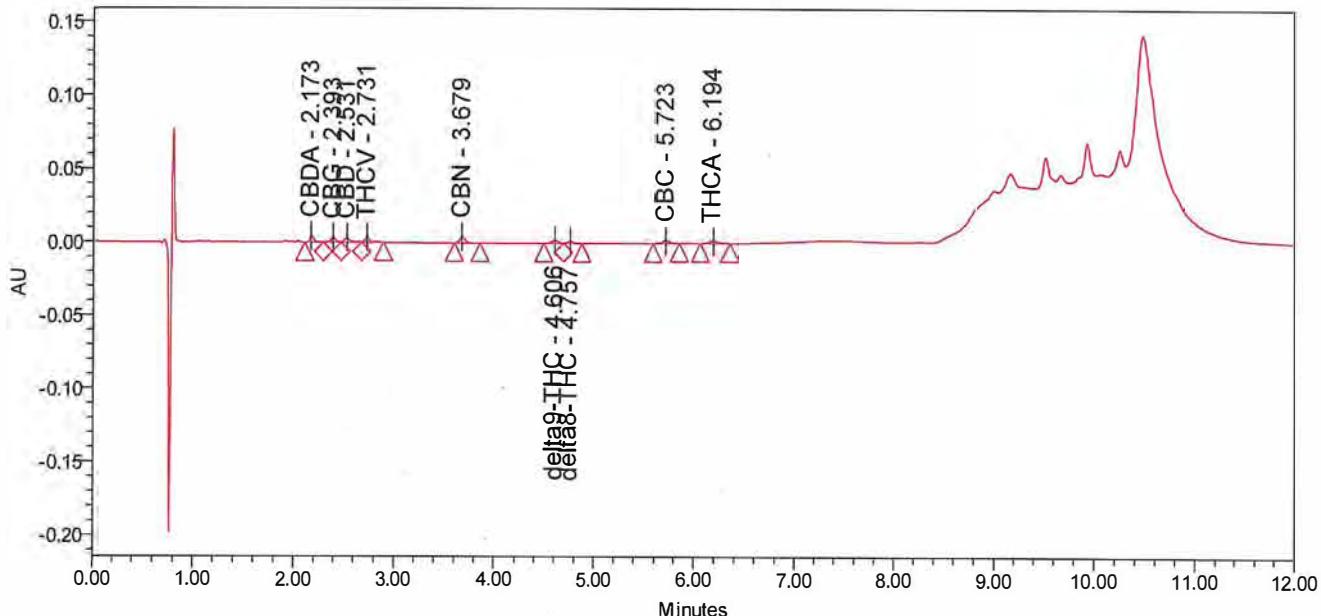
12:01:13 PM US/Pacific

SAMPLE INFORMATION

Sample Name:	LOD-1	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	ValidationDay3_20220322
Vial:	18	Acq. Method Set:	Cannabinoids_20220322_Day3
Injection #:	1	Processing Method:	Cannabinoids_20220322_Day3
Injection Volume:	2.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 9:26:09 PM PDT
 Date Processed: 3/23/2022 11:38:51 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.173	13118	4485	0.607	ppm
2	CBG	2.393	11345	3358	0.677	ppm
3	CBD	2.531	12855	3403	0.764	ppm
4	THCV	2.731	11316	3308	0.694	ppm
5	CBN	3.679	15918	4404	0.511	ppm
6	delta9-THC	4.606	8658	1919	0.571	ppm
7	delta8-THC	4.757	6045	1380	0.498	ppm
8	CBC	5.723	9827	1858	0.541	ppm
9	THCA	6.194	10054	1524	0.502	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 17 of 23

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

12:01:13 PM US/Pacific

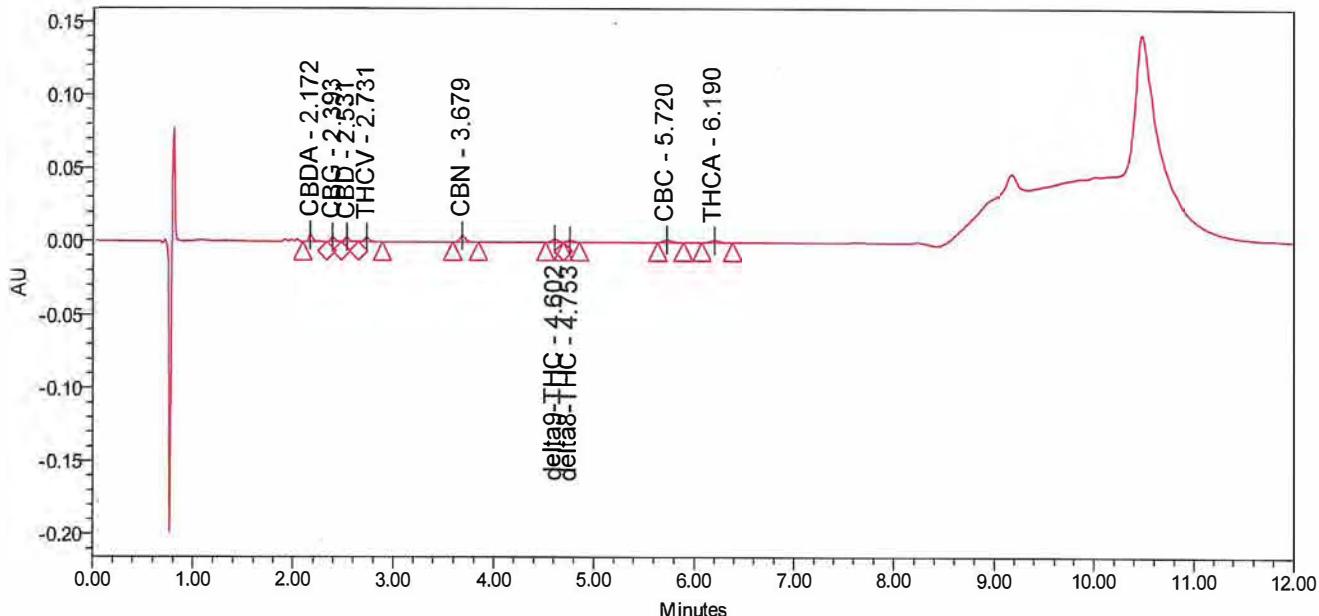
SAMPLE INFORMATION

Sample Name: LOD-2
 Sample Type: Unknown
 Vial: 19
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

 Acquired By: System
 Sample Set Name: ValidationDay3_20220322
 Acq. Method Set: Cannabinoids_20220322_Day3
 Processing Method: Cannabinoids_20220322_Day3
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 9:38:45 PM PDT
 Date Processed: 3/23/2022 11:52:29 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.172	13504	4606	0.624	ppm
2	CBG	2.393	9194	3193	0.559	ppm
3	CBD	2.531	9708	3128	0.592	ppm
4	THCV	2.731	9860	3122	0.612	ppm
5	CBN	3.679	16131	4400	0.517	ppm
6	delta9-THC	4.602	7923	1847	0.528	ppm
7	delta8-THC	4.753	5321	1335	0.445	ppm
8	CBC	5.720	9563	1816	0.528	ppm
9	THCA	6.190	9253	1465	0.464	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 18 of 23

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

12:01:13 PM US/Pacific

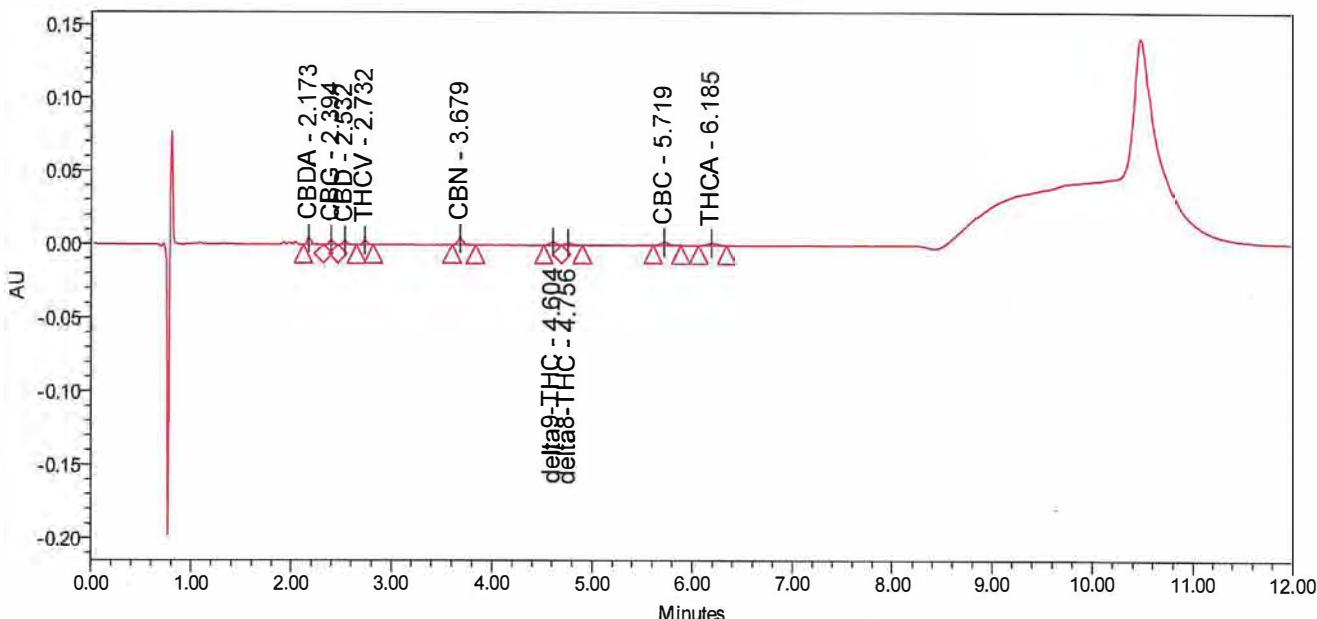
SAMPLE INFORMATION

Sample Name: LOD-3
 Sample Type: Unknown
 Vial: 20
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay3_20220322
 Acq. Method Set: Cannabinoids_20220322_Day3
 Processing Method: Cannabinoids_20220322_Day3
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 9:51:20 PM PDT
 Date Processed: 3/23/2022 11:38:51 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.173	13588	4606	0.628	ppm
2	CBG	2.394	8745	3129	0.534	ppm
3	CBD	2.532	8596	2967	0.531	ppm
4	THCV	2.732	8562	2990	0.540	ppm
5	CBN	3.679	15587	4332	0.502	ppm
6	delta9-THC	4.604	7927	1845	0.528	ppm
7	delta8-THC	4.756	6531	1431	0.534	ppm
8	CBC	5.719	10348	1873	0.567	ppm
9	THCA	6.185	9575	1507	0.479	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 19 of 23

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

12:01:13 PM US/Pacific

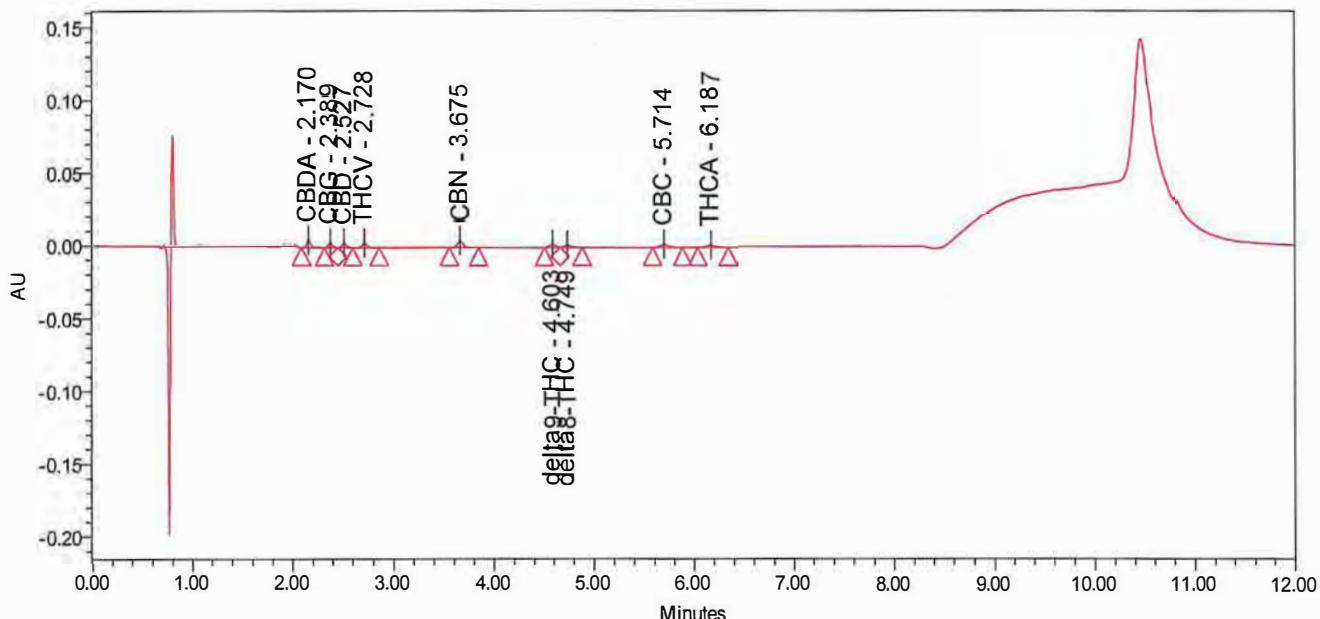
SAMPLE INFORMATION

Sample Name: LOD-4
 Sample Type: Unknown
 Vial: 21
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

 Acquired By: System
 Sample Set Name: ValidationDay3_20220322
 Acq. Method Set: Cannabinoids_20220322_Day3
 Processing Method: Cannabinoids_20220322_Day3
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 10:03:57 PM PDT
 Date Processed: 3/23/2022 11:38:52 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.170	13236	4617	0.612	ppm
2	CBG	2.389	8176	3042	0.503	ppm
3	CBD	2.527	8204	2966	0.509	ppm
4	THCV	2.728	8966	3047	0.562	ppm
5	CBN	3.675	15980	4399	0.513	ppm
6	delta9-THC	4.603	8030	1838	0.534	ppm
7	delta8-THC	4.749	6413	1425	0.526	ppm
8	CBC	5.714	10120	1876	0.555	ppm
9	THCA	6.187	10138	1514	0.506	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 20 of 23

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

12:01:13 PM US/Pacific

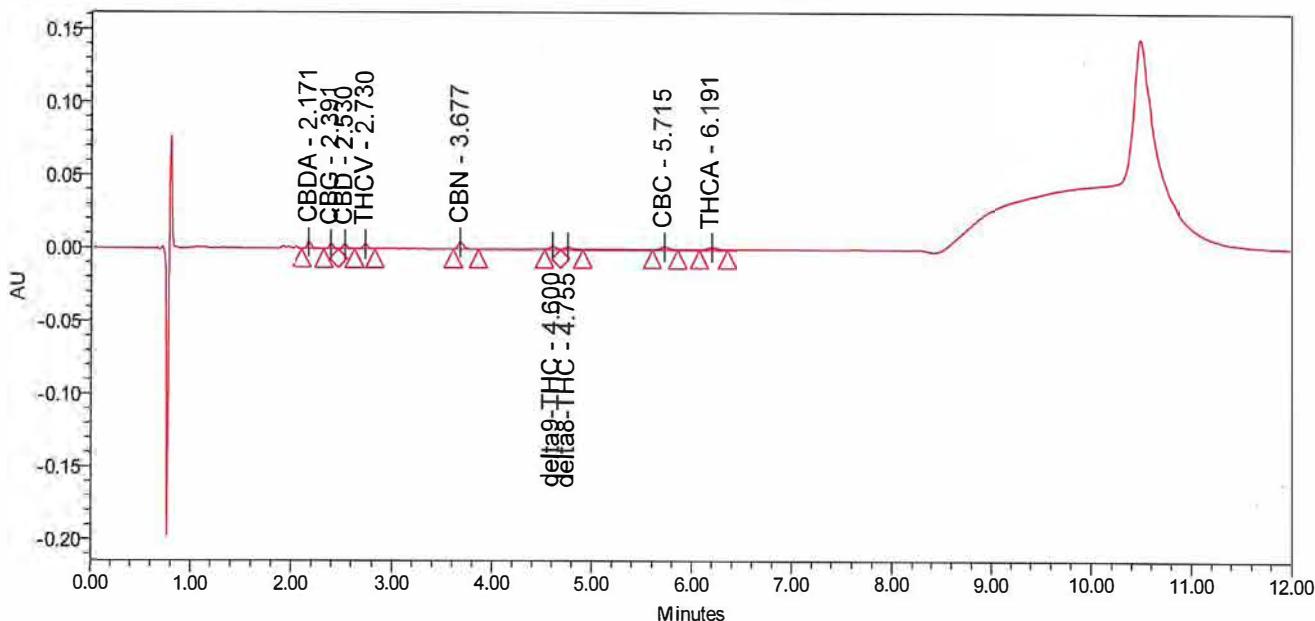
SAMPLE INFORMATION

Sample Name: LOD-5
 Sample Type: Unknown
 Vial: 22
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay3_20220322
 Acq. Method Set: Cannabinoids_20220322_Day3
 Processing Method: Cannabinoids_20220322_Day3
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 10:16:32 PM PDT
 Date Processed: 3/23/2022 11:38:52 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.171	13035	4562	0.604	ppm
2	CBG	2.391	8534	3109	0.522	ppm
3	CBD	2.530	8602	3033	0.531	ppm
4	THCV	2.730	8977	3029	0.563	ppm
5	CBN	3.677	16097	4414	0.516	ppm
6	delta9-THC	4.600	8081	1881	0.537	ppm
7	delta8-THC	4.755	6359	1396	0.522	ppm
8	CBC	5.715	9895	1894	0.544	ppm
9	THCA	6.191	9425	1489	0.472	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 21 of 23

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

12:01:13 PM US/Pacific

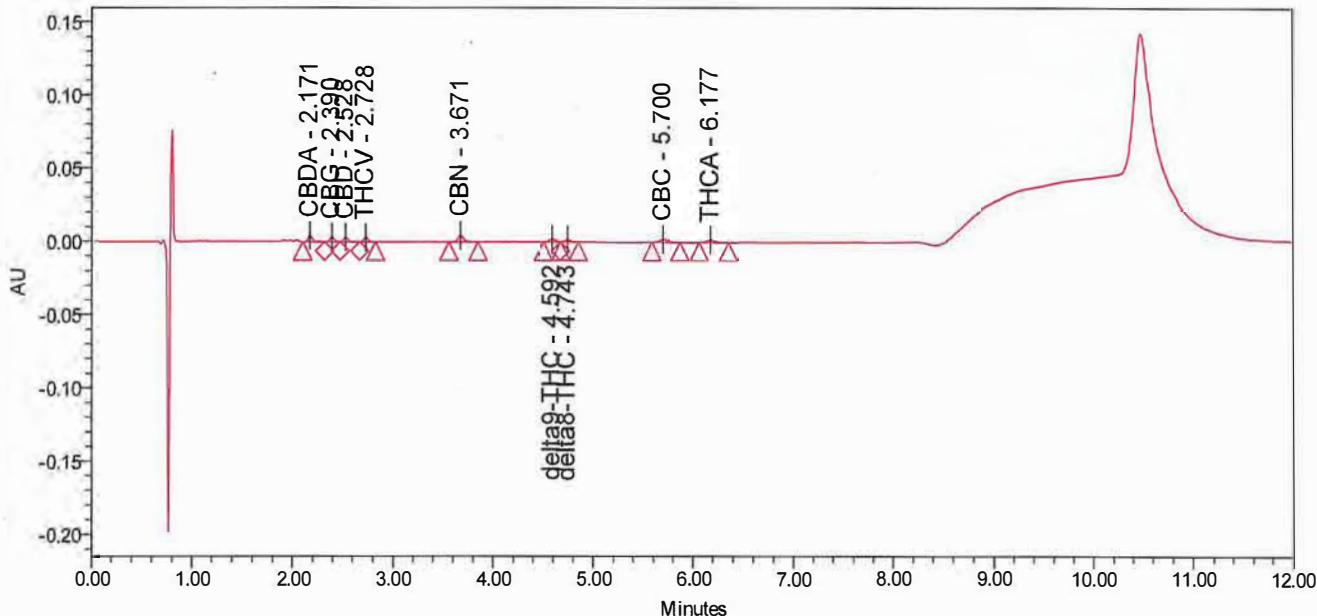
SAMPLE INFORMATION

Sample Name: LOD-6
 Sample Type: Unknown
 Vial: 23
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name: ValidationDay3_20220322
 Acq. Method Set: Cannabinoids_20220322_Day3
 Processing Method: Cannabinoids_20220322_Day3
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 10:29:07 PM PDT
 Date Processed: 3/23/2022 11:53:07 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.171	12696	4446	0.589	ppm
2	CBG	2.390	9739	3209	0.589	ppm
3	CBD	2.528	9949	3134	0.605	ppm
4	THCV	2.728	8784	3034	0.552	ppm
5	CBN	3.671	15930	4379	0.511	ppm
6	delta9-THC	4.592	8028	1855	0.534	ppm
7	delta8-THC	4.743	5070	1296	0.426	ppm
8	CBC	5.700	10184	1833	0.559	ppm
9	THCA	6.177	8929	1445	0.448	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 22 of 23

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

12:01:13 PM US/Pacific

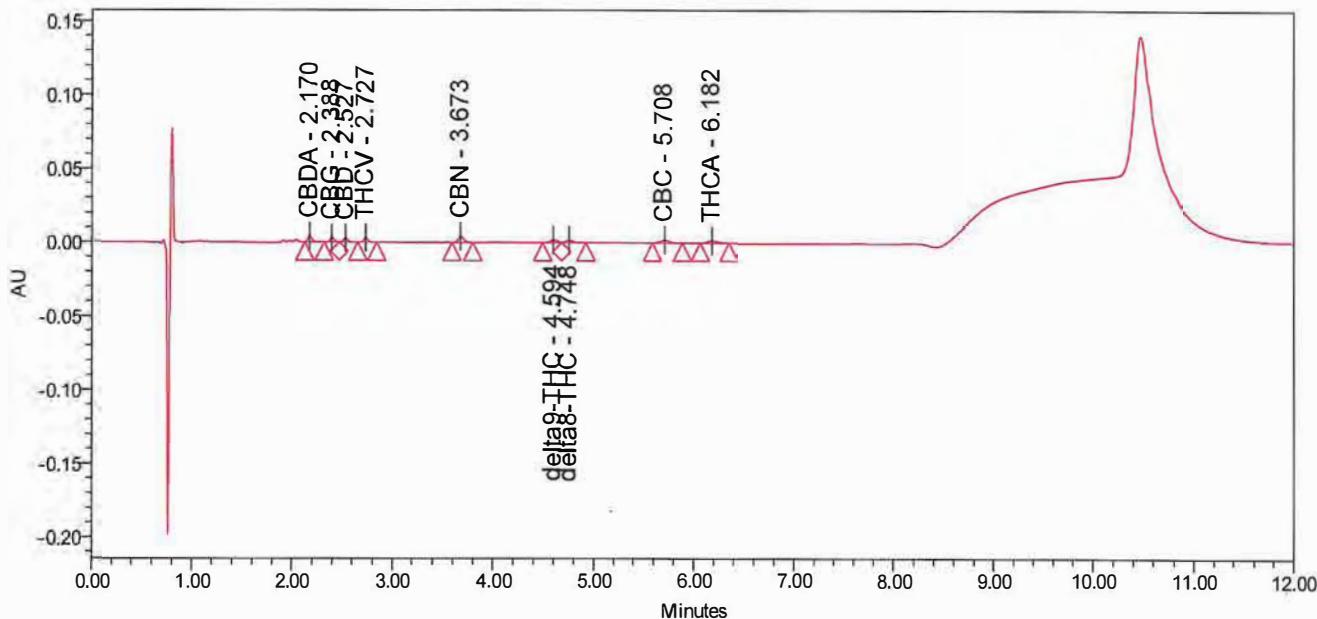
SAMPLE INFORMATION

Sample Name: LOD-7
 Sample Type: Unknown
 Vial: 24
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes

 Acquired By: System
 Sample Set Name: ValidationDay3_20220322
 Acq. Method Set: Cannabinoids_20220322_Day3
 Processing Method: Cannabinoids_20220322_Day3
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 10:41:39 PM PDT
 Date Processed: 3/23/2022 11:38:54 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.170	12526	4505	0.581	ppm
2	CBG	2.388	8702	3097	0.532	ppm
3	CBD	2.527	8750	3037	0.539	ppm
4	THCV	2.727	8590	3014	0.541	ppm
5	CBN	3.673	15836	4321	0.509	ppm
6	$\Delta^9\text{-THC}$	4.594	8808	1905	0.580	ppm
7	$\Delta^8\text{-THC}$	4.748	7348	1512	0.595	ppm
8	CBC	5.708	10110	1818	0.555	ppm
9	THCA	6.182	9308	1473	0.466	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 23 of 23

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

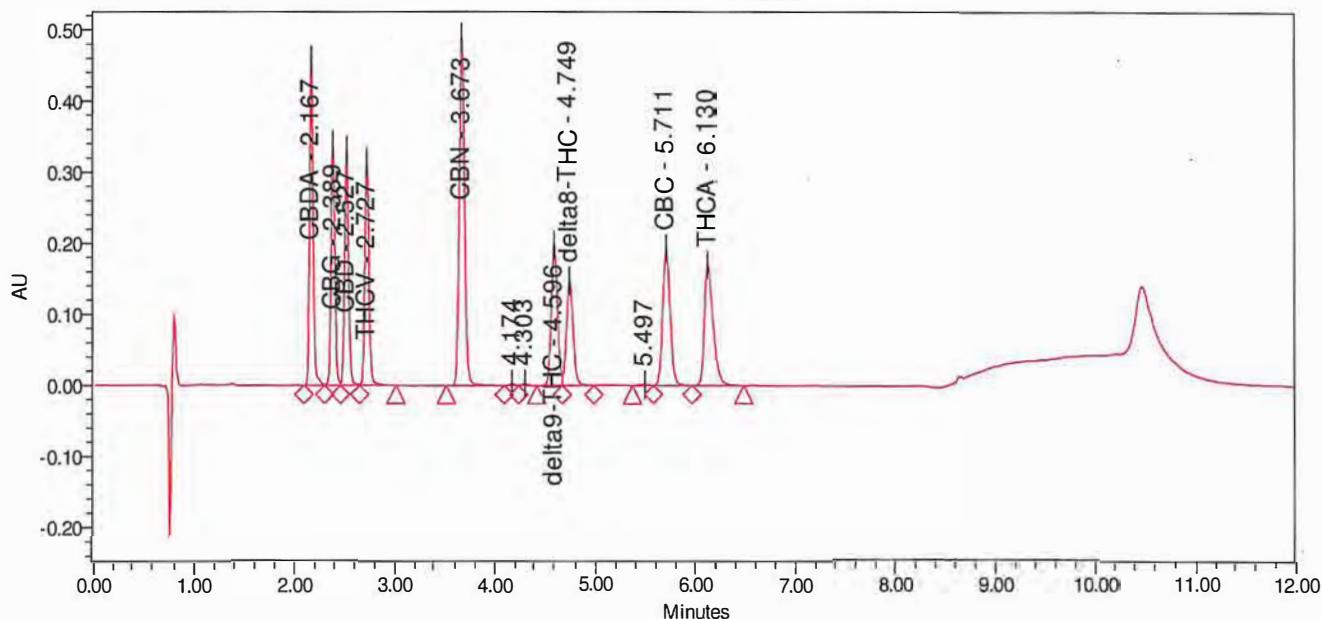
12:01:13 PM US/Pacific

SAMPLE INFORMATION

Sample Name: CCV1_50ppm
 Sample Type: Unknown
 Vial: 7
 Injection #: 1
 Injection Volume: 2.00 ul
 Run Time: 12.0 Minutes
 Acquired By: System
 Sample Set Name: ValidationDay3_20220322
 Acq. Method Set: Cannabinoids_20220322_Day3
 Processing Method: Cannabinoids_20220322_Day3
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 8:48:23 PM PDT
 Date Processed: 3/23/2022 11:38:49 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.167	1145263	458318	50.288	ppm
2	CBG	2.389	909142	340432	50.246	ppm
3	CBD	2.527	914738	331603	50.160	ppm
4	THCV	2.727	894155	315341	50.133	ppm
5	CBN	3.673	1758545	490113	50.134	ppm
6	delta9-THC	4.596	846693	197936	50.139	ppm
7	delta8-THC	4.749	675152	148205	49.937	ppm
8	CBC	5.711	1009244	192754	49.985	ppm
9	THCA	6.130	1039680	169177	50.115	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 1 of 1

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

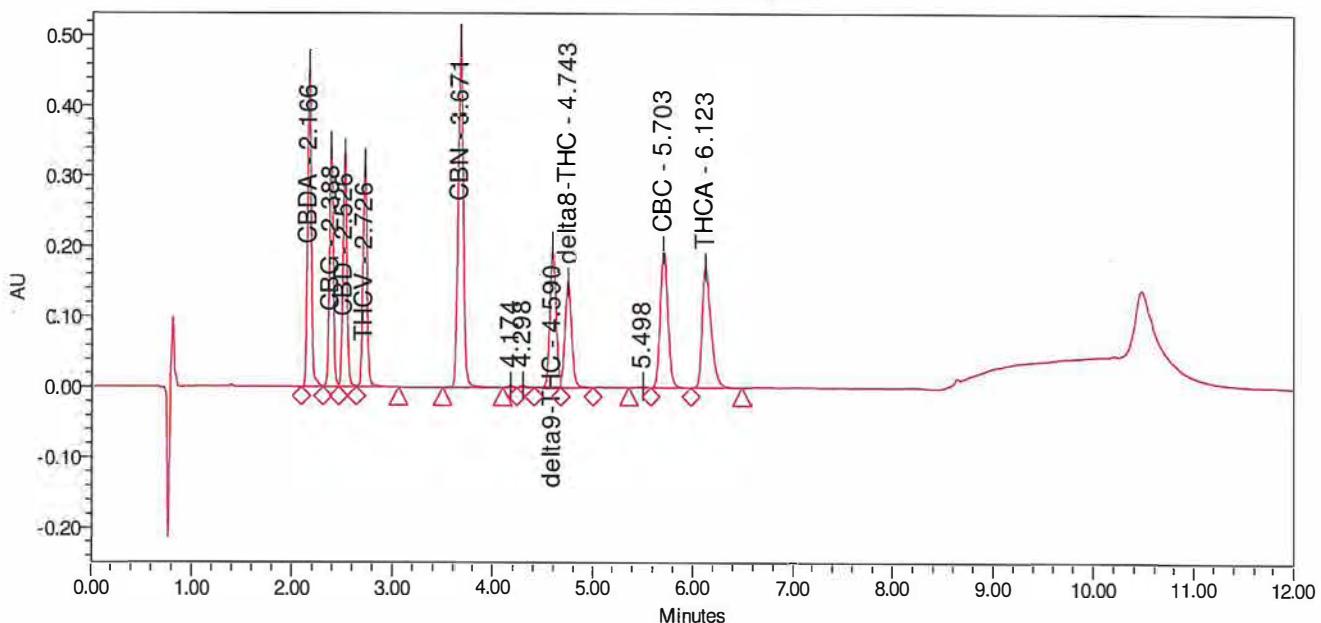
12:02:58 PM US/Pacific

SAMPLE INFORMATION

Sample Name: CCV2_50ppm
Sample Type: Unknown
Vial: 7
Injection #: 1
Injection Volume: 2.00 ul
Run Time: 12.0 Minutes
Acquired By: System
Sample Set Name: ValidationDay3_20220322
Acq. Method Set: Cannabinoids_20220322_Day3
Processing Method: Cannabinoids_20220322_Day3
Channel Name: PDA Ch1 220nm@4.8nm
Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/22/2022 10:54:29 PM PDT
Date Processed: 3/23/2022 11:38:54 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.166	1155432	460762	50.734	ppm
2	CBG	2.388	918156	342984	50.744	ppm
3	CBD	2.526	923401	333189	50.635	ppm
4	THCV	2.726	906374	318824	50.818	ppm
5	CBN	3.671	1776835	496502	50.655	ppm
6	delta9-THC	4.590	855396	201042	50.653	ppm
7	delta8-THC	4.743	682207	150091	50.458	ppm
8	CBC	5.703	1019332	194734	50.484	ppm
9	THCA	6.123	1048489	170647	50.540	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 1 of 1

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

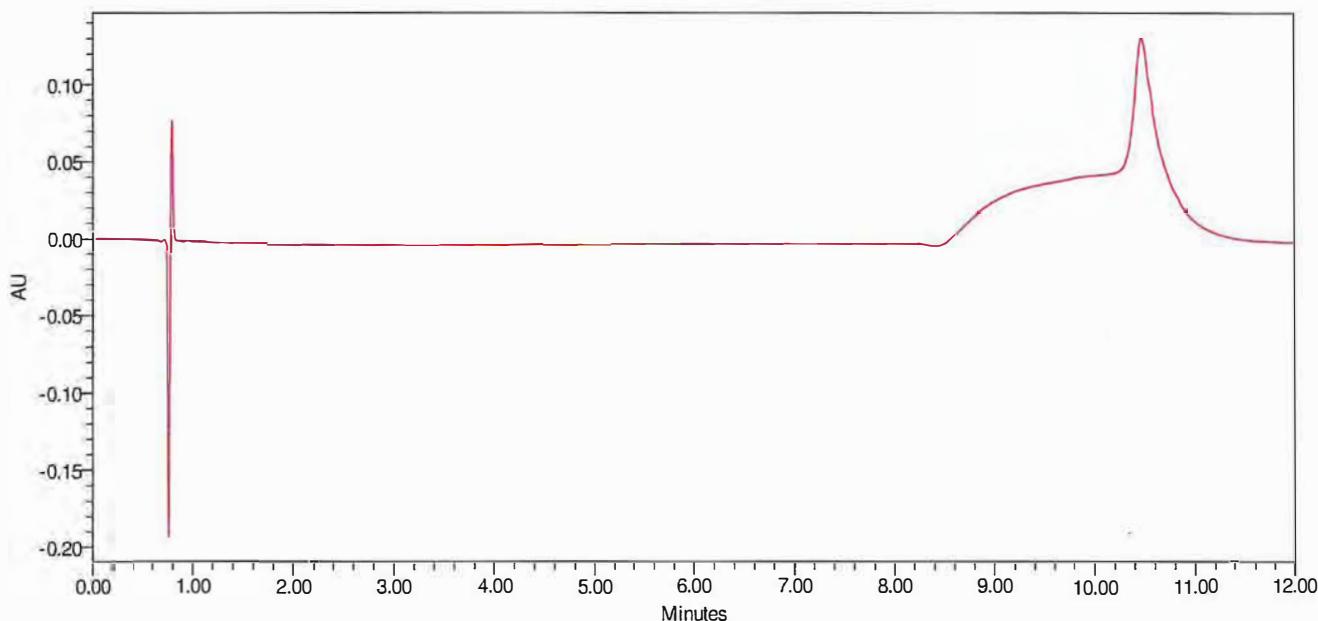
12:03:25 PM US/Pacific

SAMPLE INFORMATION

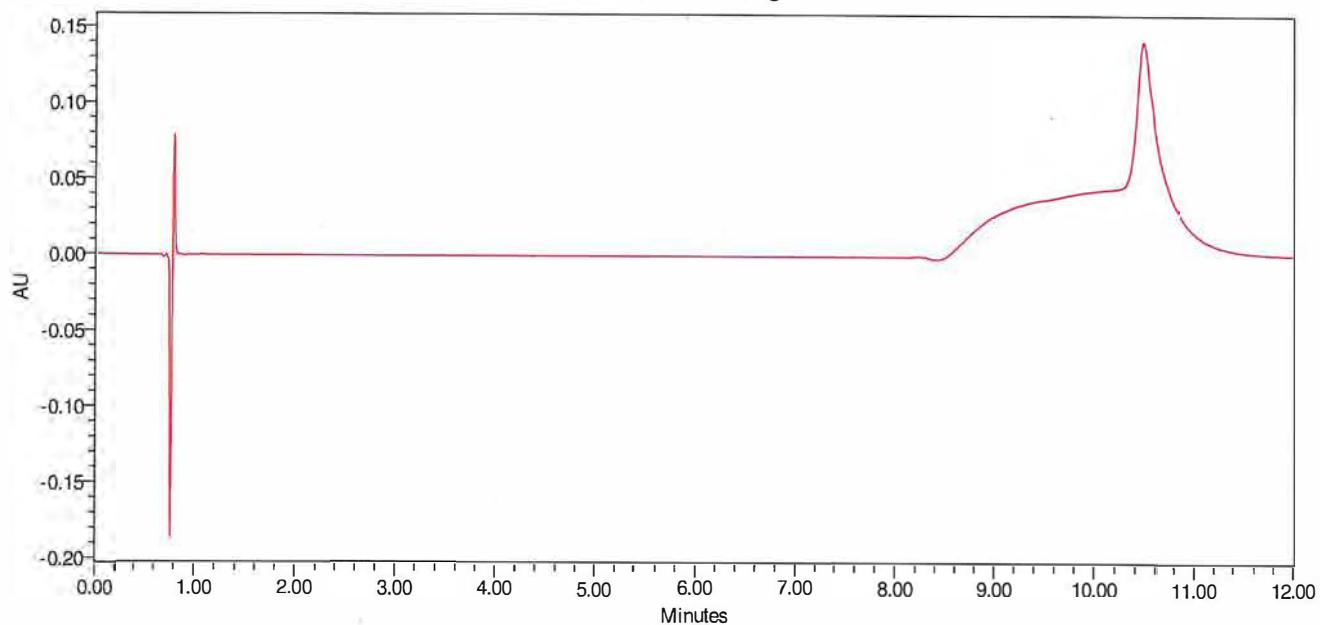
Sample Name:	SolvBlk	Acquired By:	System
Sample Type:	Unknown	Sample Set Name	ValidationDay3_20220322
Vial:	1	Acq. Method Set:	Cannabinoids_20220322_Day3
Injection #:	1, 2, 3	Processing Method	Cannabinoids_20220322_Day3
Injection Volume:	2.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm,
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm,

Date Acquired: 3/22/2022 4:49:08 PM PDT, 3/22/2022 5:01:41 PM PDT, 3/22/2022 5:14:13 PM PDT,
Date Processed: 3/23/2022 11:38:38 AM PDT, 3/23/2022 11:38:39 AM PDT, 3/23/2022 11:38:44 AM

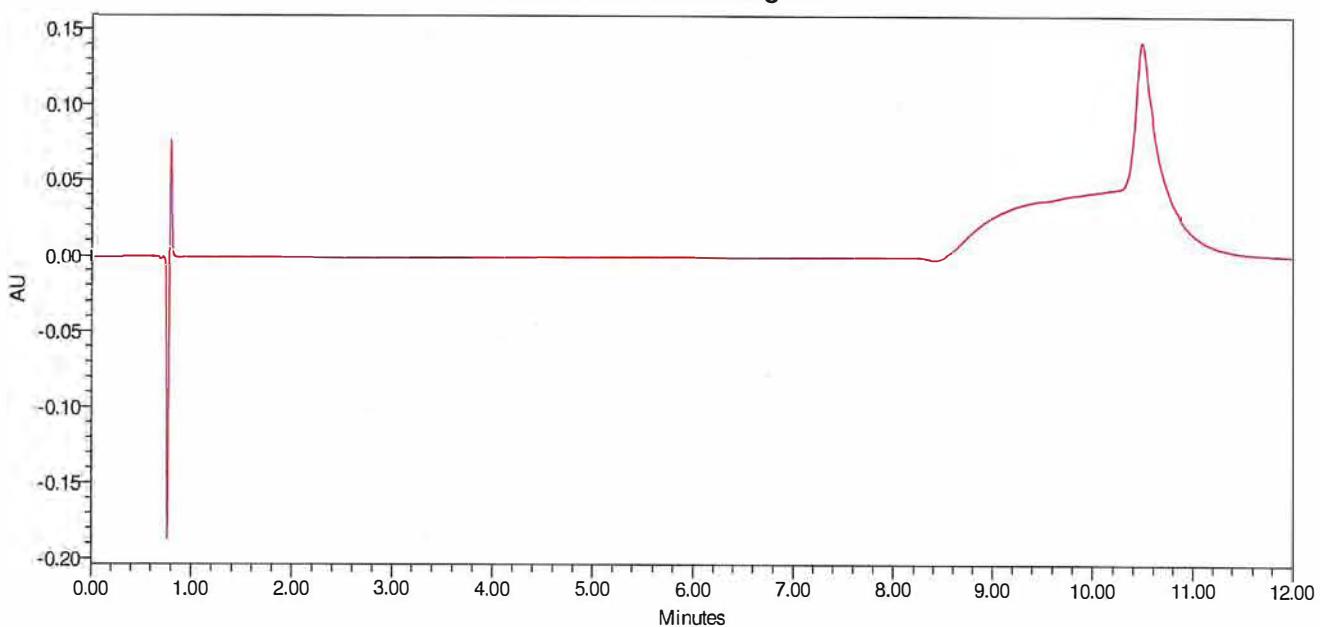
Auto-Scaled Chromatogram



Auto-Scaled Chromatogram



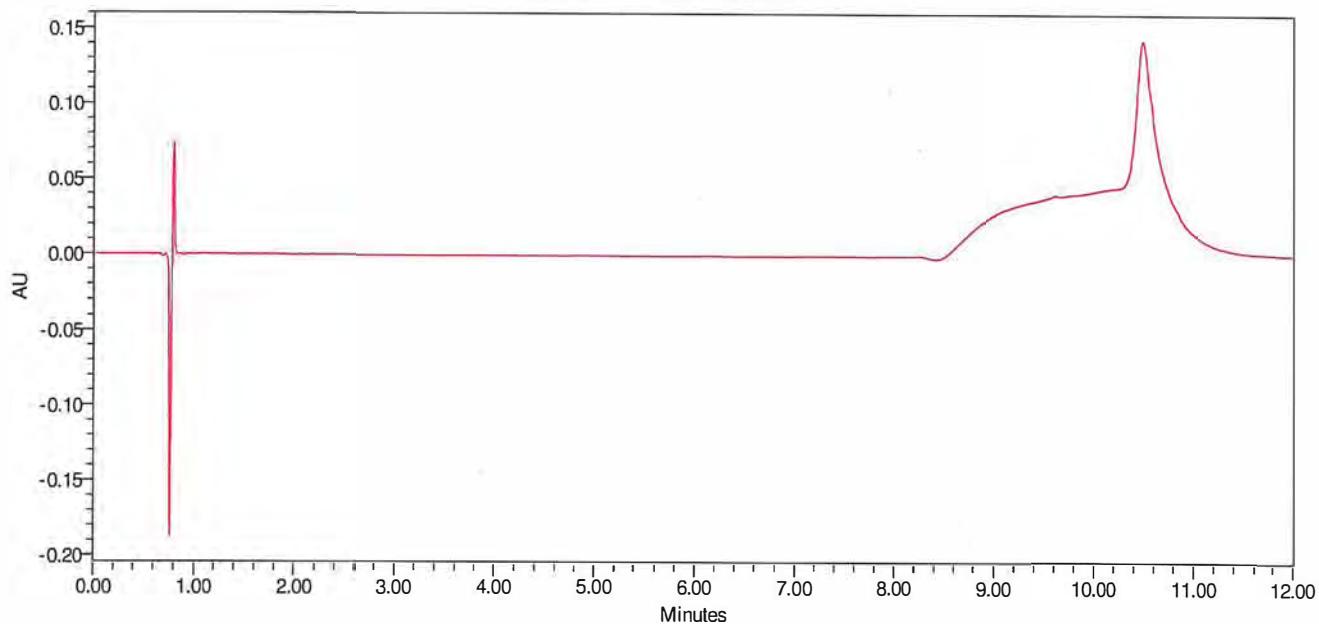
Auto-Scaled Chromatogram



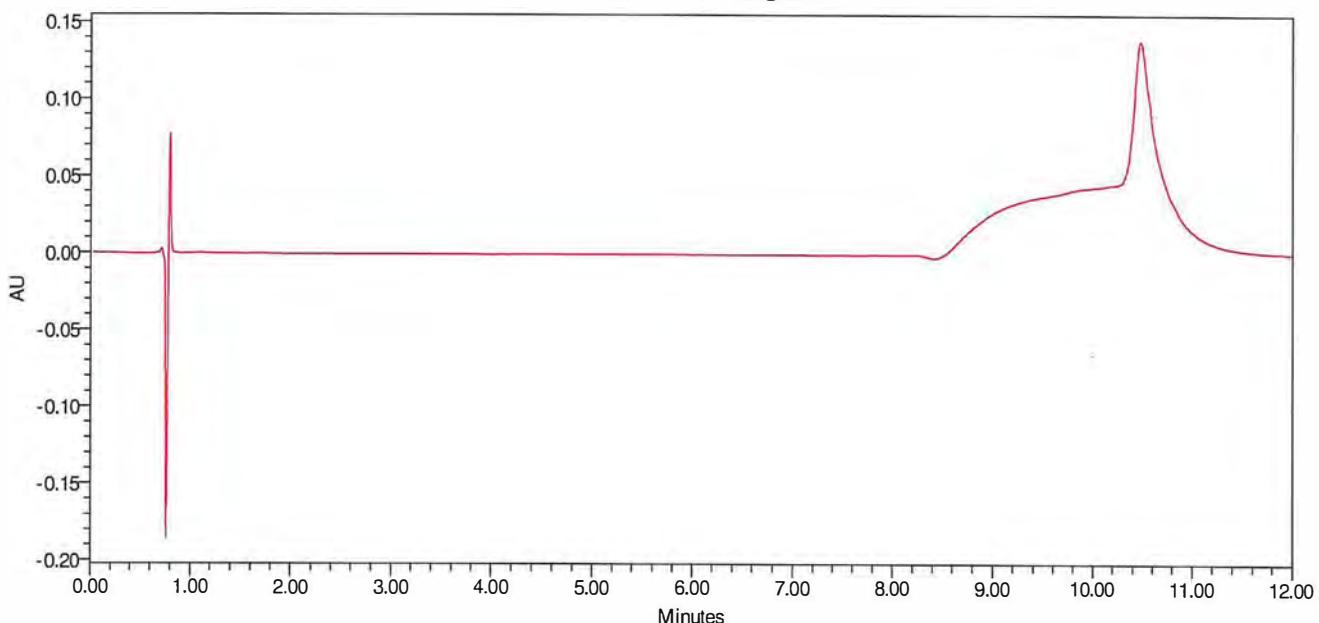
Reported by User: System
Report Method: Cannabinoids Quan Rep
Report Method ID: 13447
Page: 2 of 7

Project Name: 2021\Method Development Miao
Date Printed: 3/23/2022
12:04:02 PM US/Pacific

Auto-Scaled Chromatogram



Auto-Scaled Chromatogram



Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 3 of 7

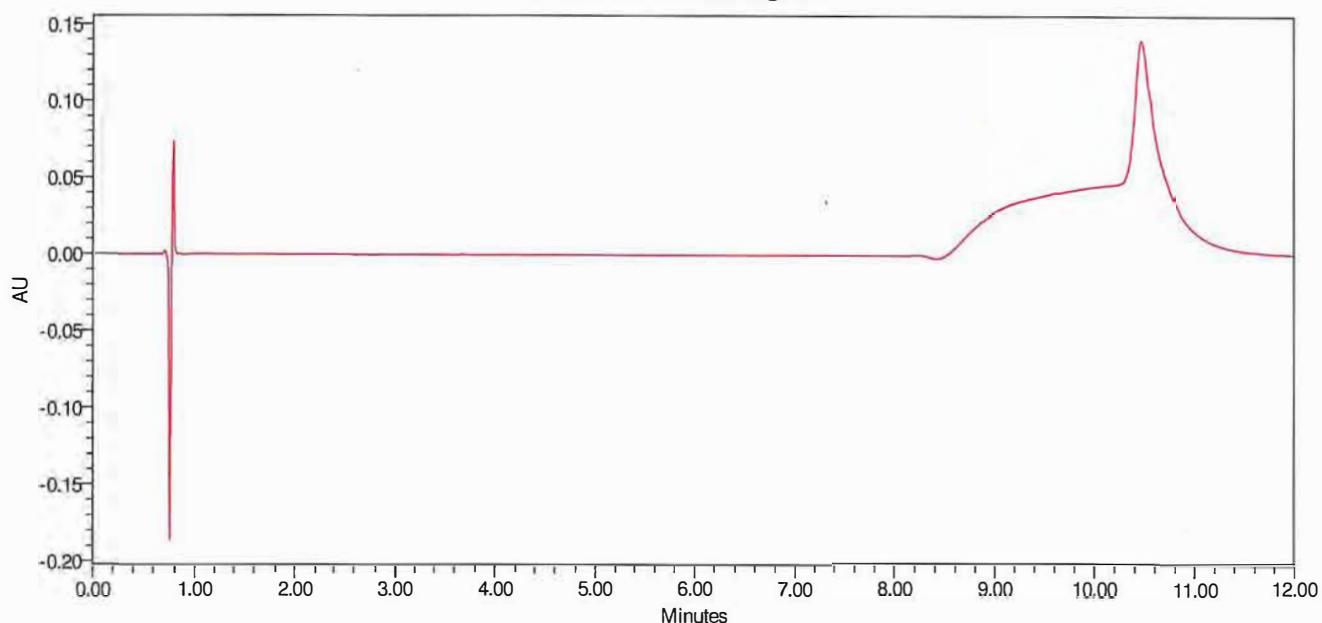
Project Name: 2021\Method Development Miao

Date Printed:

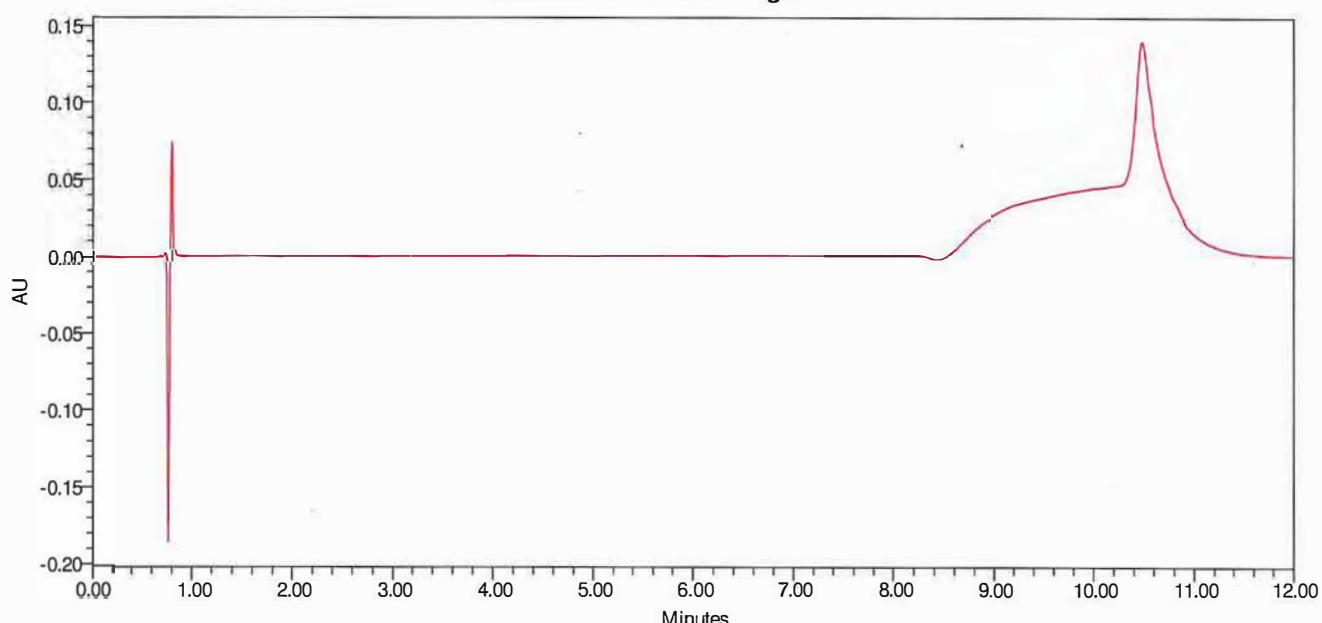
3/23/2022

12:04:02 PM US/Pacific

Auto-Scaled Chromatogram



Auto-Scaled Chromatogram



Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 4 of 7

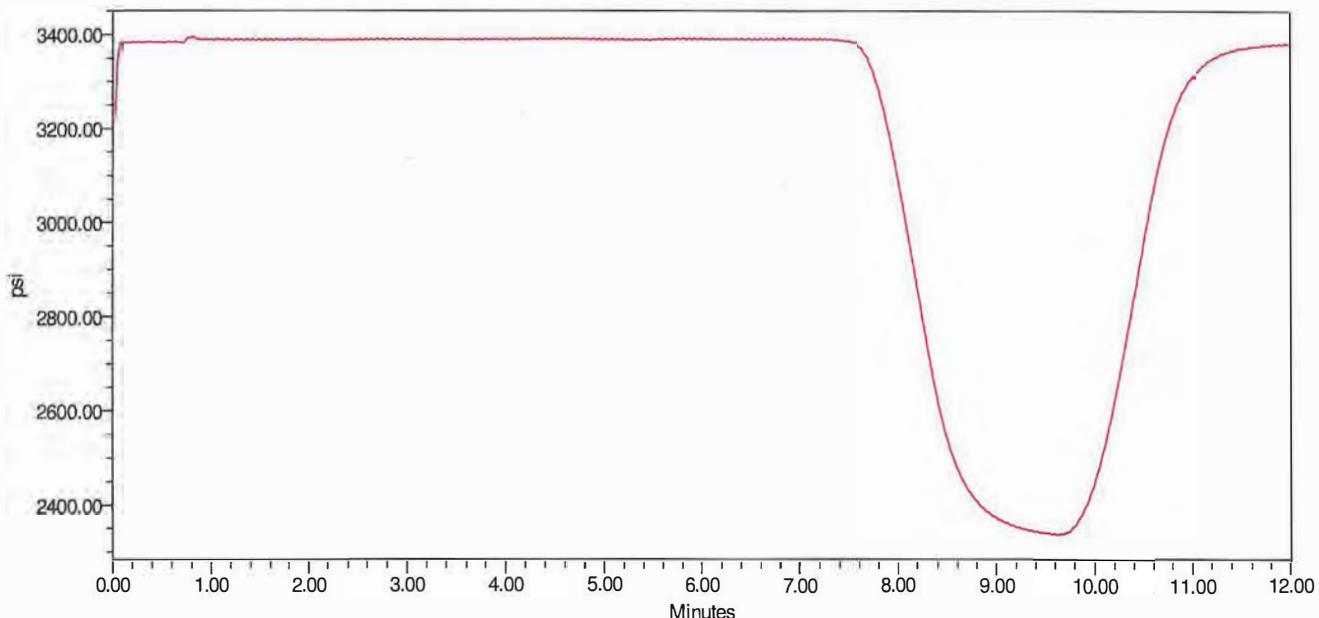
Project Name: 2021\Method Development Miao

Date Printed:

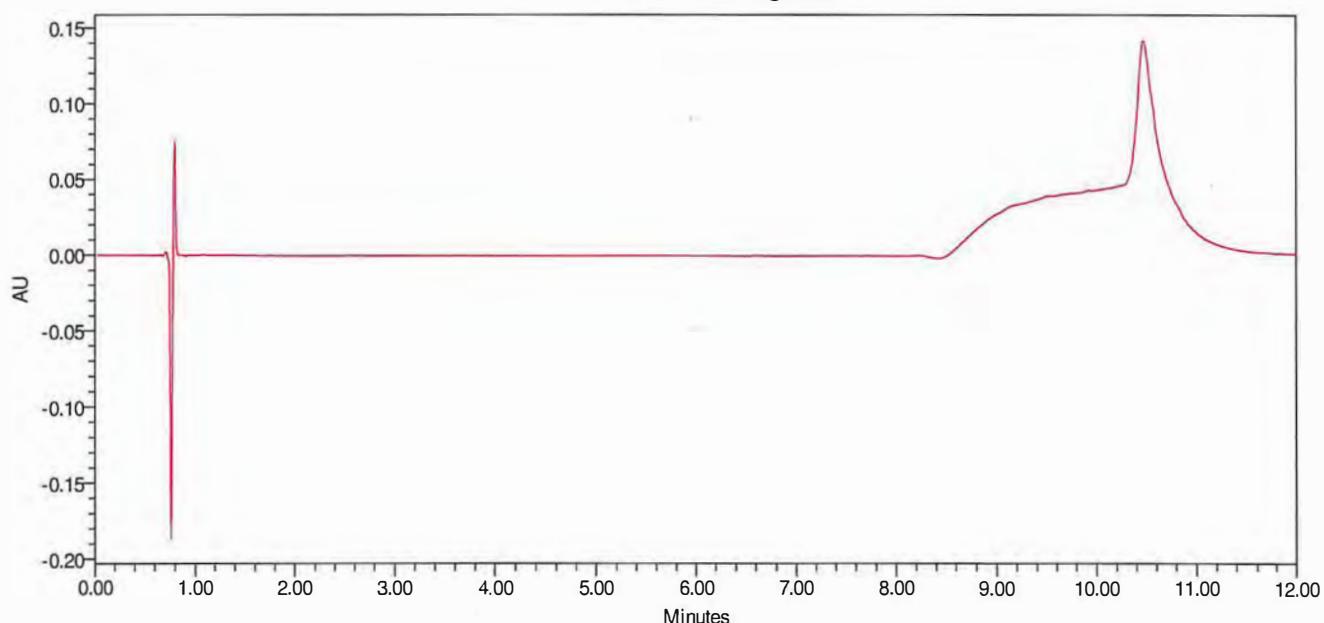
3/23/2022

12:04:02 PM US/Pacific

Auto-Scaled Chromatogram



Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.158				
2	CBDA	2.158				
3	CBDA	2.158				
4	CBDA	2.158				
5	CBDA	2.158				

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 5 of 7

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

12:04:02 PM US/Pacific

Peak Results

	Name	RT	Area	Height	Amount	Units
6	CBDA	2.158				
7	CBDA	2.158				
8	CBDA	2.158				
9	CBG	2.369				
10	CBG	2.369				
11	CBG	2.369				
12	CBG	2.369				
13	CBG	2.369				
14	CBG	2.369				
15	CBG	2.369				
16	CBG	2.369				
17	CBD	2.506				
18	CBD	2.506				
19	CBD	2.506				
20	CBD	2.506				
21	CBD	2.506				
22	CBD	2.506				
23	CBD	2.506				
24	CBD	2.506				
25	THCV	2.706				
26	THCV	2.706				
27	THCV	2.706				
28	THCV	2.706				
29	THCV	2.706				
30	THCV	2.706				
31	THCV	2.706				
32	THCV	2.706				
33	CBN	3.633				
34	CBN	3.633				
35	CBN	3.633				
36	CBN	3.633				
37	CBN	3.633				
38	CBN	3.633				
39	CBN	3.633				
40	CBN	3.633				
41	delta9-THC	4.546				
42	delta9-THC	4.546				
43	delta9-THC	4.546				
44	delta9-THC	4.546				
45	delta9-THC	4.546				
46	delta9-THC	4.546				

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 6 of 7

Project Name: 2021\Method Development Miao

Date Printed:

3/23/2022

12:04:02 PM US/Pacific

Peak Results

	Name	RT	Area	Height	Amount	Units
47	delta9-THC	4.546				
48	delta9-THC	4.546				
49	delta8-THC	4.694				
50	delta8-THC	4.694				
51	delta8-THC	4.694				
52	delta8-THC	4.694				
53	delta8-THC	4.694				
54	delta8-THC	4.694				
55	delta8-THC	4.694				
56	delta8-THC	4.694				
57	CBC	5.636				
58	CBC	5.636				
59	CBC	5.636				
60	CBC	5.636				
61	CBC	5.636				
62	CBC	5.636				
63	CBC	5.636				
64	CBC	5.636				
65	THCA	6.131				
66	THCA	6.131				
67	THCA	6.131				
68	THCA	6.131				
69	THCA	6.131				
70	THCA	6.131				
71	THCA	6.131				
72	THCA	6.131				
73						

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

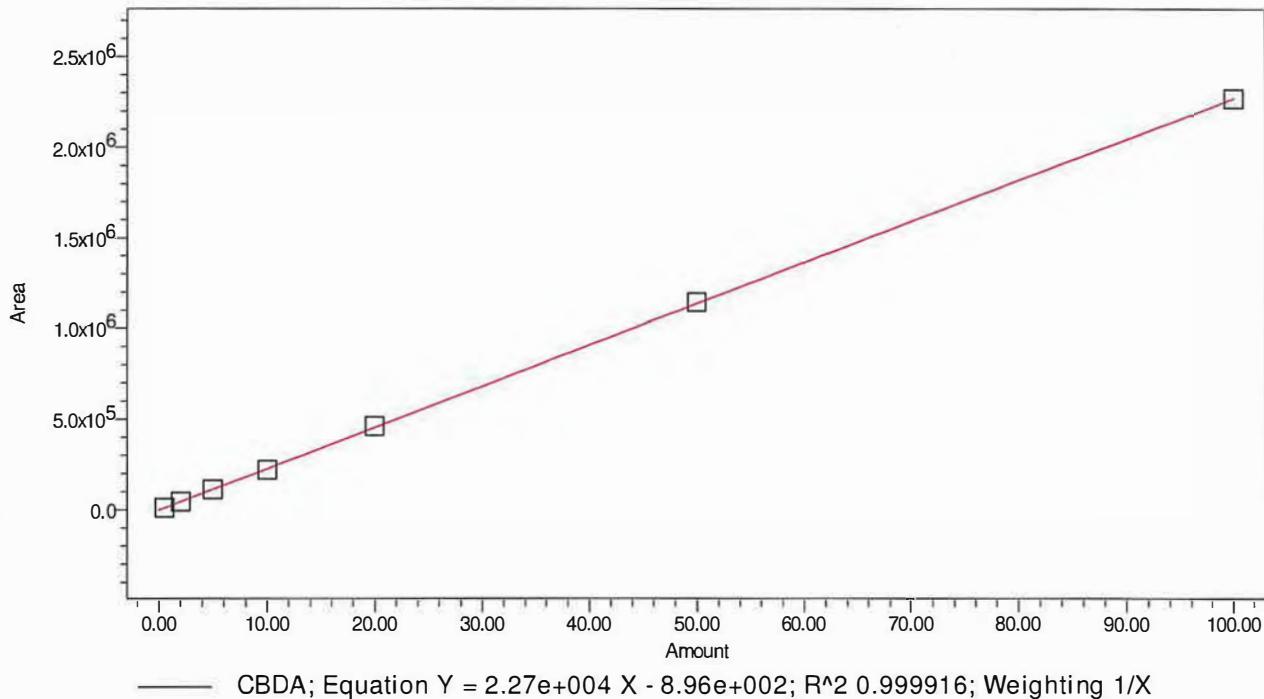
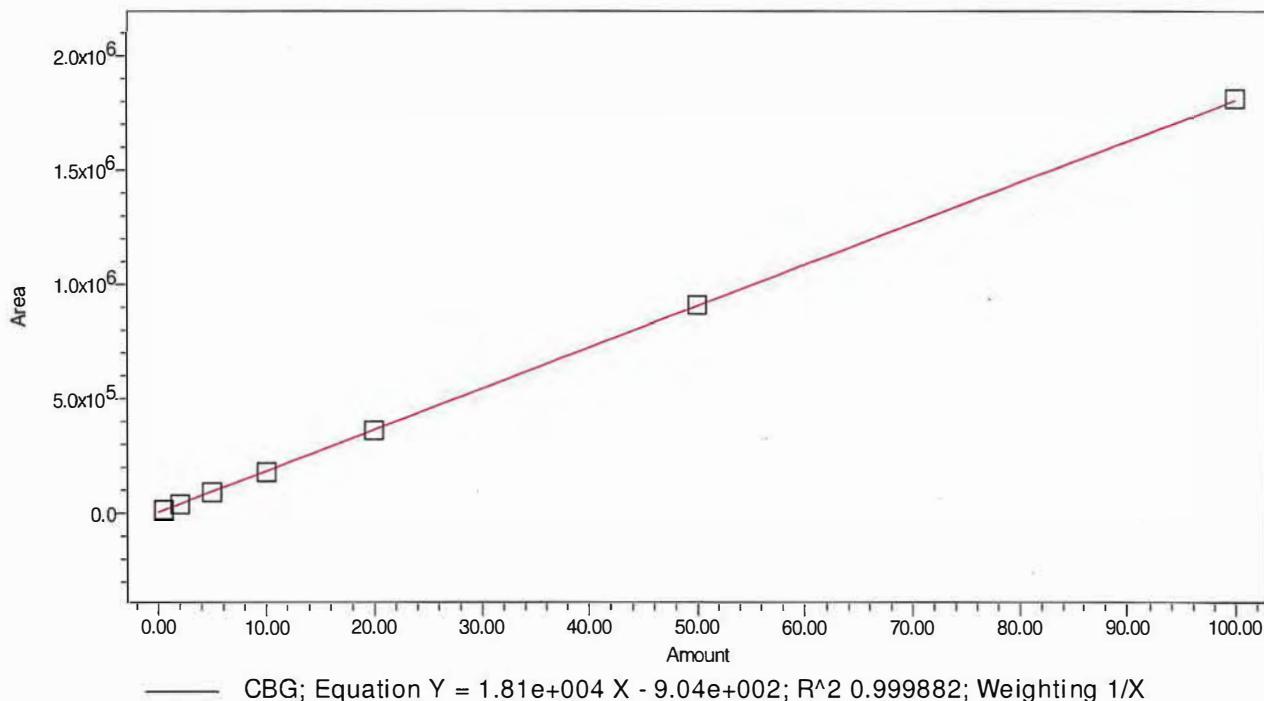
Page: 7 of 7

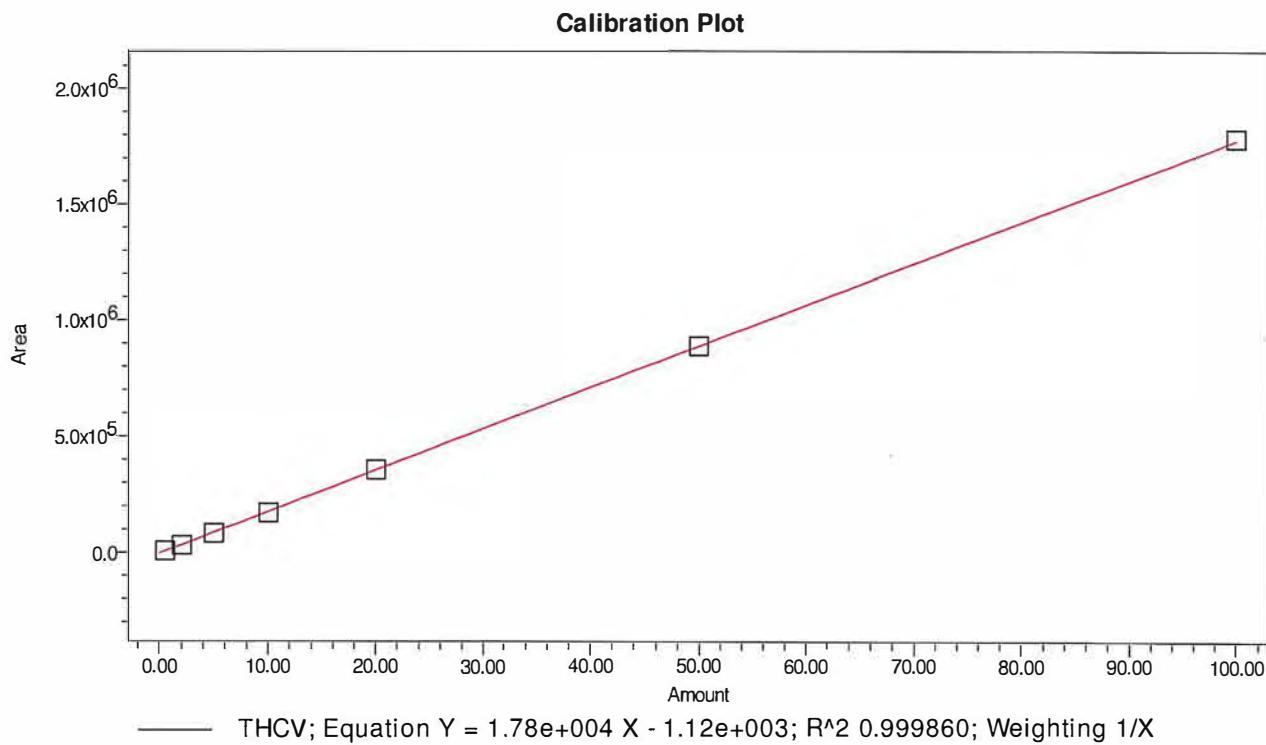
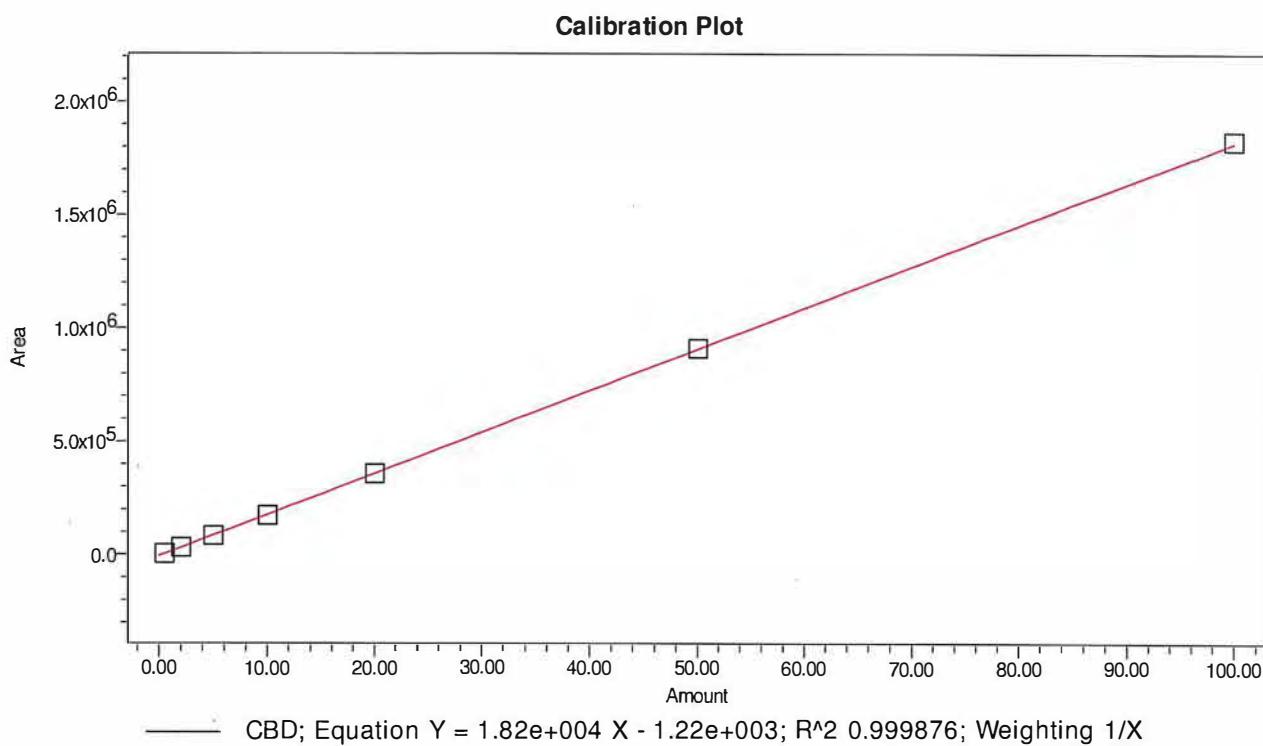
Project Name: 2021\Method Development Miao

Date Printed:

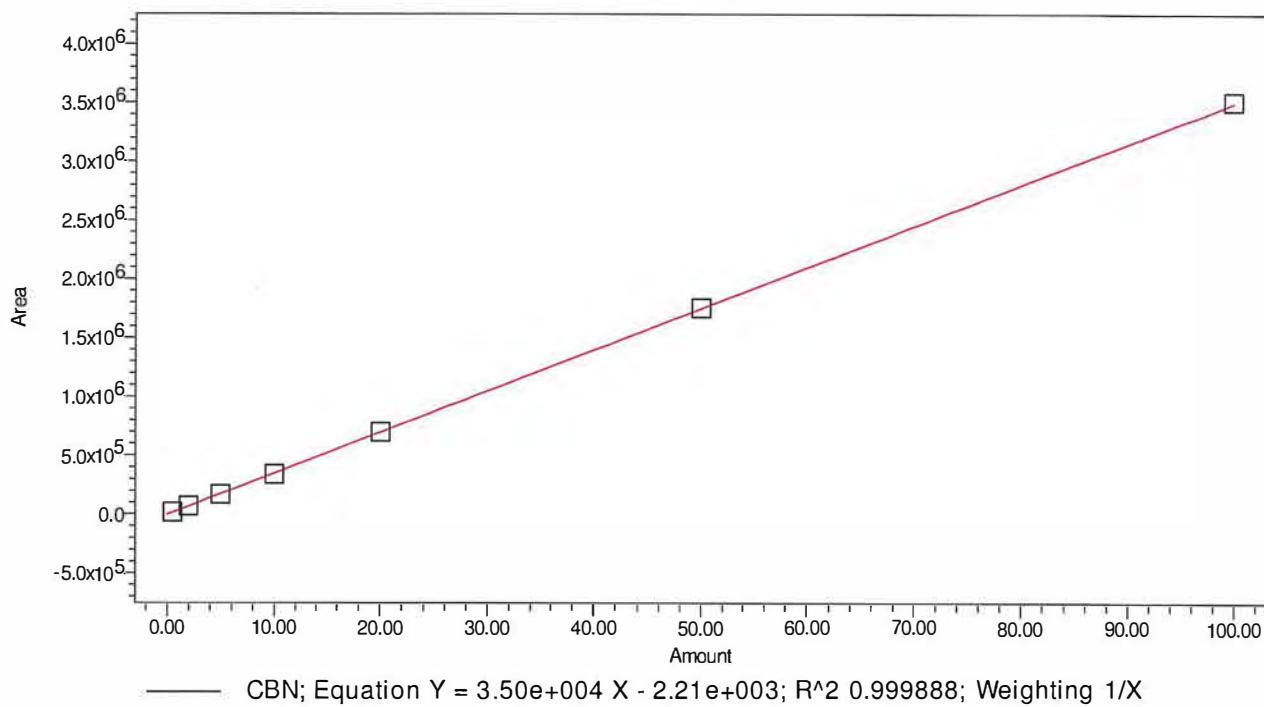
3/23/2022

12:04:02 PM US/Pacific

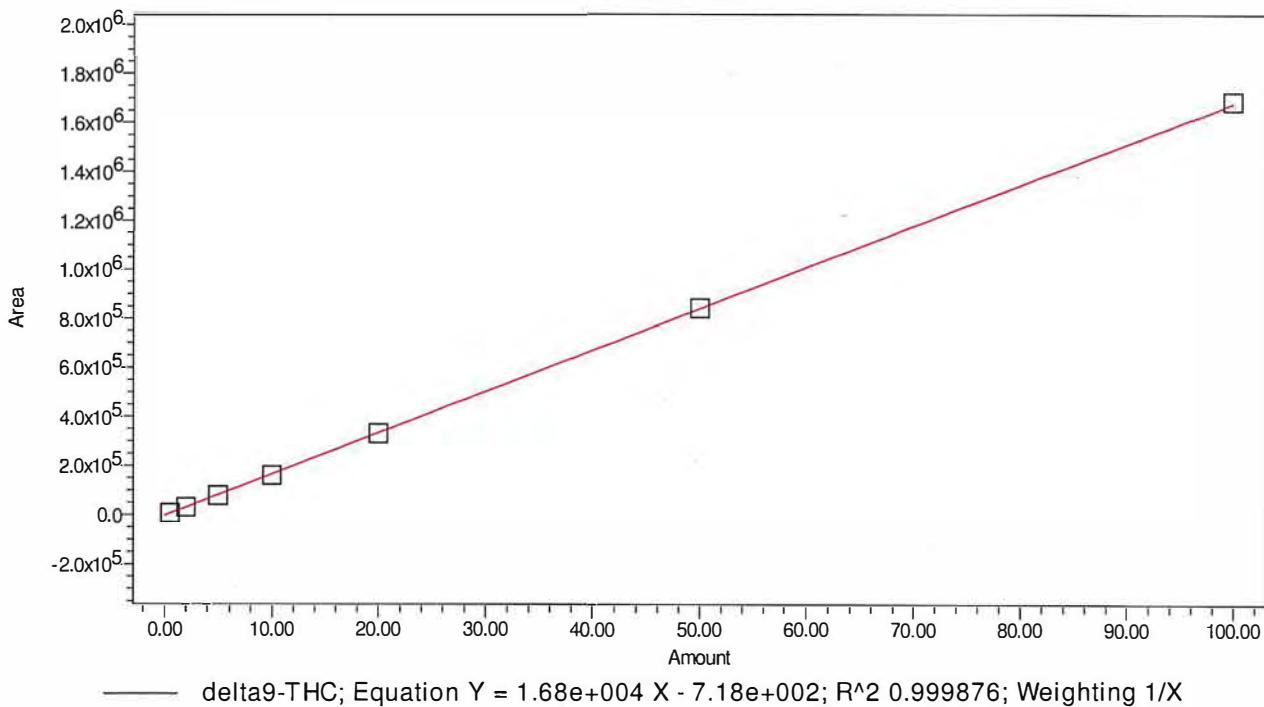
Calibration Plot**Calibration Plot**

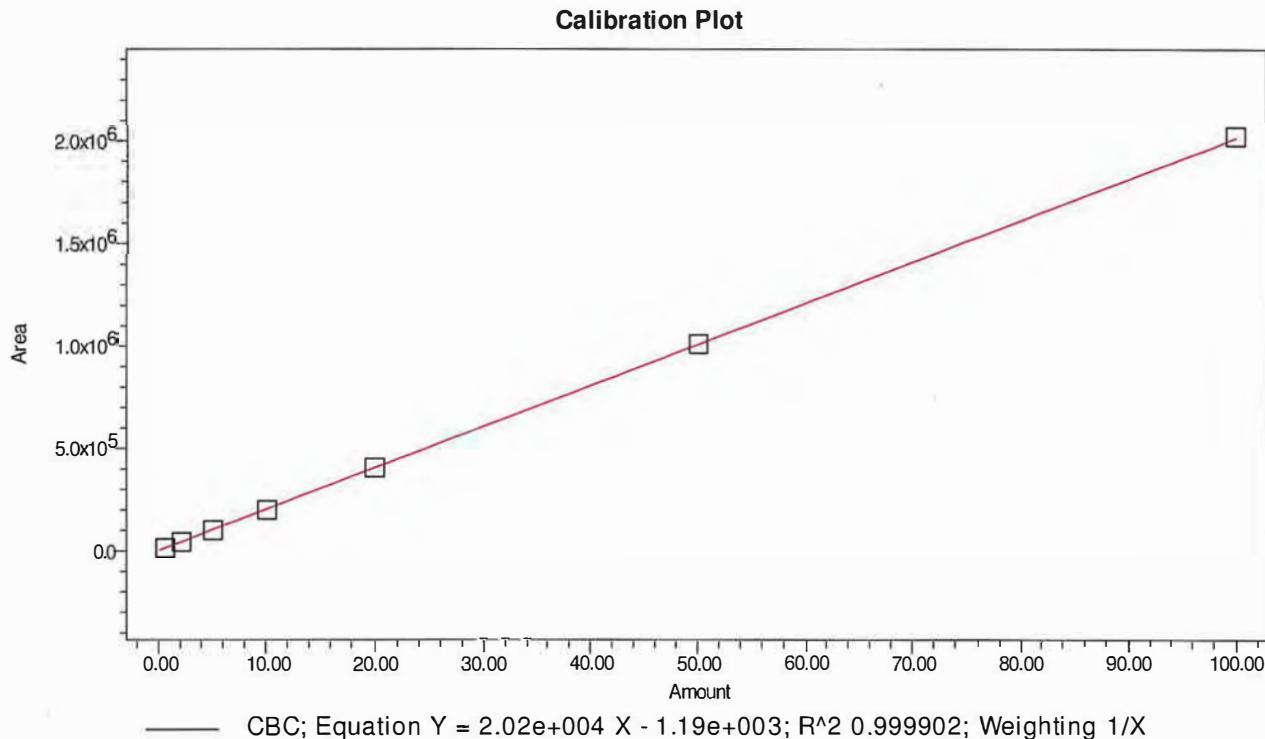
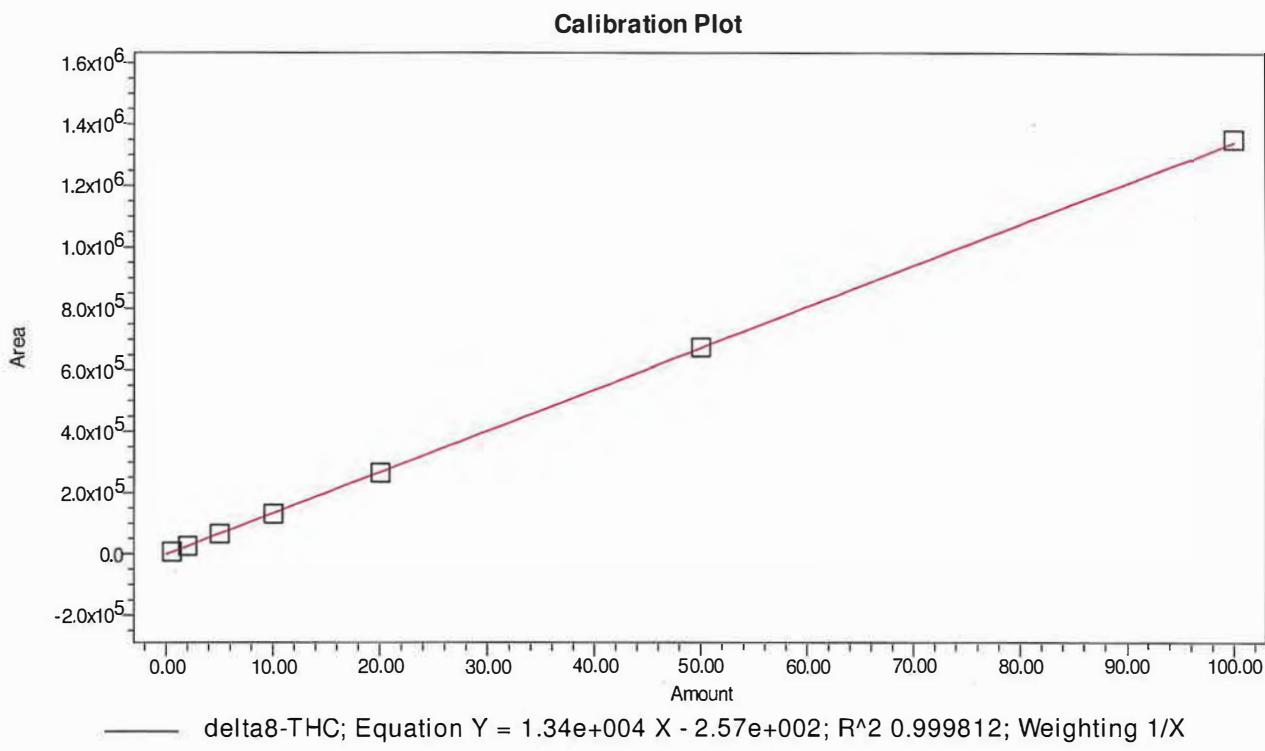


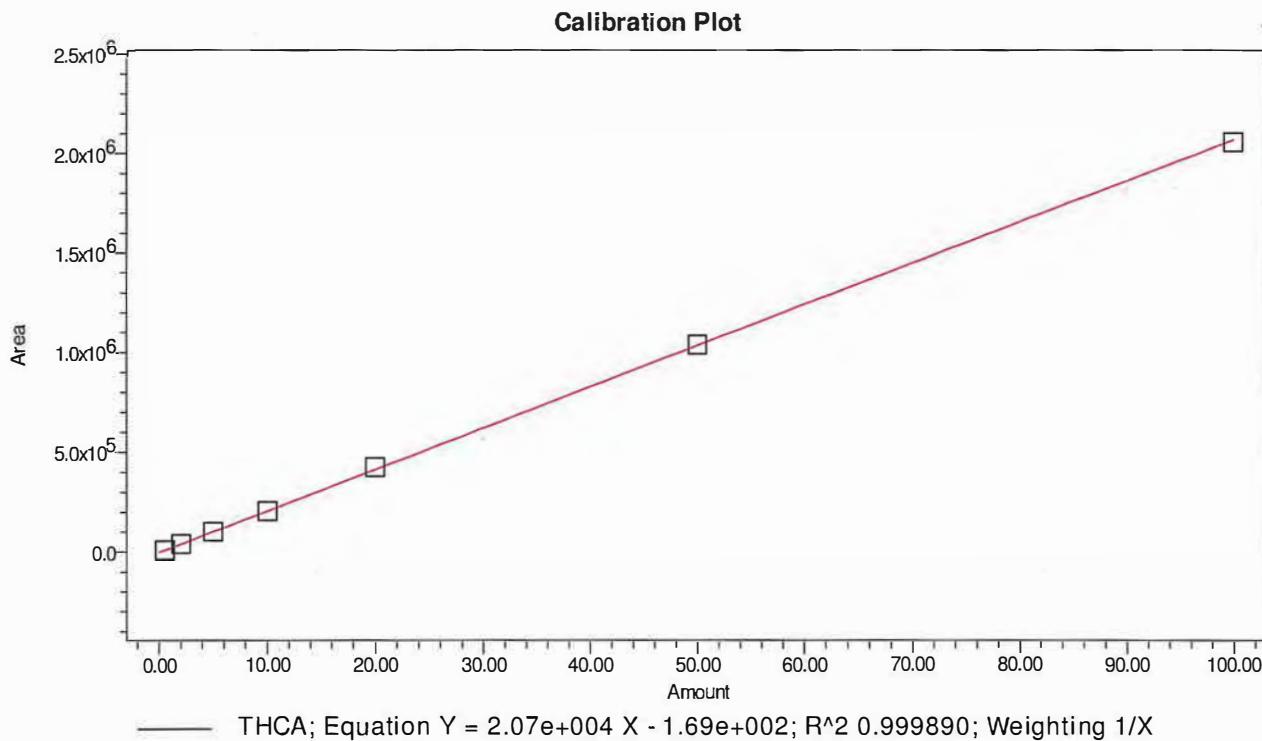
Calibration Plot



Calibration Plot







Peak: CBDA											
	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	CBDA	Level 1	2.161	10909	11.100	4084	0.500000	0.518895	ppm	3.779	No
2	CBDA	Level 2	2.164	43919	13.300	16747	2.000000	1.969993	ppm	-1.500	No
3	CBDA	Level 3	2.164	111078	13.700	42816	5.000000	4.922213	ppm	-1.556	No
4	CBDA	Level 4	2.163	221016	13.800	85831	10.000000	9.754953	ppm	-2.450	No
5	CBDA	Level 5	2.164	460423	12.900	181058	20.000000	20.278977	ppm	1.395	No
6	CBDA	Level 6	2.166	1142852	13.000	456304	50.000000	50.277661	ppm	0.555	No
7	CBDA	Level 7	2.162	2268900	12.700	920201	100.000000	99.777307	ppm	-0.223	No

Peak: CBG											
	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	CBG	Level 1	2.380	8855	10.300	3185	0.500000	0.540317	ppm	8.063	No
2	CBG	Level 2	2.383	34304	9.800	12702	2.000000	1.949396	ppm	-2.530	No
3	CBG	Level 3	2.384	86905	9.300	32249	5.000000	4.861735	ppm	-2.765	No
4	CBG	Level 4	2.383	174107	9.400	64713	10.000000	9.689926	ppm	-3.101	No
5	CBG	Level 5	2.385	358922	9.300	133209	20.000000	19.922615	ppm	-0.387	No
6	CBG	Level 6	2.390	905471	9.500	337542	50.000000	50.183670	ppm	0.367	No
7	CBG	Level 7	2.387	1811576	9.600	682636	100.000000	100.352341	ppm	0.352	No

Reported by User: System

Report Method: Calibration curves

Report Method ID: 12679

Page: 5 of 7

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

11:28:24 AM US/Pacific

Peak: CBD

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	CBD	Level 1	2.517	8642	10.800	3080	0.500000	0.541544	ppm	8.309	No
2	CBD	Level 2	2.522	34405	11.200	12479	2.000000	1.955981	ppm	-2.201	No
3	CBD	Level 3	2.521	86722	10.200	31557	5.000000	4.828262	ppm	-3.435	No
4	CBD	Level 4	2.521	175843	11.500	63465	10.000000	9.721156	ppm	-2.788	No
5	CBD	Level 5	2.523	361232	10.800	130410	20.000000	19.899388	ppm	-0.503	No
6	CBD	Level 6	2.528	910674	11.200	328300	50.000000	50.064806	ppm	0.130	No
7	CBD	Level 7	2.524	1829112	11.300	660697	100.000000	100.488862	ppm	0.489	No

Peak: THCV

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	THCV	Level 1	2.719	8607	13.500	2963	0.500000	0.545494	ppm	9.099	No
2	THCV	Level 2	2.722	33507	13.700	12002	2.000000	1.942400	ppm	-2.880	No
3	THCV	Level 3	2.722	84535	15.500	30146	5.000000	4.805205	ppm	-3.896	No
4	THCV	Level 4	2.722	171916	17.600	60619	10.000000	9.707478	ppm	-2.925	No
5	THCV	Level 5	2.724	355530	22.600	124967	20.000000	20.008663	ppm	0.043	No
6	THCV	Level 6	2.729	891328	22.300	313601	50.000000	50.068171	ppm	0.136	No
7	THCV	Level 7	2.725	1788875	40.600	628765	100.000000	100.422589	ppm	0.423	No

Peak: CBN

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	CBN	Level 1	3.660	16615	14.700	4560	0.500000	0.537738	ppm	7.548	No
2	CBN	Level 2	3.662	66407	17.100	18548	2.000000	1.959755	ppm	-2.012	No
3	CBN	Level 3	3.666	167935	20.200	46803	5.000000	4.859322	ppm	-2.814	No
4	CBN	Level 4	3.665	337103	21.900	93957	10.000000	9.690608	ppm	-3.094	No
5	CBN	Level 5	3.668	695960	25.700	193874	20.000000	19.939294	ppm	-0.304	No
6	CBN	Level 6	3.674	1754222	28.200	488593	50.000000	50.162411	ppm	0.325	No
7	CBN	Level 7	3.669	3511571	36.300	980743	100.000000	100.350872	ppm	0.351	No

Peak: delta9-THC

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	delta9-THC	Level 1	4.582	8390	10.100	1933	0.500000	0.540884	ppm	8.177	No
2	delta9-THC	Level 2	4.582	32173	12.100	7522	2.000000	1.953249	ppm	-2.338	No
3	delta9-THC	Level 3	4.587	81057	12.200	18958	5.000000	4.856317	ppm	-2.874	No
4	delta9-THC	Level 4	4.584	162479	15.300	38135	10.000000	9.691639	ppm	-3.084	No
5	delta9-THC	Level 5	4.589	334081	17.400	78225	20.000000	19.882504	ppm	-0.587	No
6	delta9-THC	Level 6	4.595	843417	16.700	197859	50.000000	50.130082	ppm	0.260	No

Reported by User: System

Report Method: Calibration curves

Report Method ID: 12679

Page: 6 of 7

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

11:28:24 AM US/Pacific

Peak: delta9-THC

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
7	delta9-THC	Level 7	4.590	1690670	15.000	397508	100.000000	100.445325	ppm	0.445	No

Peak: delta8-THC

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	delta8-THC	Level 1	4.735	7170	12.700	1494	0.500000	0.552877	ppm	10.575	No
2	delta8-THC	Level 2	4.734	25673	15.700	5630	2.000000	1.930343	ppm	-3.483	No
3	delta8-THC	Level 3	4.739	64528	17.700	14242	5.000000	4.822995	ppm	-3.540	No
4	delta8-THC	Level 4	4.736	129763	18.700	28678	10.000000	9.679552	ppm	-3.204	No
5	delta8-THC	Level 5	4.741	265348	18.300	58667	20.000000	19.773397	ppm	-1.133	No
6	delta8-THC	Level 6	4.748	671959	18.800	147961	50.000000	50.044197	ppm	0.088	No
7	delta8-THC	Level 7	4.743	1352344	20.000	295924	100.000000	100.696639	ppm	0.697	No

Peak: CBC

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	CBC	Level 1	5.696	9426	13.300	1809	0.500000	0.526367	ppm	5.273	No
2	CBC	Level 2	5.693	39223	22.000	7381	2.000000	2.004237	ppm	0.212	No
3	CBC	Level 3	5.700	96978	22.700	18464	5.000000	4.868881	ppm	-2.622	No
4	CBC	Level 4	5.696	194063	24.900	37083	10.000000	9.684205	ppm	-3.158	No
5	CBC	Level 5	5.703	401266	24.400	76256	20.000000	19.961321	ppm	-0.193	No
6	CBC	Level 6	5.711	1007569	24.200	191642	50.000000	50.033520	ppm	0.067	No
7	CBC	Level 7	5.703	2023470	23.300	386327	100.000000	100.421469	ppm	0.421	No

Peak: THCA

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	THCA	Level 1	6.162	10177	18.900	1651	0.500000	0.499069	ppm	-0.186	No
2	THCA	Level 2	6.154	40490	27.500	6483	2.000000	1.961306	ppm	-1.935	No
3	THCA	Level 3	6.153	103532	28.500	16635	5.000000	5.002345	ppm	0.047	No
4	THCA	Level 4	6.141	206645	28.900	33253	10.000000	9.976333	ppm	-0.237	No
5	THCA	Level 5	6.137	425267	29.100	68950	20.000000	20.522242	ppm	2.611	No
6	THCA	Level 6	6.130	1039687	29.600	170128	50.000000	50.160759	ppm	0.322	No
7	THCA	Level 7	6.110	2059982	30.100	337149	100.000000	99.377945	ppm	-0.622	No

Reported by User: System

Report Method: Calibration curves

Report Method ID: 12679

Page: 7 of 7

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

11:28:24 AM US/Pacific

Sample Name	Weight (g)	Concentration in 1:10 dilution of 40 ml ACN:MeOH 80:20 Extract (mg/L)									Concentration in sample (mg/g) calculated from 1:10 dilution								
		CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
F4-1_10x	0.2006	0.239	0.000	0.000	1.168	2.024	28.461	1.611	50.758	0.551	0.477	0.000	0.000	2.329	4.036	56.752	3.212	101.212	1.099
F4-2_10x	0.2015	0.241	0.000	0.000	1.228	1.973	28.777	1.661	51.529	0.520	0.478	0.000	0.000	2.438	3.917	57.126	3.297	102.291	1.032
Concentration in 40 ml ACN:MeOH 80:20 Extract (mg/L)																			
MS1	0.1994	2.582	2.522	2.377	2.398	2.364	2.475	2.446	2.420	2.556	0.103	0.101	0.095	0.096	0.095	0.099	0.098	0.097	0.102
Amount spiked											0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
Recovery											103%	101%	95%	96%	95%	99%	98%	97%	102%
Concentration in 1:20 dilution of 40 ml Sample Extract (mg/L)																			
Post-dilution Spike		42.244	41.233	39.078	39.318	39.31	55.179	41.639	67.78	40.966									
Amount spiked		40	40	40	40	40	40	40	40	40									
Unspiked sample		0.241	0	0	1.228	1.973	28.777	1.661	51.529	0.52									
Recovery		105%	103%	98%	97%	96%	102%	102%	105%	102%									
Concentration in 40 ml ACN:MeOH 80:20 Extract (mg/L)																			
Method blank		CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
Matrix blank 1	0.1999	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	0	0	0	0	0	0	0	0	0

Sample Name	Weight (g)	Concentration in 1:1 dilution of 40 ml Sample Extract (mg/L)									Concentration in sample (mg/g) calculated from 1:1 dilution								
		CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
F4-1_1x	0.2006	2.274	2.197	0.000	11.627	20.114	286.917	17.291	501.376	4.652	0.453	0.438	0.000	2.318	4.011	57.212	3.448	99.975	0.928
F4-2_1x	0.2015	2.380	2.331	0.000	11.934	20.138	287.402	19.060	505.325	4.680	0.472	0.463	0.000	2.369	3.998	57.053	3.784	100.313	0.929
HM1_1x	0.1983	270.952	1.129	248.100	8.272	1.328	15.446	0.654	4.503	17.446	54.655	0.228	50.045	1.669	0.268	3.116	0.132	0.908	3.519
HM2_1x	0.2020	277.595	1.186	256.068	8.562	1.351	16.093	0.840	4.816	18.134	54.969	0.235	50.707	1.695	0.268	3.187	0.166	0.954	3.591
HM3_1x	0.2020	276.355	1.154	254.787	8.538	1.337	15.895	0.931	4.578	18.270	54.724	0.229	50.453	1.691	0.265	3.148	0.184	0.907	3.618

Sample Name	Weight (g)	Concentration in 1:5 dilution of 40 ml Sample Extract (mg/L)									Concentration in sample (mg/g) calculated from 1:5 dilution								
		CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
HM1_5x	0.1983	64.909	0.388	54.036	1.889	0.370	3.028	0.000	0.925	3.700	65.465	0.391	54.499	1.905	0.373	3.054	0.000	0.933	3.732
HM2_5x	0.2020	66.314	0.283	55.278	1.764	0.369	3.134	0.000	0.951	3.574	65.657	0.280	54.731	1.747	0.365	3.103	0.000	0.942	3.539
HM3_5x	0.2020	67.203	0.290	55.645	1.791	0.402	3.176	0.000	0.923	3.656	66.538	0.287	55.094	1.773	0.398	3.145	0.000	0.914	3.620

day 4

Note for HM1, HM2 and HM3:

For CBD and CBDA

For all the other cannabinoids

Concentration in sample (mg/g) = (Concentration in 1: 5 of 40ml sample extract ug/L) x 5 x 40 / Weight (g) / 1000/ 1000

Concentration in sample (mg/g) = (Concentration in 1: 1 of 40ml sample extract ug/L) x 1 x 40 / Weight (g) / 1000/ 1000

	Cannabinoids Concentration in Sample (mg/g)								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
HM1	65.465	0.228	54.499	1.669	0.268	3.116	0.132	0.908	3.519
HM2	65.657	0.235	54.731	1.695	0.268	3.187	0.166	0.954	3.591
HM3	66.538	0.229	55.094	1.691	0.265	3.148	0.184	0.907	3.618
RL	0.500	0.100	0.500	0.100	0.100	0.100	0.100	0.100	0.100
AVG	65.887	ND	54.775	1.685	0.267	3.150	0.161	0.923	3.576
RSD	0.9%		0.5%	0.9%	0.6%	1.1%	16.6%	2.9%	1.4%
	Cannabinoids Concentration in Sample (%)								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
HM1	6.547	0.023	5.450	0.167	0.027	0.312	0.013	0.091	0.352
HM2	6.566	0.023	5.473	0.170	0.027	0.319	0.017	0.095	0.359
HM3	6.654	0.023	5.509	0.169	0.026	0.315	0.018	0.091	0.362
RL	0.050	0.010	0.050	0.010	0.010	0.010	0.010	0.010	0.010
AVG	6.589	ND	5.477	0.168	0.027	0.315	0.016	0.092	0.358
CoA	6.716	NA	5.230	0.143	0.027	0.299		0.108	0.319
RPD (CoA)	1.9%	NA	4.6%	16.7%	0.0%	5.3%	NA	15.5%	11.3%
LCMS	5.586	0.011	5.206	0.161	0.027	0.350		0.086	0.319
RPD (LCMS)	16.5%	NA	5.1%	4.5%	0.1%	10.5%	NA	7.6%	11.5%

Note: The retention time of suspected THCV peaks in hemp samples (HM1, HM2 and HM3) fell out of the acceptance window, therefore, not considered as THCV. The concentration of THCV in hemp samples are reported as ND (not detected).

Sample Name	Retention Time (min)								
	CBDA	THCV	CBD	CBG	CBN	Δ9-THC	Δ8-THC	THCA	CBC
9Mix_0.5ppm_Std	2.17	2.72	2.52	2.39	3.67	4.60	4.75	6.18	5.71
9Mix_2ppm_Std	2.17	2.73	2.53	2.39	3.68	4.60	4.76	6.18	5.72
9Mix_5ppm_Std	2.17	2.73	2.53	2.39	3.68	4.60	4.76	6.17	5.72
9Mix_10ppm_Std	2.17	2.73	2.53	2.39	3.67	4.60	4.75	6.16	5.72
9Mix_20ppm_Std	2.17	2.73	2.53	2.39	3.68	4.61	4.76	6.16	5.73
9Mix_50ppm_Std	2.17	2.73	2.53	2.39	3.68	4.61	4.76	6.14	5.73
9Mix_100ppm_Std	2.17	2.73	2.53	2.39	3.68	4.61	4.76	6.13	5.73
Average	2.17	2.73	2.53	2.39	3.68	4.60	4.76	6.16	5.72
MS_1x	2.17	2.73	2.53	2.39	3.68	4.61	4.76	6.19	5.73
F4-1_10x	2.18	2.71	2.51	2.40	3.68	4.61	4.78	6.14	5.73
F4-2_10x	2.18	2.71	2.51	2.39	3.68	4.61	4.78	6.14	5.73
F4-2_PDS_20x	2.17	2.74	2.54	2.40	3.69	4.62	4.77	6.14	5.74
F4-1_1x	2.18	2.73	2.51	2.40	3.69	4.61	4.72	6.09	5.74
F4-2_1x	2.18	2.73	2.51	2.40	3.69	4.61	4.72	6.09	5.74
HM1_5x	2.17	2.81	2.54	2.40	3.69	4.62	4.69	6.21	5.75
HM2_5x	2.17	2.81	2.54	2.40	3.70	4.62	4.69	6.21	5.75
HM3_5x	2.17	2.80	2.54	2.40	3.69	4.62	4.69	6.21	5.74
HM1_1x	2.16	2.80	2.53	2.39	3.69	4.62	4.80	6.19	5.74
HM2_1x	2.16	2.80	2.53	2.39	3.69	4.62	4.80	6.19	5.74
HM3_1x	2.16	2.81	2.53	2.40	3.69	4.62	4.79	6.20	5.74

Acceptance Window (Avg ± 2.5%Avg) Control Limit	2.17 ± 0.05	2.73 ± 0.07	2.53 ± 0.06	2.39 ± 0.06	3.68 ± 0.09	4.60 ± 0.12	4.76 ± 0.12	6.16 ± 0.15	5.72 ± 0.14
	2.11 - 2.22	2.66 - 2.80	2.46 - 2.59	2.33 - 2.45	3.59 - 3.77	4.49 - 4.72	4.64 - 4.88	6.00 - 6.31	5.58 - 5.86
	Sample Name	CBDA pass (Y/N)	THCV pass (Y/N)	CBD pass (Y/N)	CBG pass (Y/N)	CBN pass (Y/N)	Δ9-THC pass (Y/N)	Δ8-THC pass (Y/N)	CBC pass (Y/N)
MS_1x	Y	Y	Y	Y	Y	Y	Y	Y	Y
F4-1_10x	Y	Y	Y	Y	Y	Y	Y	Y	Y
F4-2_10x	Y	Y	Y	Y	Y	Y	Y	Y	Y
F4-2_PDS_20x	Y	Y	Y	Y	Y	Y	Y	Y	Y
F4-1_1x	Y	Y	Y	Y	Y	Y	Y	Y	Y
F4-2_1x	Y	Y	Y	Y	Y	Y	Y	Y	Y
HM1_5x	Y	N	Y	Y	Y	Y	Y	Y	Y
HM2_5x	Y	N	Y	Y	Y	Y	Y	Y	Y
HM3_5x	Y	N	Y	Y	Y	Y	Y	Y	Y
HM1_1x	Y	N	Y	Y	Y	Y	Y	Y	Y
HM2_1x	Y	N	Y	Y	Y	Y	Y	Y	Y
HM3_1x	Y	N	Y	Y	Y	Y	Y	Y	Y

Note: The retention time of suspected THCV peaks in hemp samples (HM1, HM2 and HM3) fell out of the acceptance window, therefore, not considered as THCV. The concentration of THCV in hemp samples are reported as ND (not detected).

**Method Validation
Quality Control Report**
for Initial and Continuing Calibration Verification Standard, Method Blanks, Method Standard, and Laboratory Control Sample

Date of Analysis: 3/23/2022
 Matrix: Cannabis flower, Cellulose powder (LCS)
 CTLB Nos.: 19-01597-CE

Analytical Method: Cannabinoids Concentration by UPLC

Analyte	Initial and Continuing Calibration Verification Standard					Method Blanks		Matrix Blanks		Method Standard				
	Sample Name	Found	True Value	Recovery	Control Limits	Repl. 1	Repl. 2	Repl. 1	Repl. 2	Found	True Value	Recovery	Control Limits	
		mg/L	mg/L	%	%	mg/L	mg/L	mg/L	mg/L	mg	mg	%	%	
CBDA	ICV_10ppm	9.8	10.0	97.7	80-120	ND		ND				#DIV/0!	80-120	
THCV		9.8	10.0	98.3	80-120	ND		ND				#DIV/0!	80-120	
CBD		9.4	10.0	94.4	80-120	ND		ND				#DIV/0!	80-120	
CBG		9.5	10.0	95.0	80-120	ND		ND				#DIV/0!	80-120	
CBN		9.3	10.0	92.9	80-120	ND		ND				#DIV/0!	80-120	
Δ9-THC		9.8	10.0	97.6	80-120	ND		ND				#DIV/0!	80-120	
Δ8-THC		9.8	10.0	97.9	80-120	ND		ND				#DIV/0!	80-120	
THCA		9.7	10.0	96.7	80-120	ND		ND				#DIV/0!	80-120	
CBC		9.9	10.0	98.7	80-120	ND		ND				#DIV/0!	80-120	
CBDA	CCV_50ppm_001	51.0	50.0	102.0	80-120									
THCV		50.8	50.0	101.7	80-120									
CBD		50.8	50.0	101.6	80-120									
CBG		51.0	50.0	102.0	80-120									
CBN		51.0	50.0	101.9	80-120									
Δ9-THC		50.9	50.0	101.7	80-120									
Δ8-THC		50.2	50.0	100.5	80-120									
THCA		50.5	50.0	101.1	80-120									
CBC		50.8	50.0	101.5	80-120									
CBDA	CCV_50ppm_002	51.4	50.0	102.9	80-120									
THCV		51.2	50.0	102.5	80-120									
CBD		51.3	50.0	102.7	80-120									
CBG		51.5	50.0	103.0	80-120									
CBN		51.5	50.0	103.0	80-120									
Δ9-THC		51.3	50.0	102.7	80-120									
Δ8-THC		50.8	51.0	99.6	80-120									
THCA		51.0	50.0	102.0	80-120									
CBC		51.2	50.0	102.5	80-120									

Notes:

Miaotian Sun

Analyst

3/24/2022

Date

Supervisor



3-30-22

**Method Validation
Quality Control Report
for Matrix Spike Recovery**

Date of Analysis: 3/23/2022
 Matrix: Cannabis flower, Cellulose powder (LCS)
 I.S. Nos.: 19-01597-CE
 CTLB Nos.: 19-01597-CE
 Analytical Method: Cannabinoids Concentration by UPLC

Page 2 of 2

Analyte	Matrix Spikes 1			Matrix Spikes 2			Matrix Spikes 3			Control Limits	
	Weight (g)	0.1994		Control Limits	Weight (g)		Control Limits	Weight (g)			
	Found	Amount Added	Recovery		Found	Amount Added		Found	Amount Added		
	mg	mg	%		mg	mg		mg	mg		
CBDA	0.103	0.100	103.3	70-130			#DIV/0!	70-130		#DIV/0!	70-130
THCV	0.101	0.100	100.9	70-130			#DIV/0!	70-130		#DIV/0!	70-130
CBD	0.095	0.100	95.1	70-130			#DIV/0!	70-130		#DIV/0!	70-130
CBG	0.096	0.100	95.9	70-130			#DIV/0!	70-130		#DIV/0!	70-130
CBN	0.095	0.100	94.6	70-130			#DIV/0!	70-130		#DIV/0!	70-130
Δ9-THC	0.099	0.100	99.0	70-130			#DIV/0!	70-130		#DIV/0!	70-130
Δ8-THC	0.098	0.100	97.8	70-130			#DIV/0!	70-130		#DIV/0!	70-130
THCA	0.097	0.100	96.8	70-130			#DIV/0!	70-130		#DIV/0!	70-130
CBC	0.102	0.100	102.2	70-130			#DIV/0!	70-130		#DIV/0!	70-130
	Unspiked Sample			Post Dilution Spike							
	mg/L	mg/L	mg/L	RPD	mg/L	mg/L	%	%			
CBDA	0.2		0.2	100.0%	42.2	40.0	105.3	70-130			
THCV	0.0		0.0	#DIV/0!	41.2	40.0	103.1	70-130			
CBD	0.0		0.0	#DIV/0!	39.1	40.0	97.7	70-130			
CBG	1.2		1.2	100.0%	39.3	40.0	96.8	70-130			
CBN	2.0		2.0	100.0%	39.3	40.0	95.8	70-130			
Δ9-THC	28.8		28.8	100.0%	55.2	40.0	102.0	70-130			
Δ8-THC	1.7		1.7	100.0%	41.6	40.0	102.0	70-130			
THCA	51.5		51.5	100.0%	67.8	40.0	105.0	70-130			
CBC	0.5		0.5	100.0%	41.0	40.0	101.8	70-130			

Notes: Recovery of Post Dilution Spike (PDS) = (Concentration in PDS (mg/L) - Concentration in Unspiked Sample (mg/L) / 2) / Amount Spiked (mg/L)

Dilution factor of PDS is twice as of the Unspiked Sample.

Miaotian Sun 3/24/2022
 Analyst Date


 Supervisor

3/30/22
 Date

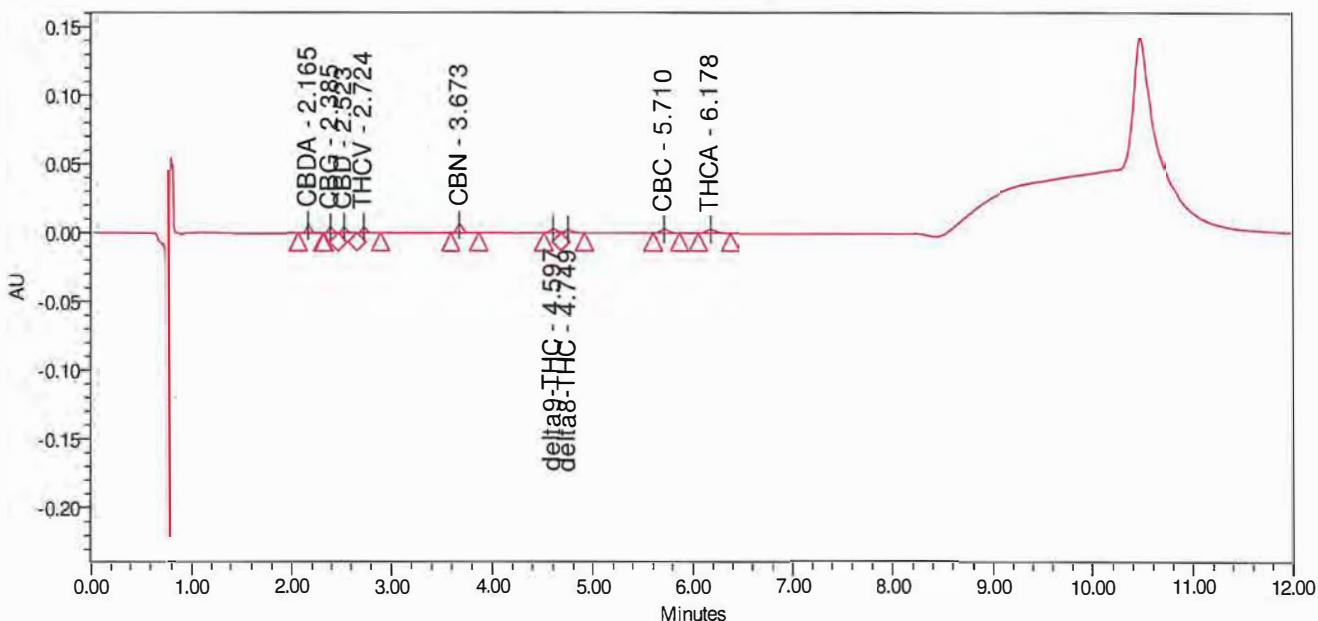
	Vial	Inj Vol (uL)	# of Injs	Label	SampleName	Level	Function	Method Set / Report or Export Method	Label Reference	Processing	Run Time (Minutes)
1							Clear Calibration	Cannabinoids_20220323_Day4		Normal	
2							Refresh Syringe	Cannabinoids_20220323_Day4			
3							Wash Needle	Cannabinoids_20220323_Day4			
4							Purge Inj	Cannabinoids_20220323_Day4			10.00
5	1	3.0	3	03162022	SolvBlk		Inject Samples	Cannabinoids_20220323_Day4		Normal	12.00
6	2	3.0	1	03162022	9Mix_0.5ppm_Std	Level 1	Inject Standards	Cannabinoids_20220323_Day4		Normal	12.00
7	3	3.0	1	03162022	9Mix_2ppm_Std	Level 2	Inject Standards	Cannabinoids_20220323_Day4		Normal	12.00
8	4	3.0	1	03162022	9Mix_5ppm_Std	Level 3	Inject Standards	Cannabinoids_20220323_Day4		Normal	12.00
9	5	3.0	1	03162022	9Mix_10ppm_Std	Level 4	Inject Standards	Cannabinoids_20220323_Day4		Normal	12.00
10	6	3.0	1	03162022	9Mix_20ppm_Std	Level 5	Inject Standards	Cannabinoids_20220323_Day4		Normal	12.00
11	7	3.0	1	03162022	9Mix_50ppm_Std	Level 6	Inject Standards	Cannabinoids_20220323_Day4		Normal	12.00
12	8	3.0	1	03162022	9Mix_100ppm_Std	Level 7	Inject Standards	Cannabinoids_20220323_Day4		Normal	12.00
13							Purge Inj	Cannabinoids_20220323_Day4			10.00
14	1	3.0	1	03162022	SolvBlk		Inject Samples	Cannabinoids_20220323_Day4		Normal	12.00
15	9	3.0	1	03162022	ICV_10ppm		Inject Samples	Cannabinoids_20220323_Day4		Normal	12.00
16	10	3.0	1	Smp	MethBlk_1x		Inject Controls	Cannabinoids_20220323_Day4		Normal	12.00
17	11	3.0	1	Smp	MatrixBlk_1x		Inject Samples	Cannabinoids_20220323_Day4		Normal	12.00
18	12	3.0	1	Smp	MS_1x		Inject Samples	Cannabinoids_20220323_Day4		Normal	12.00
19	13	3.0	1	Smp	F4-1_10x		Inject Samples	Cannabinoids_20220323_Day4		Normal	12.00
20	14	3.0	1	Smp	F4-2_10x		Inject Samples	Cannabinoids_20220323_Day4		Normal	12.00
21							Refresh Syringe	Cannabinoids_20220323_Day4			
22							Wash Needle	Cannabinoids_20220323_Day4			
23							Purge Inj	Cannabinoids_20220323_Day4			10.00
24	15	3.0	1	Smp	F4-2_PDS_20x		Inject Samples	Cannabinoids_20220323_Day4		Normal	12.00
25							Purge Inj	Cannabinoids_20220323_Day4			10.00
26	1	3.0	1	03162022	SolvBlk		Inject Samples	Cannabinoids_20220323_Day4		Normal	12.00
27	7	3.0	1	03162022	CCV1_50ppm		Inject Samples	Cannabinoids_20220323_Day4		Normal	12.00
28	16	3.0	1	Smp	F4-1_1x		Inject Samples	Cannabinoids_20220323_Day4		Normal	12.00
29	17	3.0	1	Smp	F4-2_1x		Inject Samples	Cannabinoids_20220323_Day4		Normal	12.00
30	18	3.0	1	Smp	HM1_5x		Inject Samples	Cannabinoids_20220323_Day4		Normal	12.00
31	19	3.0	1	Smp	HM2_5x		Inject Samples	Cannabinoids_20220323_Day4		Normal	12.00
32	20	3.0	1	Smp	HM3_5x		Inject Samples	Cannabinoids_20220323_Day4		Normal	12.00
33	21	3.0	1	Smp	HM1_1x		Inject Samples	Cannabinoids_20220323_Day4		Normal	12.00
34	22	3.0	1	Smp	HM2_1x		Inject Samples	Cannabinoids_20220323_Day4		Normal	12.00
35	23	3.0	1	Smp	HM3_1x		Inject Samples	Cannabinoids_20220323_Day4		Normal	12.00
36							Purge Inj	Cannabinoids_20220323_Day4			10.00
37	7	3.0	1	03162022	CCV2_50ppm		Inject Samples	Cannabinoids_20220323_Day4		Normal	12.00
38	1	3.0	3	03162022	SolvBlk		Inject Samples	Cannabinoids_20220323_Day4		Normal	12.00
39							Equilibrate	End			12.00

SAMPLE INFORMATION

Sample Name: 9Mix_0.5ppm_Std Acquired By: System
Sample Type: Standard Sample Set Name:
Vial: 2 Acq. Method Set: Cannabinoids_20220323_Day4
Injection #: 1 Processing Method: Cannabinoids_20220323_Day4
Injection Volume: 3.00 ul Channel Name: PDA Ch1 220nm@4.8nm
Run Time: 12.0 Minutes Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/24/2022 1:05:37 AM PDT
Date Processed: 3/24/2022 1:17:42 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.165	16656	5517	0.500	ppm
2	CBG	2.385	12751	3964	0.500	ppm
3	CBD	2.523	13432	4010	0.500	ppm
4	THCV	2.724	13015	3981	0.500	ppm
5	CBN	3.673	24354	6194	0.500	ppm
6	delta9-THC	4.597	12242	2656	0.500	ppm
7	delta8-THC	4.749	10434	2047	0.500	ppm
8	CBC	5.710	14207	2583	0.500	ppm
9	THCA	6.178	14964	2305	0.500	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 1 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

10:42:01 AM US/Pacific

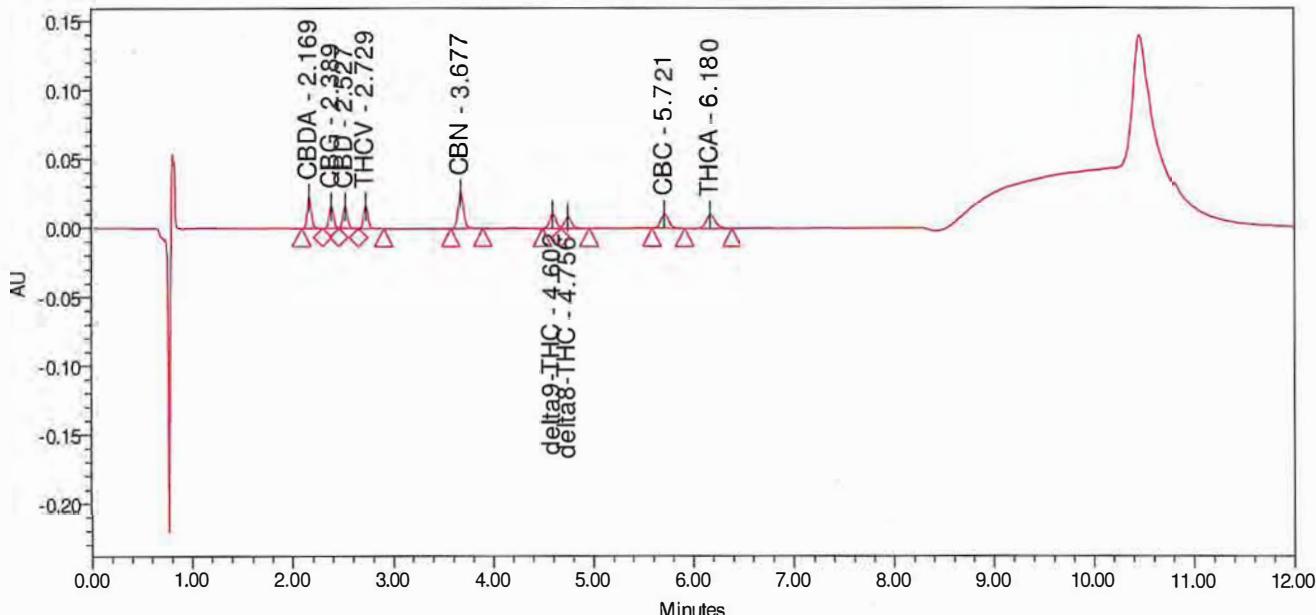
SAMPLE INFORMATION

Sample Name: 9Mix_2ppm_Std
 Sample Type: Standard
 Vial: 3
 Injection #: 1
 Injection Volume: 3.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name:
 Acq. Method Set: Cannabinoids_20220323_Day4
 Processing Method: Cannabinoids_20220323_Day4
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/24/2022 1:18:13 AM PDT
 Date Processed: 3/24/2022 1:30:16 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.169	66641	22598	2.000	ppm
2	CBG	2.389	51765	16073	2.000	ppm
3	CBD	2.527	51971	16055	2.000	ppm
4	THCV	2.729	50373	16035	2.000	ppm
5	CBN	3.677	100852	25481	2.000	ppm
6	delta ⁹ -THC	4.602	47905	10414	2.000	ppm
7	delta ⁸ -THC	4.756	38689	7968	2.000	ppm
8	CBC	5.721	57157	10309	2.000	ppm
9	THCA	6.180	62915	9620	2.000	ppm

Reported by User: System
 Report Method: Cannabinoids Quan Rep
 Report Method ID: 13447
 Page: 2 of 22

Project Name: 2021\Method Development Miao
 Date Printed: 3/24/2022
 10:42:01 AM US/Pacific

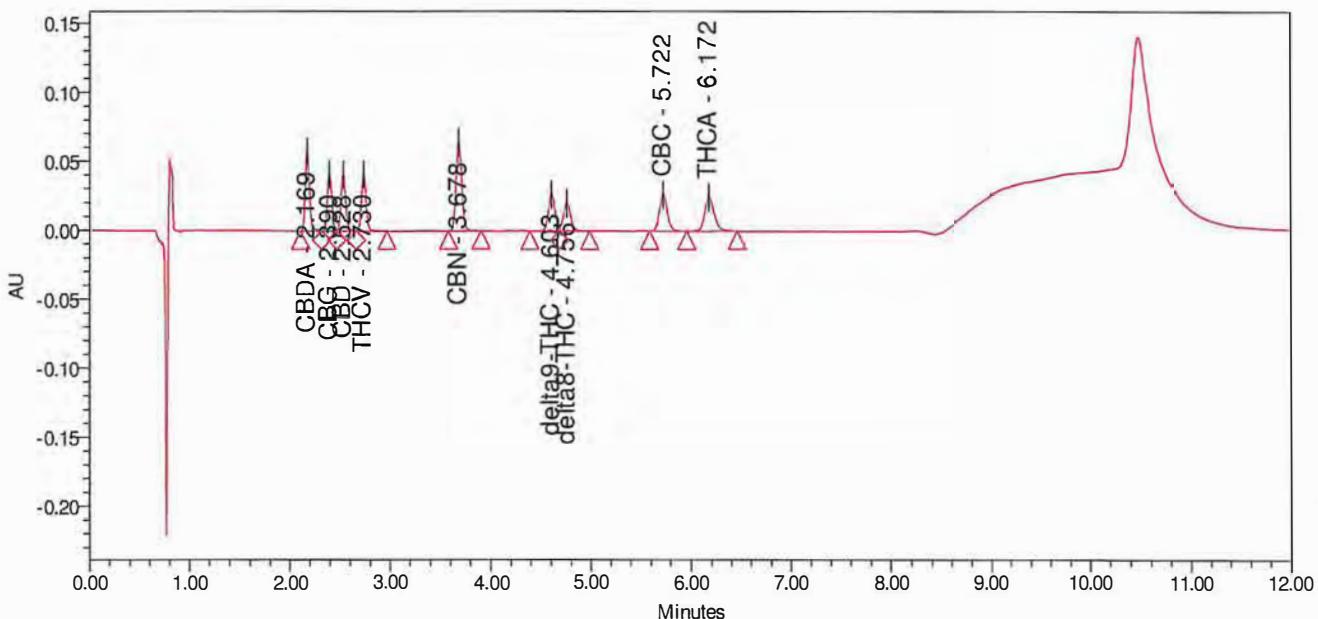
SAMPLE INFORMATION

Sample Name: 9Mix_5ppm_Std
 Sample Type: Standard
 Vial: 4
 Injection #: 1
 Injection Volume: 3.00 ul
 Run Time: 12.0 Minutes

 Acquired By: System
 Sample Set Name: Cannabinoids_20220323_Day4
 Acq. Method Set: Cannabinoids_20220323_Day4
 Processing Method: Cannabinoids_20220323_Day4
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/24/2022 1:30:48 AM PDT
 Date Processed: 3/24/2022 1:42:52 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.169	167058	57246	5.000	ppm
2	CBG	2.390	130332	40657	5.000	ppm
3	CBD	2.528	132212	40433	5.000	ppm
4	THCV	2.730	129683	40547	5.000	ppm
5	CBN	3.678	252368	63935	5.000	ppm
6	delta9-THC	4.603	121819	26509	5.000	ppm
7	delta8-THC	4.756	97417	19992	5.000	ppm
8	CBC	5.722	145984	26195	5.000	ppm
9	THCA	6.172	156904	24431	5.000	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 3 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

10:42:01 AM US/Pacific

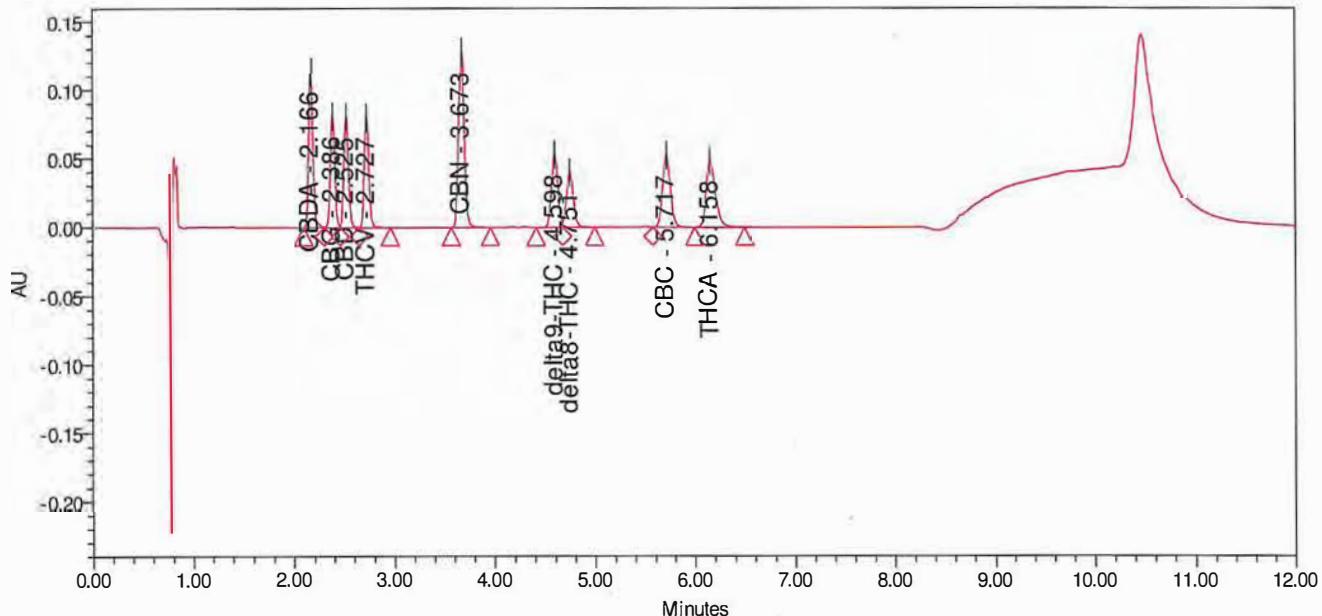
SAMPLE INFORMATION

Sample Name: 9Mix_10ppm_Std
 Sample Type: Standard
 Vial: 5
 Injection #: 1
 Injection Volume: 3.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name
 Acq. Method Set: Cannabinoids_20220323_Day4
 Processing Method: Cannabinoids_20220323_Day4
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/24/2022 1:43:24 AM PDT
 Date Processed: 3/24/2022 1:55:28 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.166	330910	114092	10.000	ppm
2	CBG	2.386	261726	81390	10.000	ppm
3	CBD	2.525	263109	80432	10.000	ppm
4	THCV	2.727	256745	80543	10.000	ppm
5	CBN	3.673	506755	128004	10.000	ppm
6	delta9-THC	4.598	243079	52890	10.000	ppm
7	delta8-THC	4.751	194067	39977	10.000	ppm
8	CBC	5.717	290873	52276	10.000	ppm
9	THCA	6.158	307980	48253	10.000	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 4 of 22

Project Name: 2021\Method Development Miao

Date Printed:

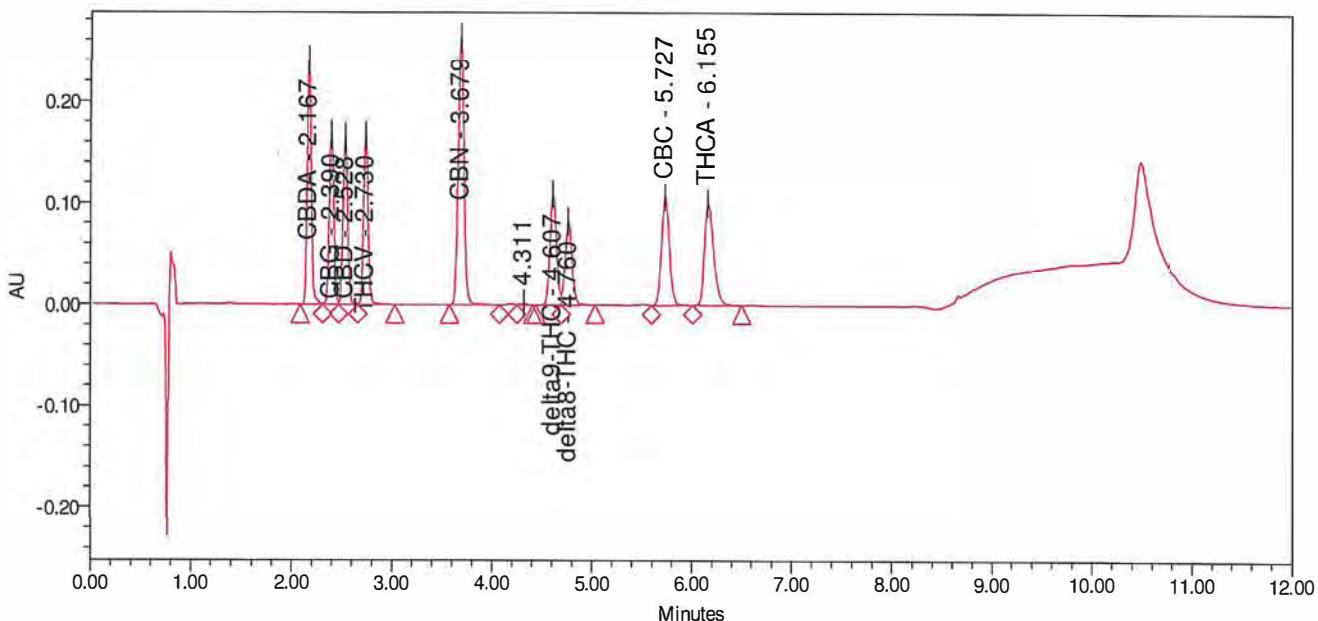
3/24/2022

10:42:01 AM US/Pacific

SAMPLE INFORMATION

Sample Name:	9Mix_20ppm_Std	Acquired By:	System
Sample Type:	Standard	Sample Set Name:	
Vial:	6	Acq. Method Set:	Cannabinoids_20220323_Day4
Injection #:	1	Processing Method:	Cannabinoids_20220323_Day4
Injection Volume:	3.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm
Date Acquired:	3/24/2022 1:56:00 AM PDT		
Date Processed:	3/24/2022 2:08:03 AM PDT		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.167	687249	241200	20.000	ppm
2	CBG	2.390	536090	167789	20.000	ppm
3	CBD	2.528	540158	165611	20.000	ppm
4	THCV	2.730	529433	166401	20.000	ppm
5	CBN	3.679	1042628	263324	20.000	ppm
6	delta9-THC	4.607	498629	108856	20.000	ppm
7	delta8-THC	4.760	397396	82150	20.000	ppm
8	CBC	5.727	595972	107062	20.000	ppm
9	THCA	6.155	634683	100386	20.000	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 5 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

10:42:01 AM US/Pacific

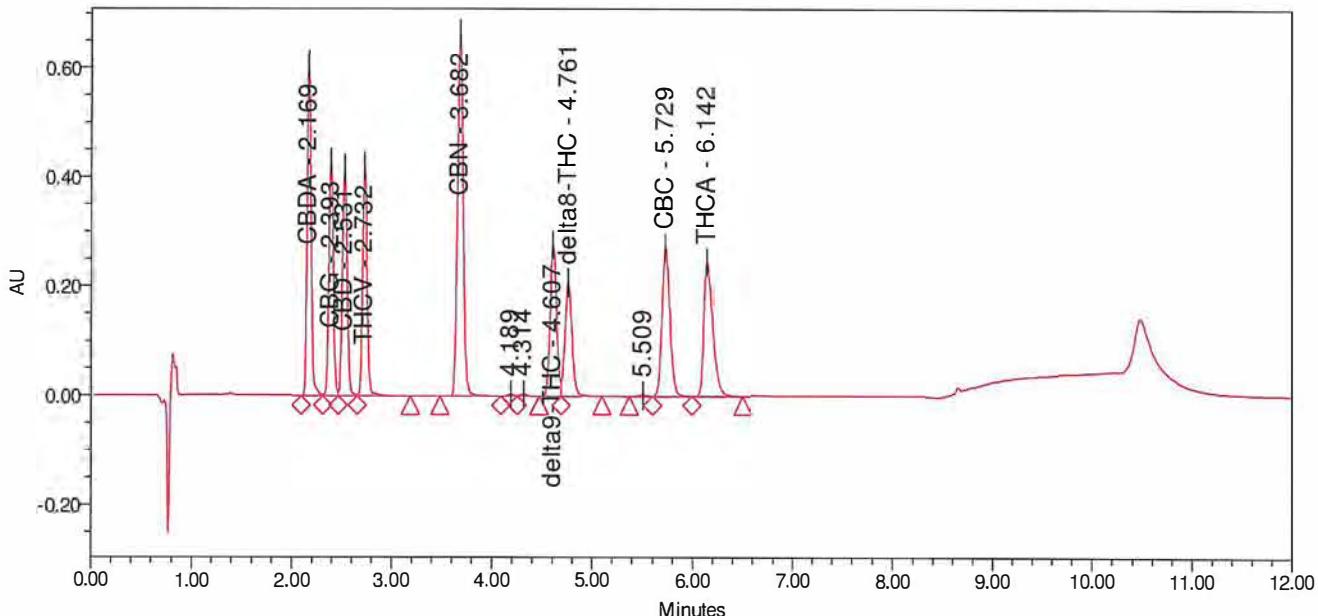
SAMPLE INFORMATION

Sample Name: 9Mix_50ppm_Std
 Sample Type: Standard
 Vial: 7
 Injection #: 1
 Injection Volume: 3.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name
 Acq. Method Set: Cannabinoids_20220323_Day4
 Processing Method: Cannabinoids_20220323_Day4
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/24/2022 2:08:36 AM PDT
 Date Processed: 3/24/2022 2:20:40 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.169	1697463	606827	50.000	ppm
2	CBG	2.393	1353691	426796	50.000	ppm
3	CBD	2.531	1366156	416550	50.000	ppm
4	THCV	2.732	1340753	419832	50.000	ppm
5	CBN	3.682	2629314	663411	50.000	ppm
6	delta9-THC	4.607	1257571	275334	50.000	ppm
7	delta8-THC	4.761	1006809	206672	50.000	ppm
8	CBC	5.729	1509636	271106	50.000	ppm
9	THCA	6.142	1535555	244487	50.000	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 6 of 22

Project Name: 2021\Method Development Miao

Date Printed:

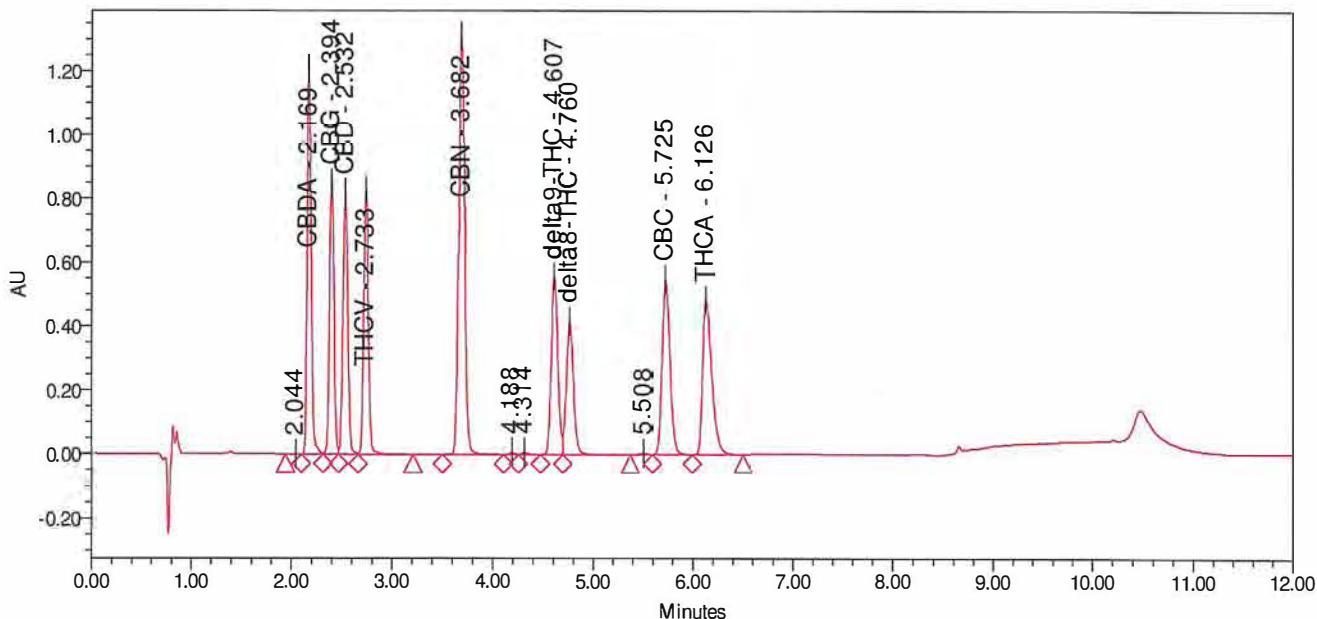
3/24/2022

10:42:01 AM US/Pacific

SAMPLE INFORMATION

Sample Name:	9Mix_100ppm_Std	Acquired By:	System
Sample Type:	Standard	Sample Set Name	
Vial:	8	Acq. Method Set:	Cannabinoids_20220323_Day4
Injection #:	1	Processing Method	Cannabinoids_20220323_Day4
Injection Volume:	3.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm
Date Acquired:	3/24/2022 2:21:11 AM PDT		
Date Processed:	3/24/2022 2:33:15 AM PDT		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.169	3352155	1210273	100.000	ppm
2	CBG	2.394	2700396	851077	100.000	ppm
3	CBD	2.532	2733770	819960	100.000	ppm
4	THCV	2.733	2663775	829426	100.000	ppm
5	CBN	3.682	5224113	1311556	100.000	ppm
6	delta9-THC	4.607	2530692	553855	100.000	ppm
7	delta8-THC	4.760	2059562	415683	100.000	ppm
8	CBC	5.725	3032311	546055	100.000	ppm
9	THCA	6.126	3046987	482026	100.000	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 7 of 22

Project Name: 2021\Method Development Miao

Date Printed:

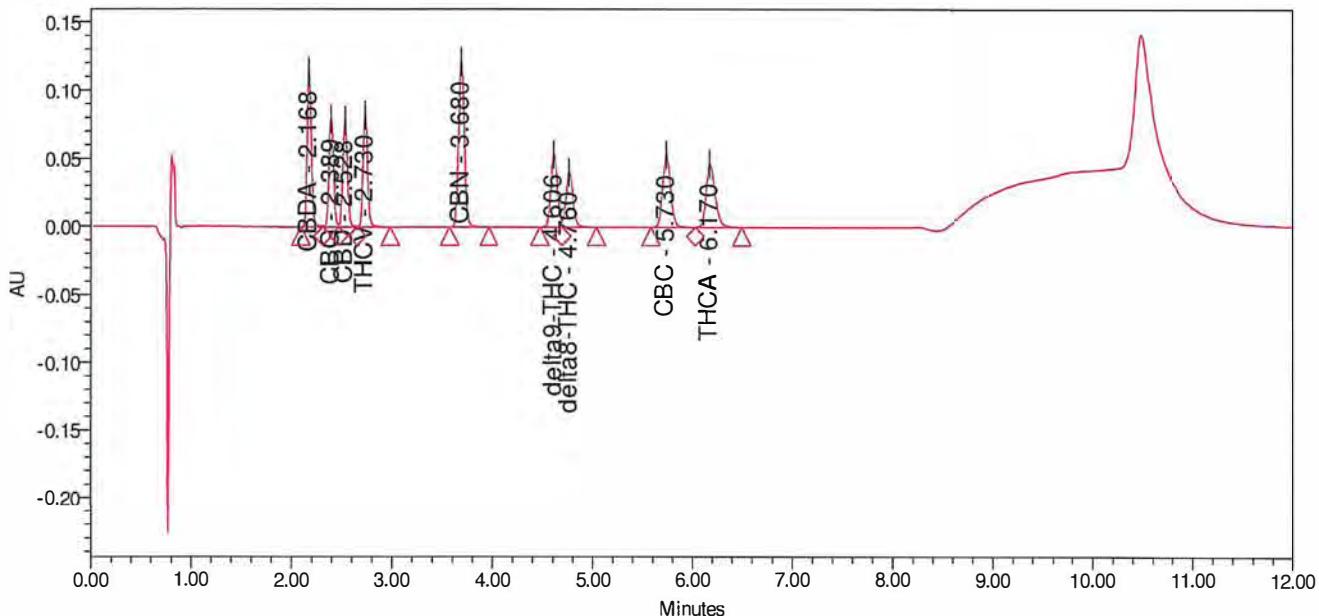
3/24/2022

10:42:01 AM US/Pacific

SAMPLE INFORMATION

Sample Name:	ICV_10ppm	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	
Vial:	9	Acq. Method Set:	Cannabinoids_20220323_Day4
Injection #:	1	Processing Method:	Cannabinoids_20220323_Day4
Injection Volume:	3.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm
Date Acquired:	3/24/2022 2:46:41 AM PDT		
Date Processed:	3/24/2022 2:58:45 AM PDT		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.168	329123	114222	9.774	ppm
2	CBG	2.389	254630	79428	9.496	ppm
3	CBD	2.528	256106	78512	9.443	ppm
4	THCV	2.730	260495	82319	9.830	ppm
5	CBN	3.680	482426	121860	9.286	ppm
6	delta9-THC	4.606	244516	53215	9.763	ppm
7	delta8-THC	4.760	198079	40529	9.790	ppm
8	CBC	5.730	295901	52921	9.868	ppm
9	THCA	6.170	297441	46536	9.671	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 8 of 22

Project Name: 2021\Method Development Miao

Date Printed:

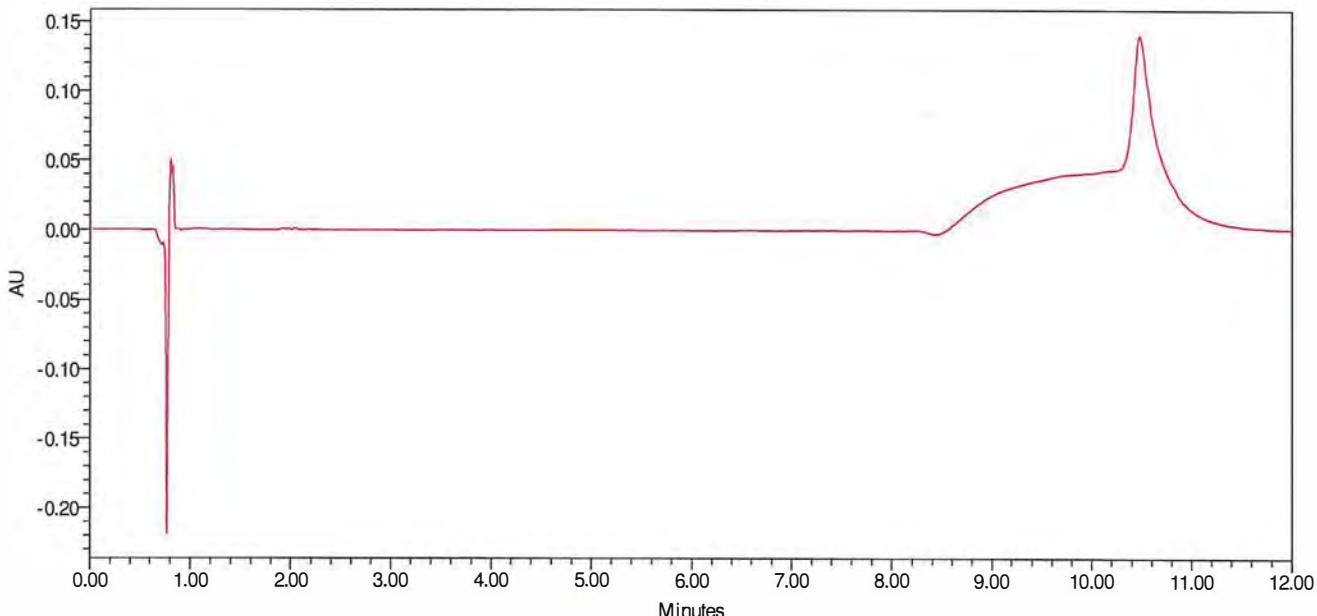
3/24/2022

10:42:01 AM US/Pacific

SAMPLE INFORMATION

Sample Name:	MethBlk_1x	Acquired By:	System
Sample Type:	Control	Sample Set Name:	
Vial:	10	Acq. Method Set:	Cannabinoids_20220323_Day4
Injection #:	1	Processing Method:	Cannabinoids_20220323_Day4
Injection Volume:	3.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm
Date Acquired:	3/24/2022 2:59:18 AM PDT		
Date Processed:	3/24/2022 3:11:20 AM PDT		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.158				
2	CBG	2.369				
3	CBD	2.506				
4	THCV	2.706				
5	CBN	3.633				
6	delta9-THC	4.546				
7	delta8-THC	4.694				
8	CBC	5.636				
9	THCA	6.131				

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 9 of 22

Project Name: 2021\Method Development Miao

Date Printed:

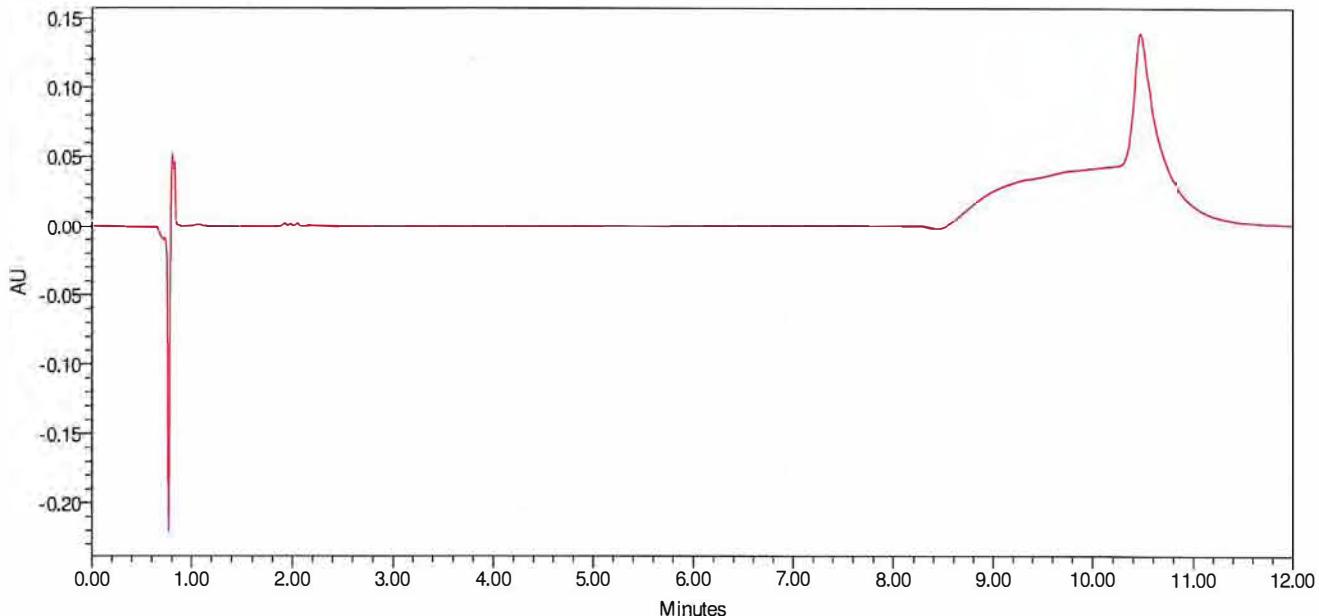
3/24/2022

10:42:01 AM US/Pacific

SAMPLE INFORMATION

Sample Name:	MatrixBlk_1x	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	
Vial:	11	Acq. Method Set:	Cannabinoids_20220323_Day4
Injection #:	1	Processing Method:	Cannabinoids_20220323_Day4
Injection Volume:	3.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm
Date Acquired:	3/24/2022 3:11:53 AM PDT		
Date Processed:	3/24/2022 3:23:58 AM PDT		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.158				
2	CBG	2.369				
3	CBD	2.506				
4	THCV	2.706				
5	CBN	3.633				
6	delta9-THC	4.546				
7	delta8-THC	4.694				
8	CBC	5.636				
9	THCA	6.131				

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 10 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

10:42:01 AM US/Pacific

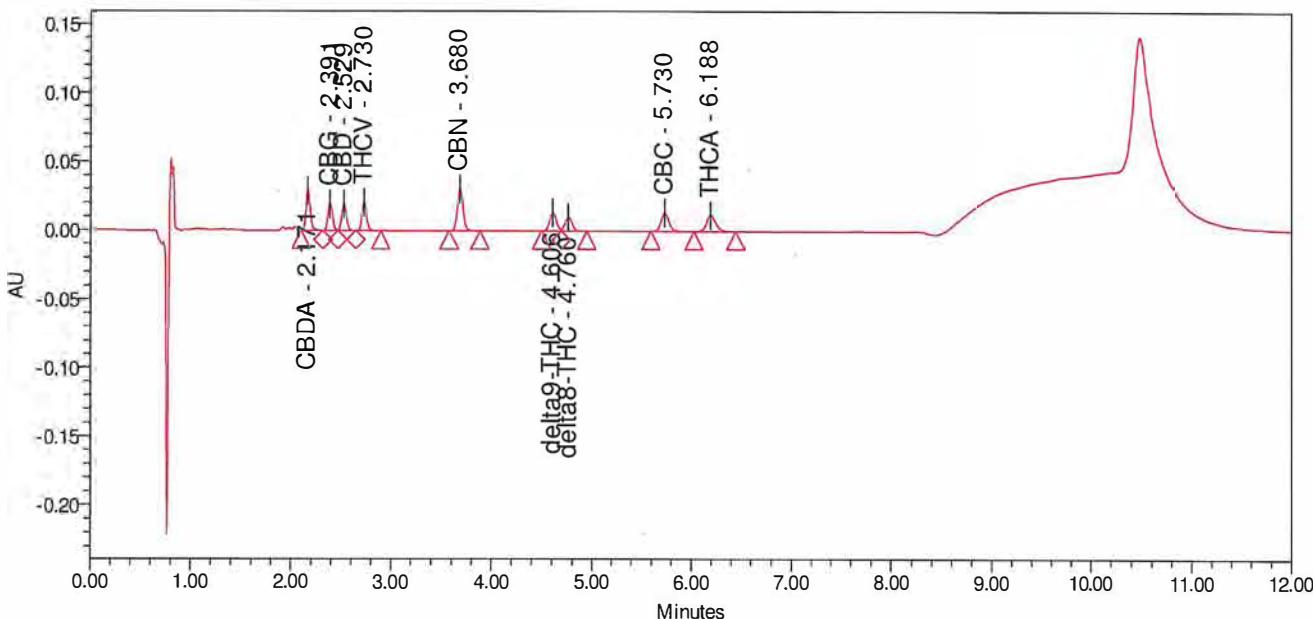
SAMPLE INFORMATION

Sample Name: MS_1x
 Sample Type: Unknown
 Vial: 12
 Injection #: 1
 Injection Volume: 3.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name
 Acq. Method Set: Cannabinoids_20220323_Day4
 Processing Method: Cannabinoids_20220323_Day4
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/24/2022 3:24:33 AM PDT
 Date Processed: 3/24/2022 3:36:37 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.171	86688	29053	2.582	ppm
2	CBG	2.391	63190	19366	2.398	ppm
3	CBD	2.529	63555	19259	2.377	ppm
4	THCV	2.730	65878	20515	2.522	ppm
5	CBN	3.680	120554	30180	2.364	ppm
6	delta ⁹ -THC	4.606	61021	13143	2.475	ppm
7	delta ⁸ -THC	4.760	48815	10061	2.446	ppm
8	CBC	5.730	75176	13211	2.556	ppm
9	THCA	6.188	74855	11511	2.420	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 11 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

10:42:01 AM US/Pacific

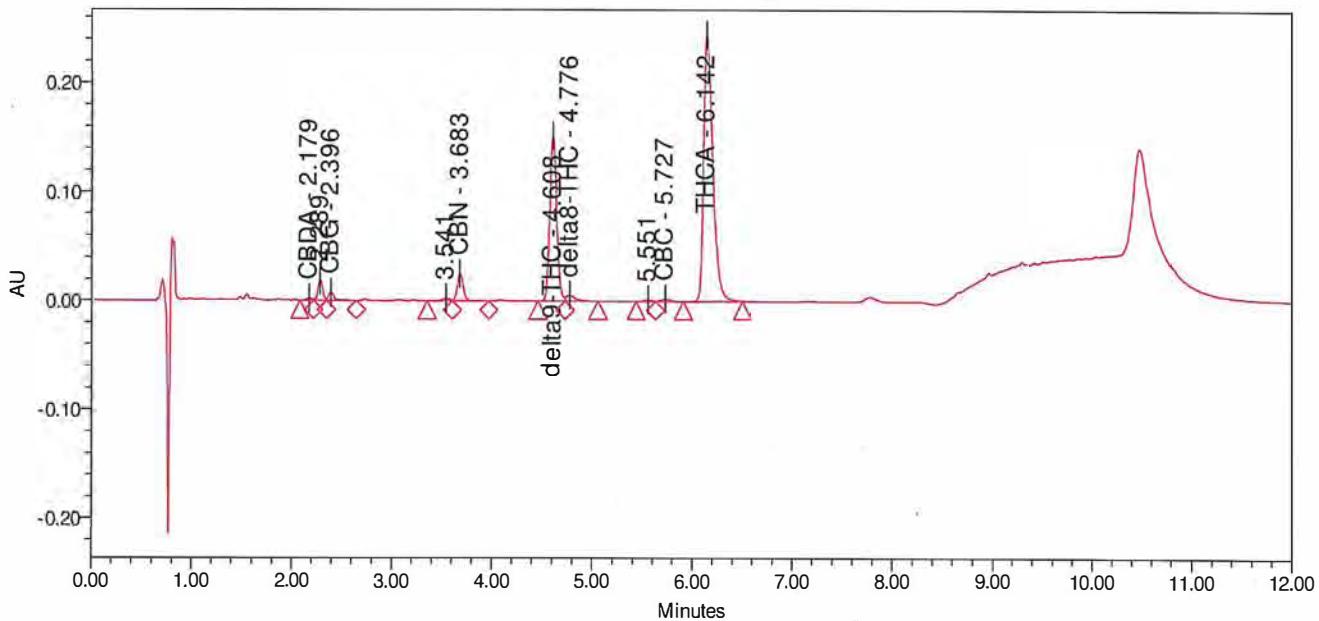
SAMPLE INFORMATION

Sample Name: F4-1_10x
 Sample Type: Unknown
 Vial: 13
 Injection #: 1
 Injection Volume: 3.00 μ l
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name
 Acq. Method Set: Cannabinoids_20220323_Day4
 Processing Method: Cannabinoids_20220323_Day4
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/24/2022 3:37:09 AM PDT
 Date Processed: 3/24/2022 10:18:43 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.179	7703	2185	0.239	ppm
2	CBG	2.396	30017	7346	1.168	ppm
3	CBD	2.506				
4	THCV	2.706				
5	CBN	3.683	102781	24920	2.024	ppm
6	delta9-THC	4.608	715320	152137	28.461	ppm
7	delta8-THC	4.776	31847	5255	1.611	ppm
8	CBC	5.727	14659	2251	0.551	ppm
9	THCA	6.142	1558785	244409	50.758	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 12 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

10:42:01 AM US/Pacific

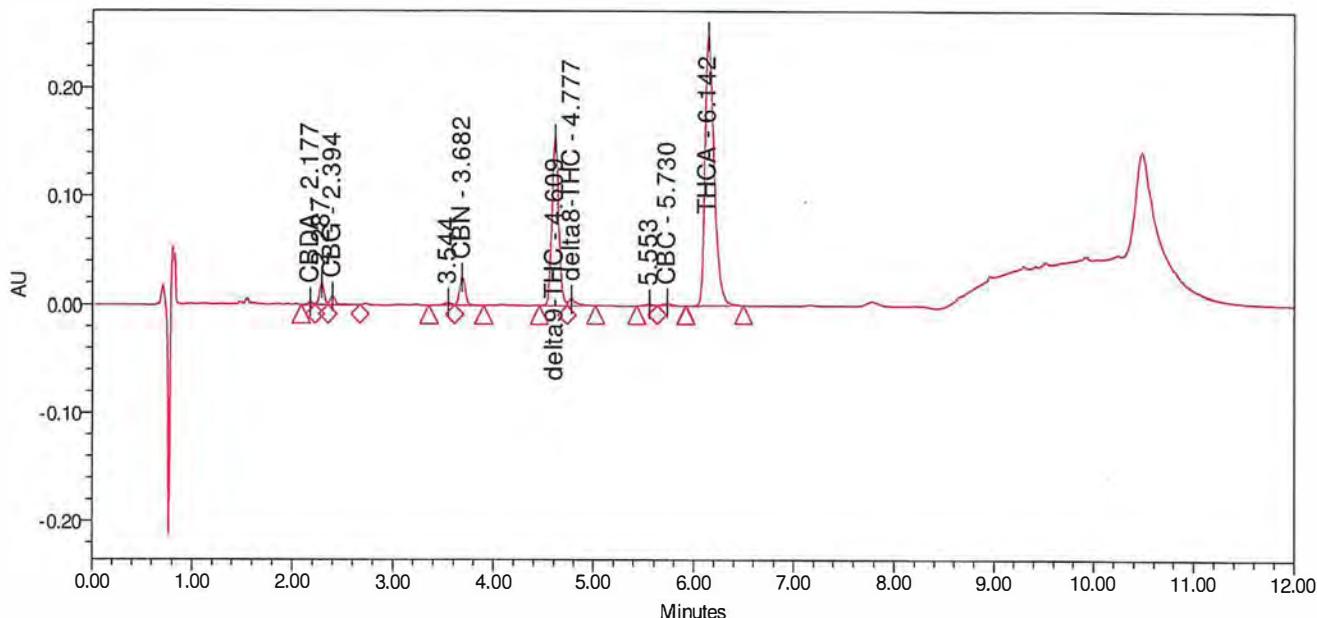
SAMPLE INFORMATION

Sample Name: F4-2_10x
 Sample Type: Unknown
 Vial: 14
 Injection #: 1
 Injection Volume: 3.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name
 Acq. Method Set: Cannabinoids_20220323_Day4
 Processing Method: Cannabinoids_20220323_Day4
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/24/2022 3:49:48 AM PDT
 Date Processed: 3/24/2022 10:36:10 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.177	7783	2162	0.241	ppm
2	CBG	2.394	31639	7377	1.228	ppm
3	CBD	2.506				
4	THCV	2.706				
5	CBN	3.682	100109	24859	1.973	ppm
6	delta9-THC	4.609	723268	153575	28.777	ppm
7	delta8-THC	4.777	32866	5395	1.661	ppm
8	CBC	5.730	13714	2153	0.520	ppm
9	THCA	6.142	1582469	248488	51.529	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 13 of 22

Project Name: 2021\Method Development Miao

Date Printed:

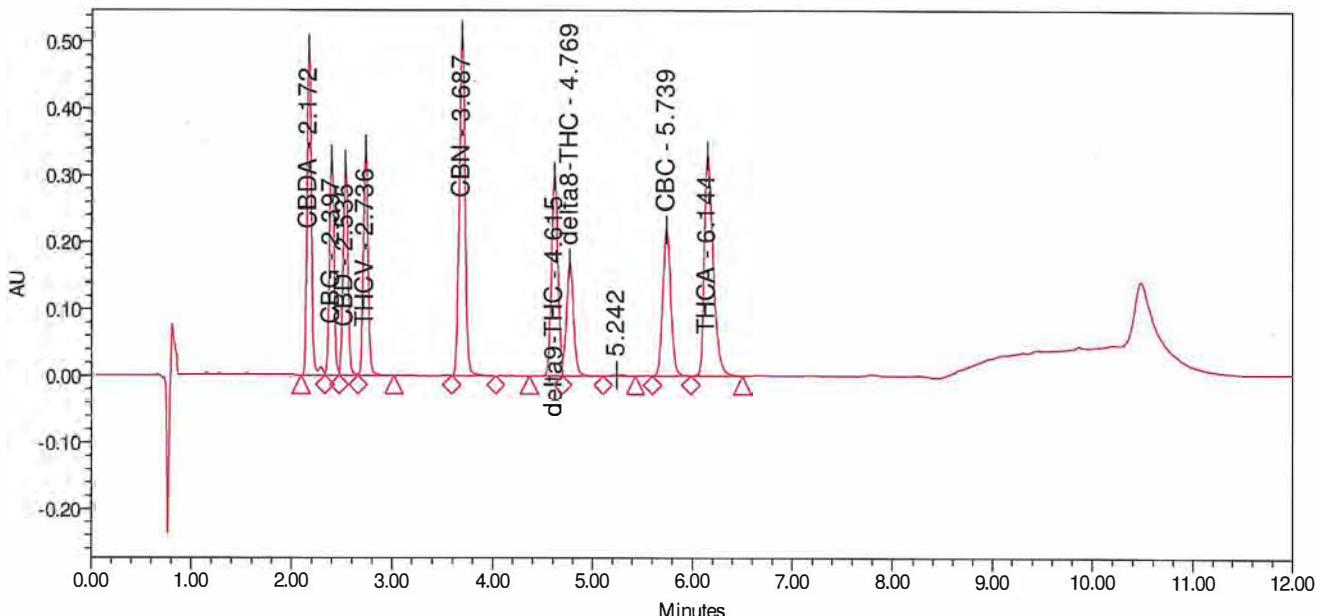
3/24/2022

10:42:01 AM US/Pacific

SAMPLE INFORMATION

Sample Name:	F4-2_PDS_20x	Acquired By:	System
Sample Type:	Unknown	Sample Set Name	
Vial:	15	Acq. Method Set:	Cannabinoids_20220323_Day4
Injection #:	1	Processing Method	Cannabinoids_20220323_Day4
Injection Volume:	3.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm
Date Acquired:	3/24/2022 4:03:48 AM PDT		
Date Processed:	3/24/2022 4:15:52 AM PDT		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.172	1423698	491285	42.244	ppm
2	CBG	2.397	1058988	324941	39.318	ppm
3	CBD	2.535	1063650	316929	39.078	ppm
4	THCV	2.736	1096656	340153	41.233	ppm
5	CBN	3.687	2051918	510885	39.310	ppm
6	delta9-THC	4.615	1388061	299162	55.179	ppm
7	delta8-THC	4.769	845341	169992	41.639	ppm
8	CBC	5.739	1234650	219471	40.966	ppm
9	THCA	6.144	2081356	329786	67.780	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 14 of 22

Project Name: 2021\Method Development Miao

Date Printed:

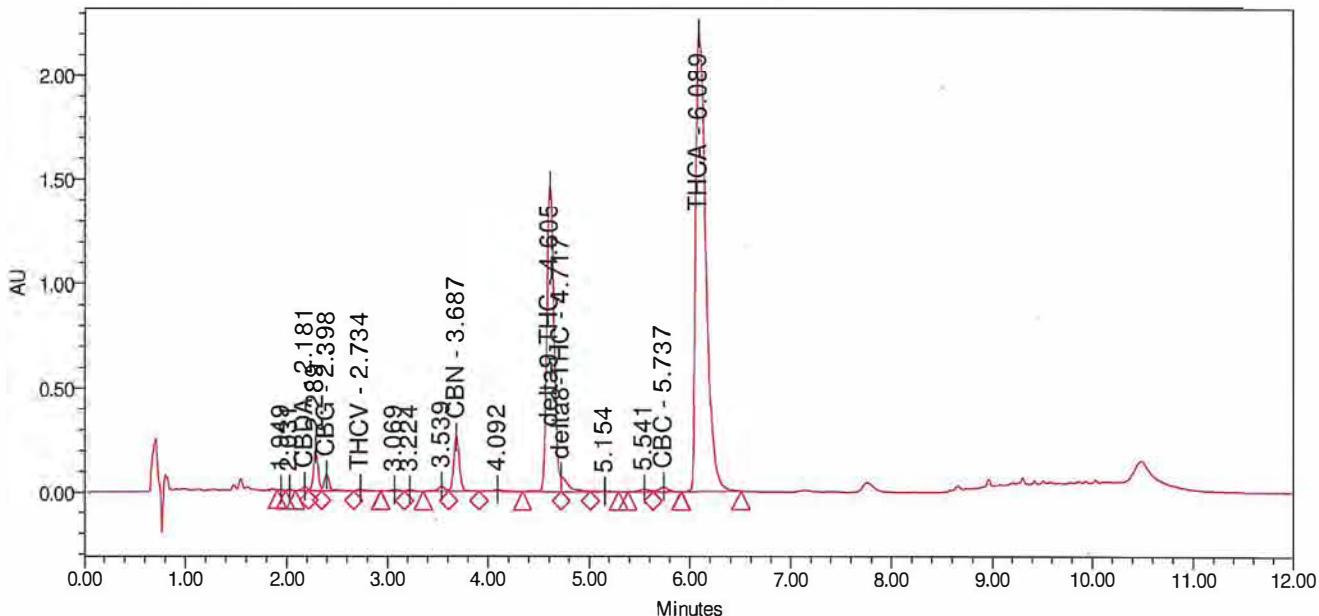
3/24/2022

10:42:01 AM US/Pacific

SAMPLE INFORMATION

Sample Name:	F4-1_1x	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	
Vial:	16	Acq. Method Set:	Cannabinoids_20220323_Day4
Injection #:	1	Processing Method:	Cannabinoids_20220323_Day4
Injection Volume:	3.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm
Date Acquired:	3/24/2022 4:41:55 AM PDT		
Date Processed:	3/24/2022 10:20:51 AM PDT		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.181	76305	21836	2.274	ppm
2	CBG	2.398	312098	78264	11.627	ppm
3	CBD	2.506				
4	THCV	2.734	57249	12784	2.197	ppm
5	CBN	3.687	1048423	261329	20.114	ppm
6	delta9-THC	4.605	7222989	1472327	286.917	ppm
7	delta8-THC	4.717	350523	70071	17.291	ppm
8	CBC	5.737	138457	22734	4.652	ppm
9	THCA	6.089	15392500	2203737	501.376	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 15 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

10:42:01 AM US/Pacific

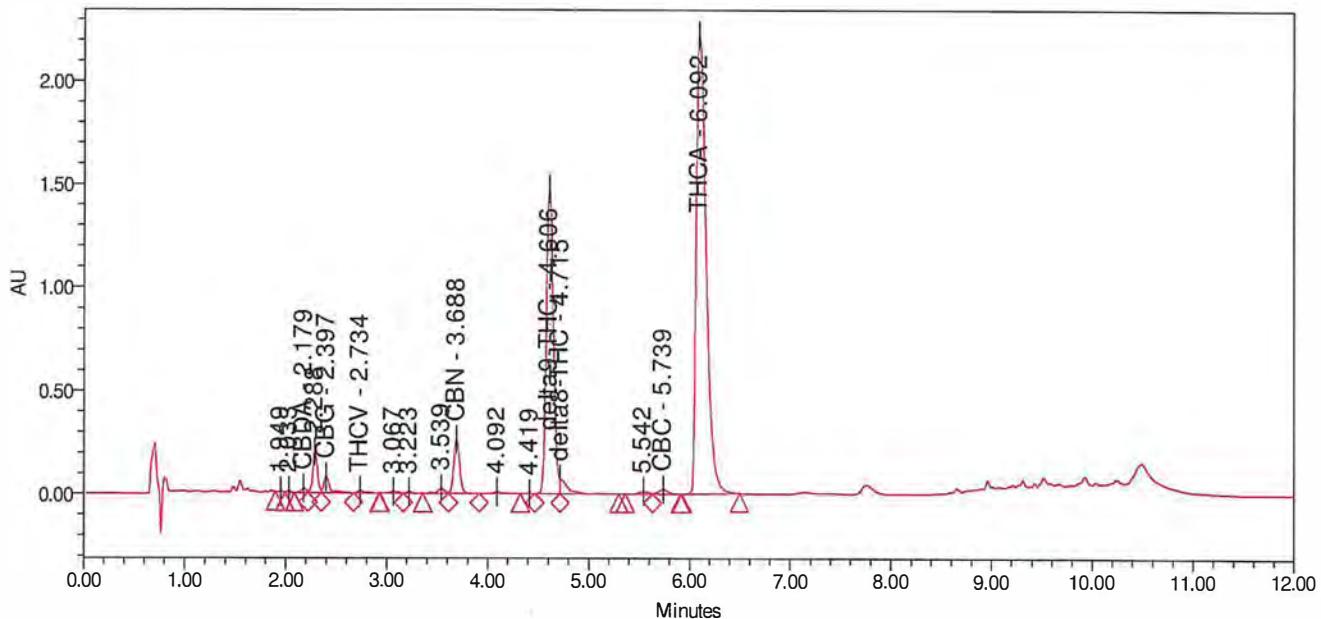
SAMPLE INFORMATION

Sample Name: F4-2_1x
 Sample Type: Unknown
 Vial: 17
 Injection #: 1
 Injection Volume: 3.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name
 Acq. Method Set: Cannabinoids_20220323_Day4
 Processing Method: Cannabinoids_20220323_Day4
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/24/2022 4:54:33 AM PDT
 Date Processed: 3/24/2022 10:21:43 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.179	79890	22595	2.380	ppm
2	CBG	2.397	320396	78833	11.934	ppm
3	CBD	2.506				
4	THCV	2.734	60815	13113	2.331	ppm
5	CBN	3.688	1049717	261419	20.138	ppm
6	delta9-THC	4.606	7235195	1480063	287.402	ppm
7	delta8-THC	4.715	386466	72467	19.060	ppm
8	CBC	5.739	139281	22824	4.680	ppm
9	THCA	6.092	15513720	2224576	505.325	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 16 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

10:42:01 AM US/Pacific

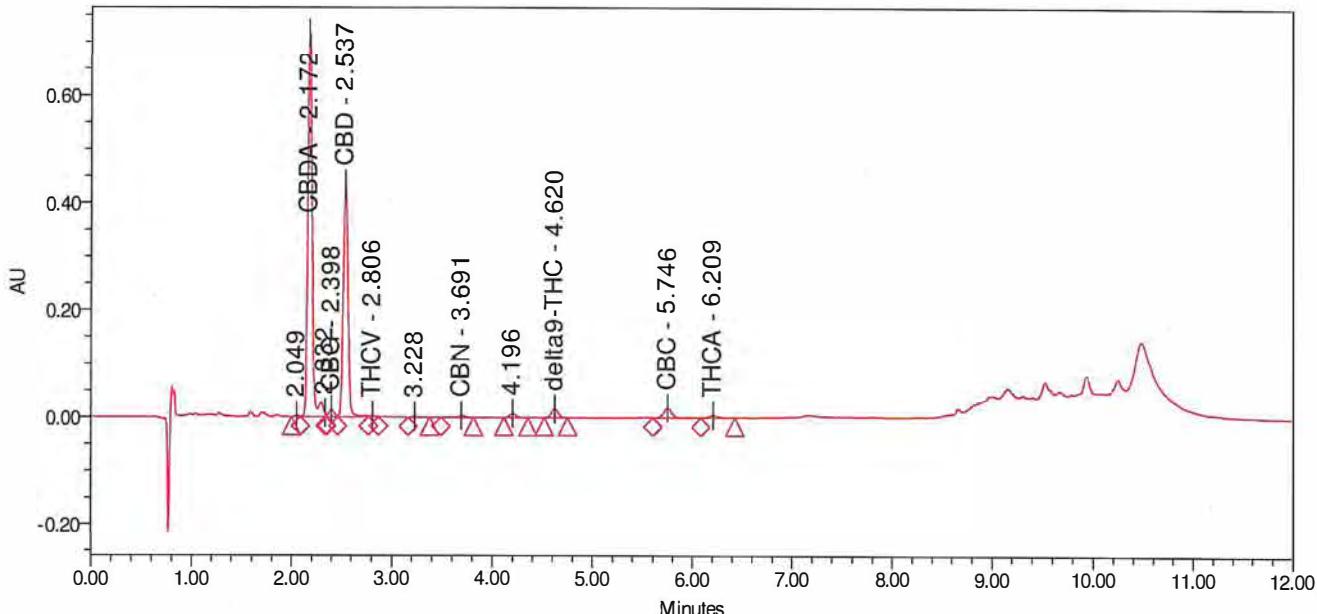
SAMPLE INFORMATION

Sample Name: HM1_5x
 Sample Type: Unknown
 Vial: 18
 Injection #: 1
 Injection Volume: 3.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name
 Acq. Method Set: Cannabinoids_20220323_Day4
 Processing Method: Cannabinoids_20220323_Day4
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/24/2022 5:07:09 AM PDT
 Date Processed: 3/24/2022 10:22:51 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.172	2187711	718044	64.909	ppm
2	CBG	2.398	49470	13220	1.889	ppm
3	CBD	2.537	1471232	434944	54.036	ppm
4	THCV	2.806	9076	1831	0.388	ppm
5	CBN	3.691	16306	3193	0.370	ppm
6	delta9-THC	4.620	74948	16068	3.028	ppm
7	delta8-THC	4.694				
8	CBC	5.746	109719	18065	3.700	ppm
9	THCA	6.209	28949	4337	0.925	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 17 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

10:42:01 AM US/Pacific

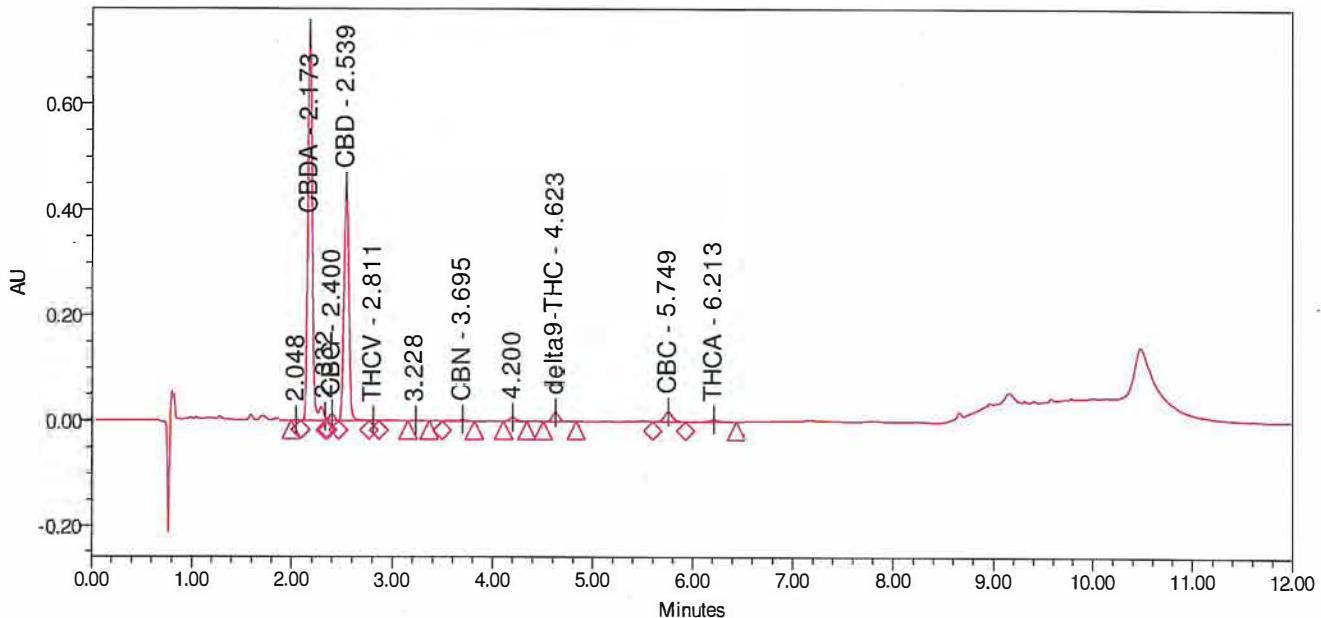
SAMPLE INFORMATION

Sample Name: HM2_5x
 Sample Type: Unknown
 Vial: 19
 Injection #: 1
 Injection Volume: 3.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name
 Acq. Method Set: Cannabinoids_20220323_Day4
 Processing Method: Cannabinoids_20220323_Day4
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/24/2022 5:19:45 AM PDT
 Date Processed: 3/24/2022 10:23:08 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.173	2235085	734681	66.314	ppm
2	CBG	2.400	46083	12912	1.764	ppm
3	CBD	2.539	1505075	446044	55.278	ppm
4	THCV	2.811	6274	1394	0.283	ppm
5	CBN	3.695	16281	3209	0.369	ppm
6	delta9-THC	4.623	77619	16517	3.134	ppm
7	delta8-THC	4.694				
8	CBC	5.749	105917	18458	3.574	ppm
9	THCA	6.213	29749	4449	0.951	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 18 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

10:42:01 AM US/Pacific

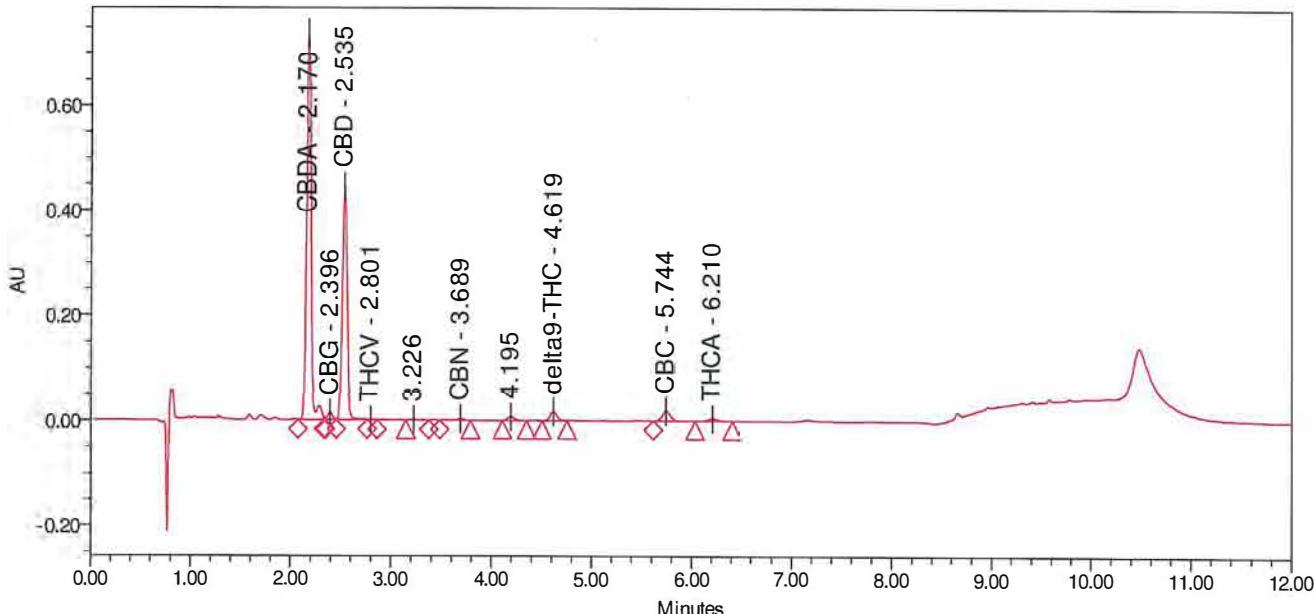
SAMPLE INFORMATION

Sample Name: HM3_5x
 Sample Type: Unknown
 Vial: 20
 Injection #: 1
 Injection Volume: 3.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name
 Acq. Method Set: Cannabinoids_20220323_Day4
 Processing Method: Cannabinoids_20220323_Day4
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/24/2022 5:32:21 AM PDT
 Date Processed: 3/24/2022 10:23:13 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.170	2265031	740384	67.203	ppm
2	CBG	2.396	46817	12910	1.791	ppm
3	CBD	2.535	1515072	446427	55.645	ppm
4	THCV	2.801	6449	1382	0.290	ppm
5	CBN	3.689	17994	3393	0.402	ppm
6	delta9-THC	4.619	78677	16765	3.176	ppm
7	delta8-THC	4.694				
8	CBC	5.744	108380	18554	3.656	ppm
9	THCA	6.210	28883	4434	0.923	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 19 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

10:42:01 AM US/Pacific

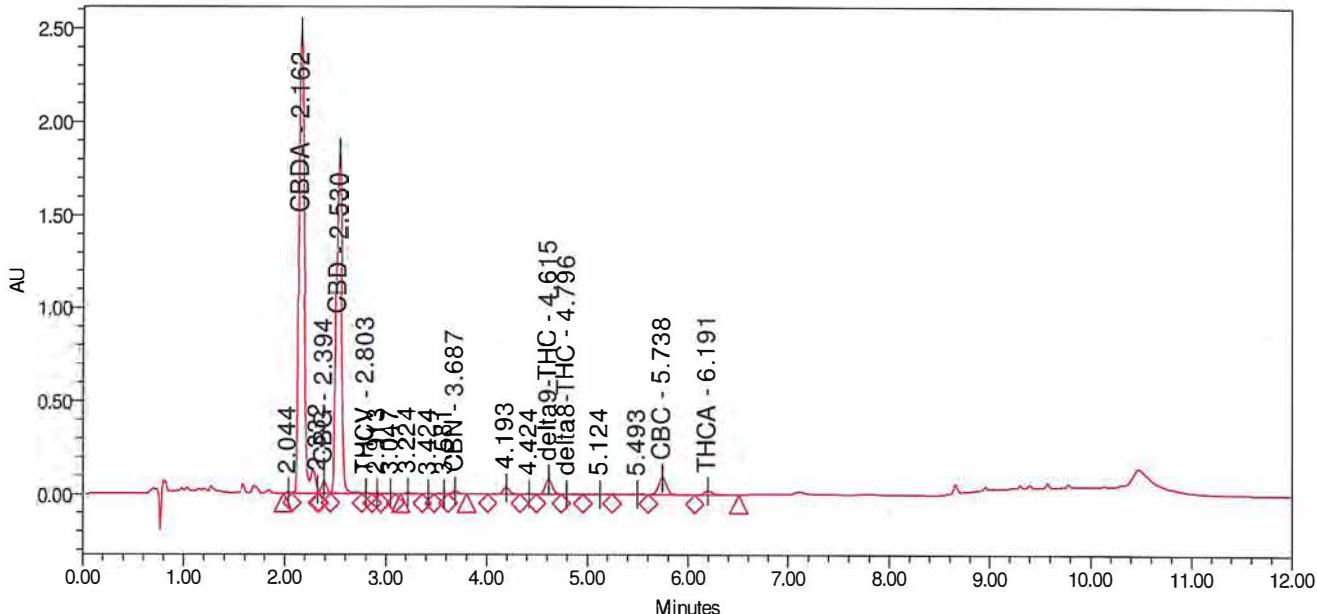
SAMPLE INFORMATION

Sample Name: HM1_1x
 Sample Type: Unknown
 Vial: 21
 Injection #: 1
 Injection Volume: 3.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name
 Acq. Method Set: Cannabinoids_20220323_Day4
 Processing Method: Cannabinoids_20220323_Day4
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/24/2022 5:44:56 AM PDT
 Date Processed: 3/24/2022 10:24:50 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.162	9133340	2479175	270.952	ppm
2	CBG	2.394	221616	61707	8.272	ppm
3	CBD	2.530	6759357	1835326	248.100	ppm
4	THCV	2.803	28800	6363	1.129	ppm
5	CBN	3.687	66394	16044	1.328	ppm
6	delta9-THC	4.615	387606	81013	15.446	ppm
7	delta8-THC	4.796	12407	1654	0.654	ppm
8	CBC	5.738	524642	89468	17.446	ppm
9	THCA	6.191	138788	21662	4.503	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 20 of 22

Project Name: 2021\Method Development Miao

Date Printed:

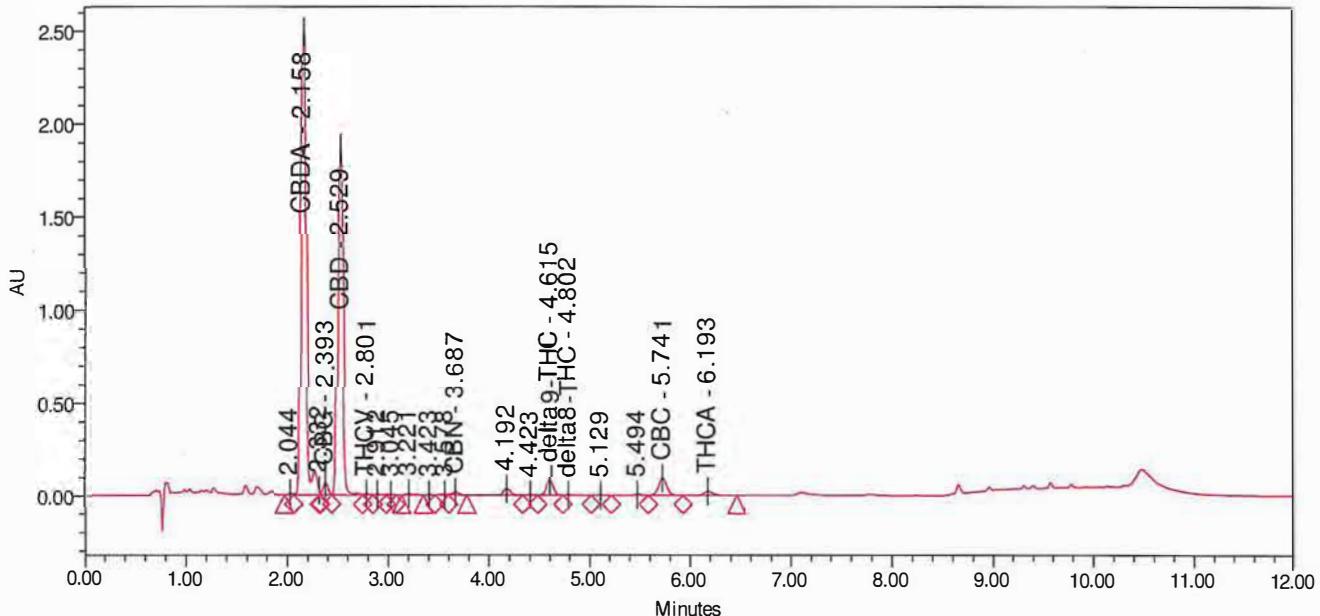
3/24/2022

10:42:01 AM US/Pacific

SAMPLE INFORMATION

Sample Name:	HM2_1x	Acquired By:	System
Sample Type:	Unknown	Sample Set Name	
Vial:	22	Acq. Method Set:	Cannabinoids_20220323_Day4
Injection #:	1	Processing Method	Cannabinoids_20220323_Day4
Injection Volume:	3.00 μ l	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm
Date Acquired:	3/24/2022 5:57:33 AM PDT		
Date Processed:	3/24/2022 6:09:35 AM PDT		

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.158	9357301	2494066	277.595	ppm
2	CBG	2.393	229435	63944	8.562	ppm
3	CBD	2.529	6976481	1875614	256.068	ppm
4	THCV	2.801	30326	6690	1.186	ppm
5	CBN	3.687	67631	16345	1.351	ppm
6	delta9-THC	4.615	403902	84178	16.093	ppm
7	delta8-THC	4.802	16176	1855	0.840	ppm
8	CBC	5.741	545419	93096	18.134	ppm
9	THCA	6.193	148397	22493	4.816	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 21 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

10:42:01 AM US/Pacific

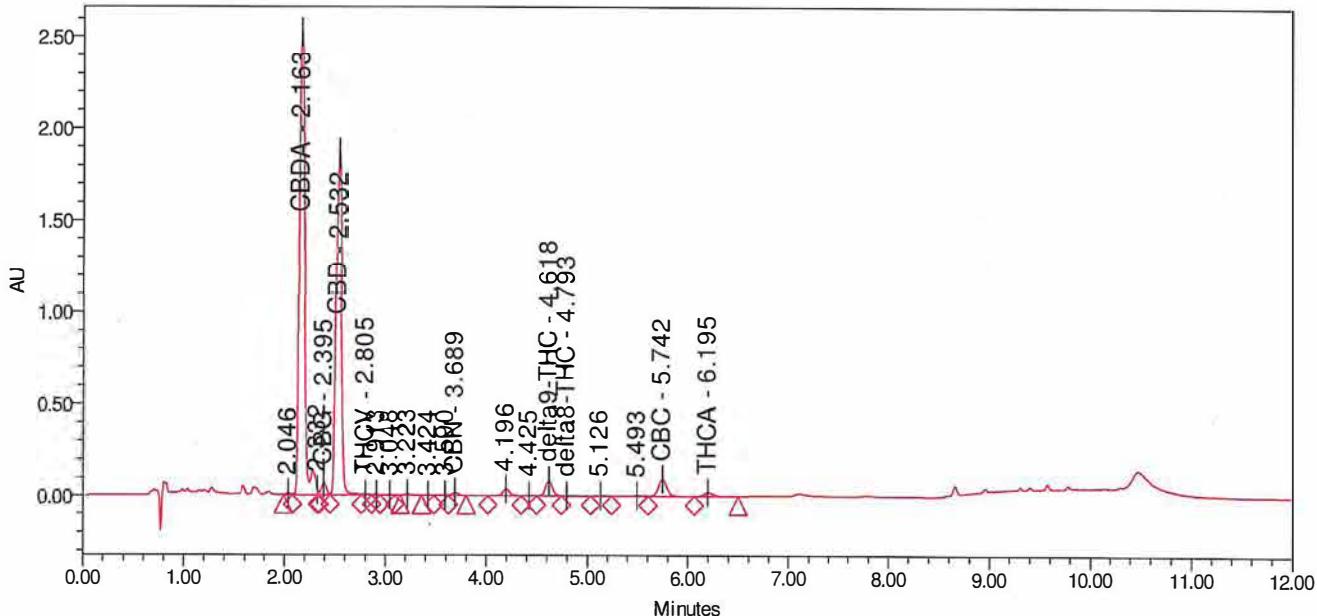
SAMPLE INFORMATION

Sample Name: HM3_1x
 Sample Type: Unknown
 Vial: 23
 Injection #: 1
 Injection Volume: 3.00 ul
 Run Time: 12.0 Minutes

Acquired By: System
 Sample Set Name:
 Acq. Method Set: Cannabinoids_20220323_Day4
 Processing Method: Cannabinoids_20220323_Day4
 Channel Name: PDA Ch1 220nm@4.8nm
 Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/24/2022 6:10:09 AM PDT
 Date Processed: 3/24/2022 10:25:17 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.163	9315478	2525200	276.355	ppm
2	CBG	2.395	228800	64085	8.538	ppm
3	CBD	2.532	6941561	1869377	254.787	ppm
4	THCV	2.805	29455	6525	1.154	ppm
5	CBN	3.689	66864	16129	1.337	ppm
6	delta9-THC	4.618	398905	83148	15.895	ppm
7	delta8-THC	4.793	18023	2009	0.931	ppm
8	CBC	5.742	549531	93450	18.270	ppm
9	THCA	6.195	141083	22041	4.578	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 22 of 22

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

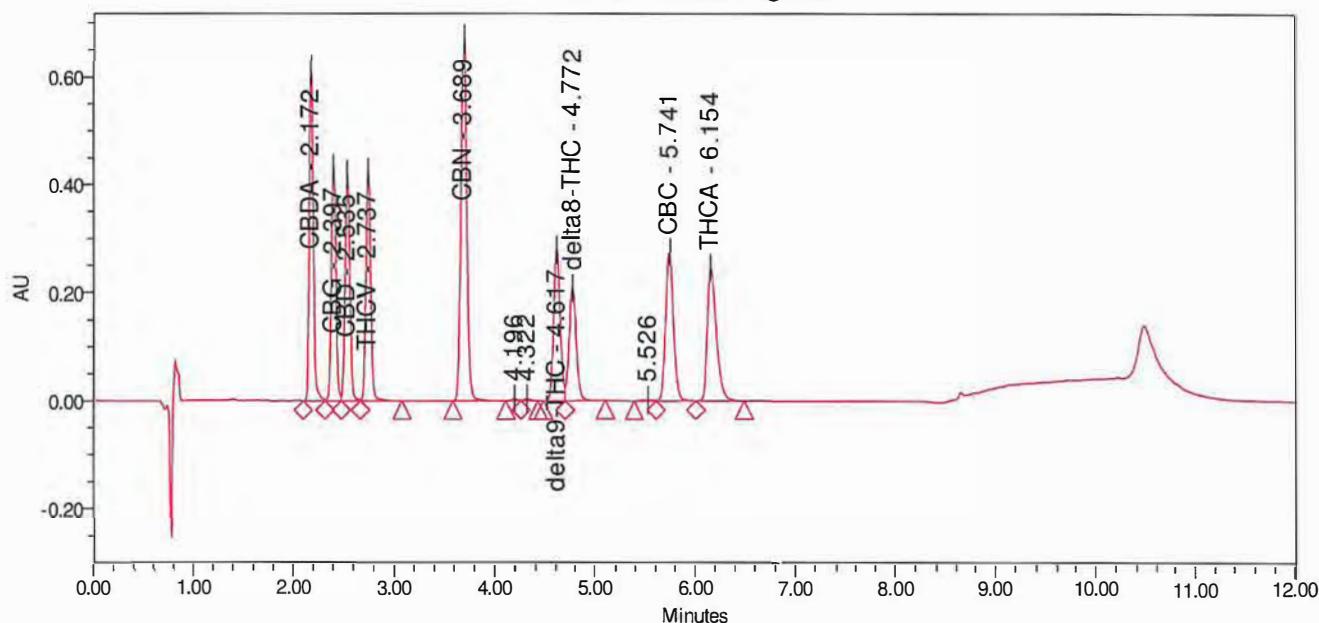
10:42:01 AM US/Pacific

SAMPLE INFORMATION

Sample Name: CCV1_50ppm
Sample Type: Unknown
Vial: 7
Injection #: 1
Injection Volume: 3.00 ul
Run Time: 12.0 Minutes
Acquired By: System
Sample Set Name
Acq. Method Set: Cannabinoids_20220323_Day4
Processing Method: Cannabinoids_20220323_Day4
Channel Name: PDA Ch1 220nm@4.8nm
Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm

Date Acquired: 3/24/2022 4:29:18 AM PDT
Date Processed: 3/24/2022 4:41:22 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.172	1718233	613634	50.982	ppm
2	CBG	2.397	1373831	430396	50.991	ppm
3	CBD	2.535	1383136	418782	50.803	ppm
4	THCV	2.737	1352516	423043	50.842	ppm
5	CBN	3.689	2660826	671090	50.959	ppm
6	delta9-THC	4.617	1279262	278488	50.858	ppm
7	delta8-THC	4.772	1020081	208178	50.237	ppm
8	CBC	5.741	1530012	274731	50.750	ppm
9	THCA	6.154	1551729	245881	50.528	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 1 of 1

Project Name: 2021\Method Development Miao

Date Printed:

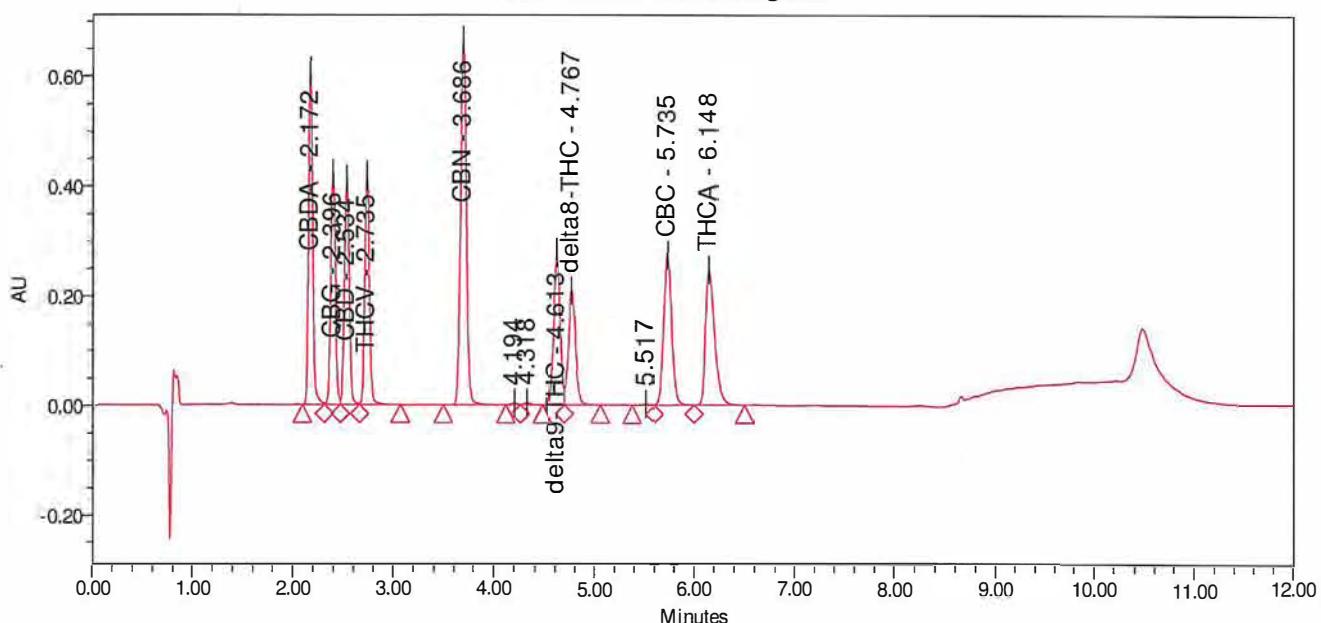
3/24/2022

10:54:08 AM US/Pacific

SAMPLE INFORMATION

Sample Name: CCV2_50ppm
Sample Type: Unknown
Vial: 7
Injection #: 1
Injection Volume: 3.00 ul
Run Time: 12.0 Minutes
Acquired By: System
Sample Set Name: Cannabinoids_20220323_Day4
Acq. Method Set: Cannabinoids_20220323_Day4
Processing Method: Cannabinoids_20220323_Day4
Channel Name: PDA Ch1 220nm@4.8nm
Proc. Chnl. Descr.: PDA Ch1 220nm@4.8nm
Date Acquired: 3/24/2022 6:35:39 AM PDT
Date Processed: 3/24/2022 6:47:42 AM PDT

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.172	1733947	609798	51.448	ppm
2	CBG	2.396	1386896	424243	51.476	ppm
3	CBD	2.534	1397665	413308	51.336	ppm
4	THCV	2.735	1363254	420434	51.245	ppm
5	CBN	3.686	2689840	666574	51.514	ppm
6	delta9-THC	4.613	1291479	278673	51.344	ppm
7	delta8-THC	4.767	1031259	208952	50.787	ppm
8	CBC	5.735	1545055	274353	51.249	ppm
9	THCA	6.148	1566555	247454	51.011	ppm

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 1 of 1

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

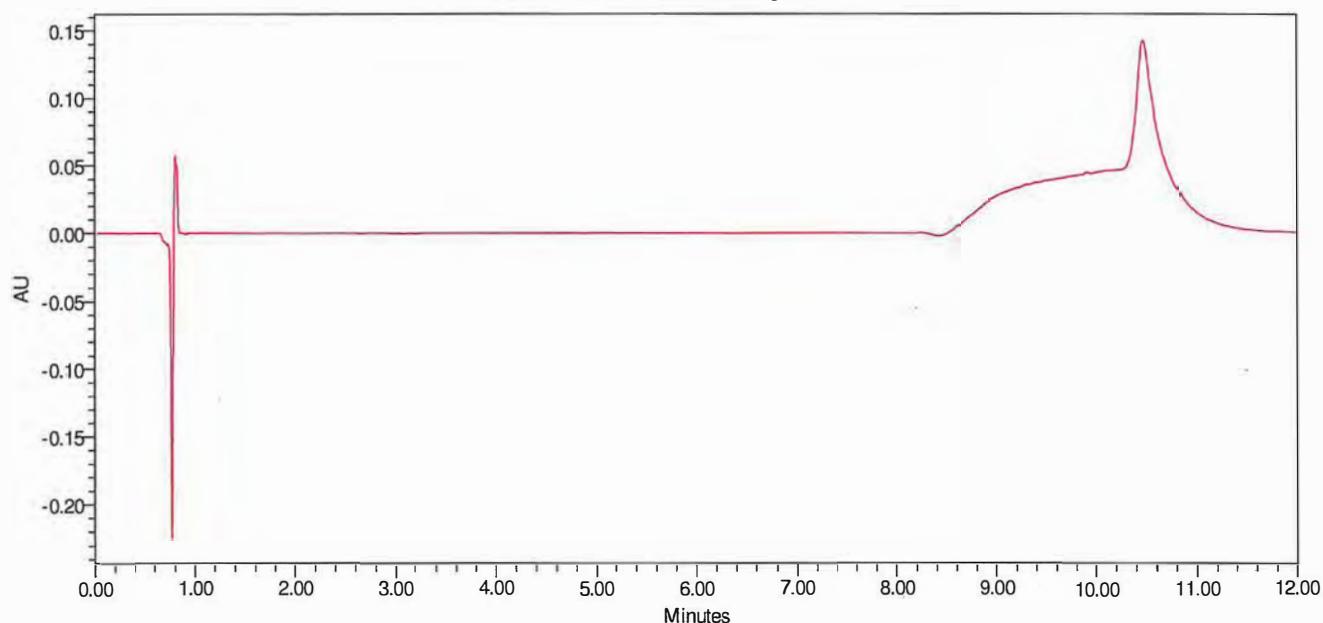
10:54:37 AM US/Pacific

SAMPLE INFORMATION

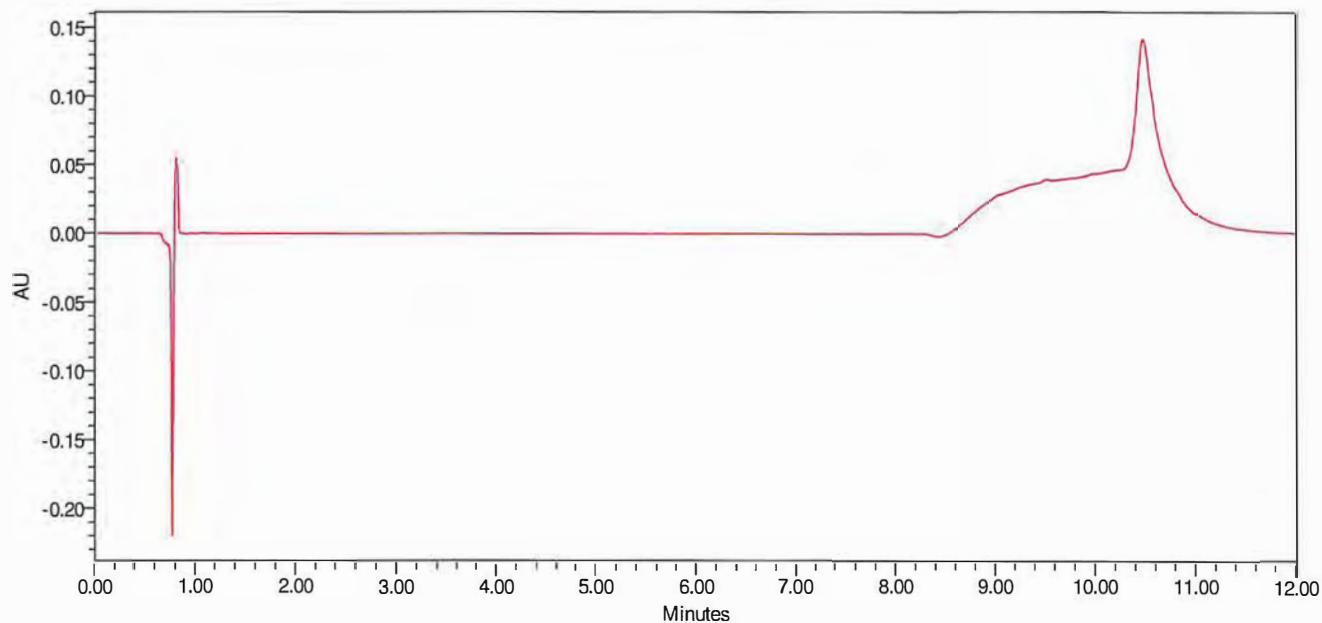
Sample Name:	SolvBlk	Acquired By:	System
Sample Type:	Unknown	Sample Set Name	
Vial:	1	Acq. Method Set:	Cannabinoids_20220323_Day4
Injection #:	1, 2, 3	Processing Method	Cannabinoids_20220323_Day4
Injection Volume:	3.00 ul	Channel Name:	PDA Ch1 220nm@4.8nm
Run Time:	12.0 Minutes	Proc. Chnl. Descr.:	PDA Ch1 220nm@4.8nm

Date Acquired: 3/24/2022 12:27:50 AM PDT, 3/24/2022 12:40:27 AM PDT, 3/24/2022 12:53:01 AM
Date Processed: 3/24/2022 12:39:54 AM PDT, 3/24/2022 12:52:29 AM PDT, 3/24/2022 1:05:05 AM

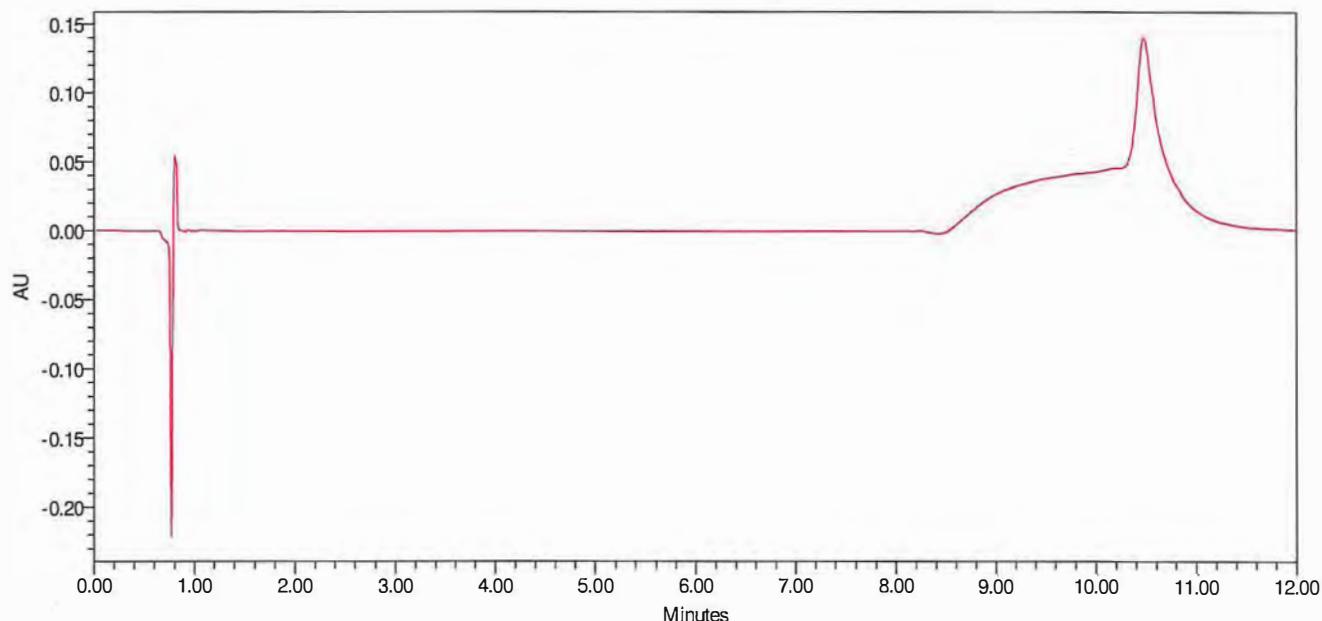
Auto-Scaled Chromatogram



Auto-Scaled Chromatogram



Auto-Scaled Chromatogram



Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 2 of 7

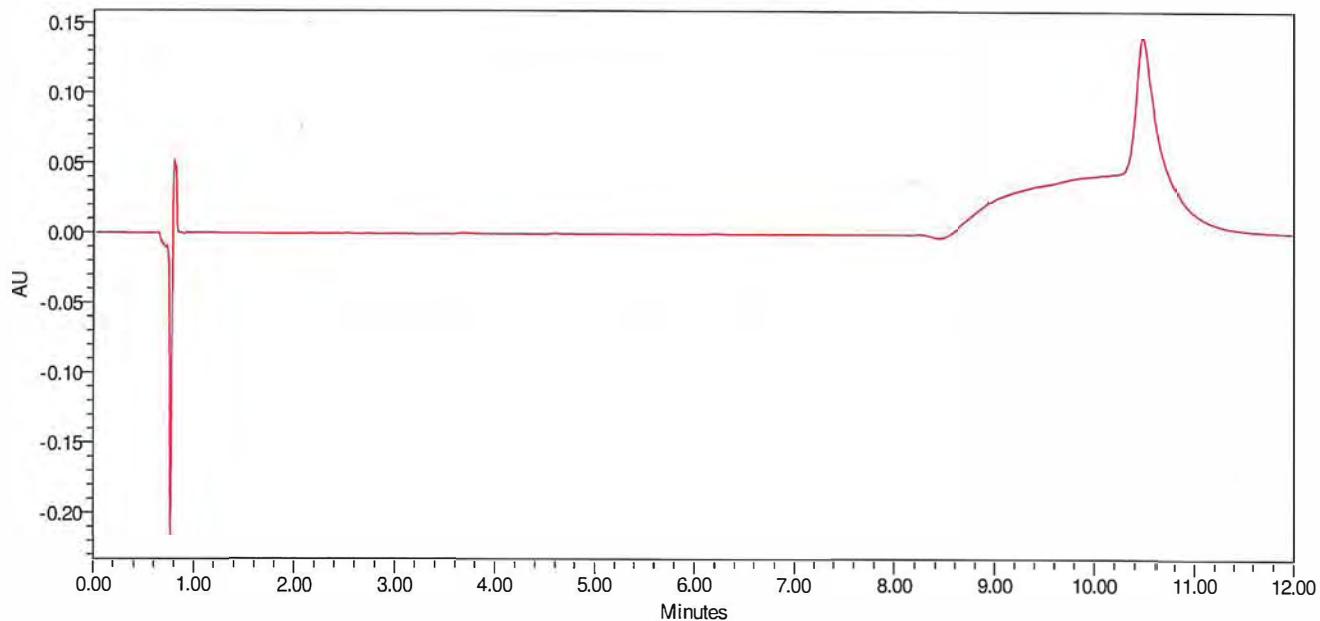
Project Name: 2021\Method Development Miao

Date Printed:

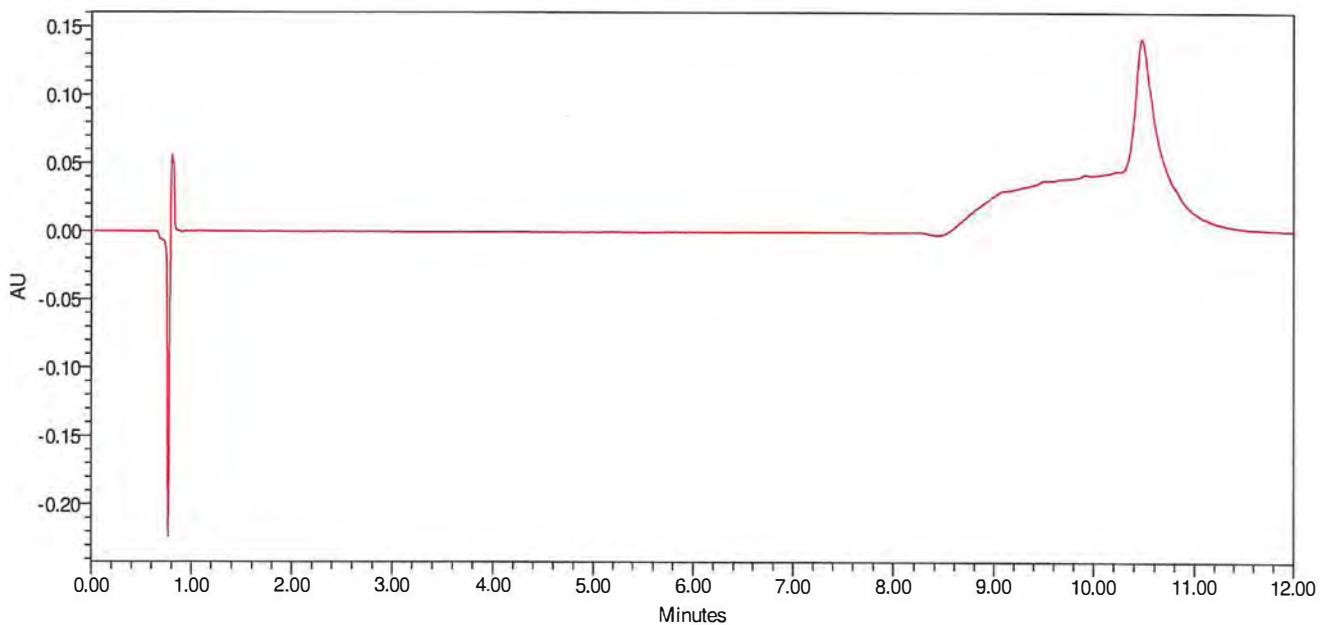
3/24/2022

10:53:36 AM US/Pacific

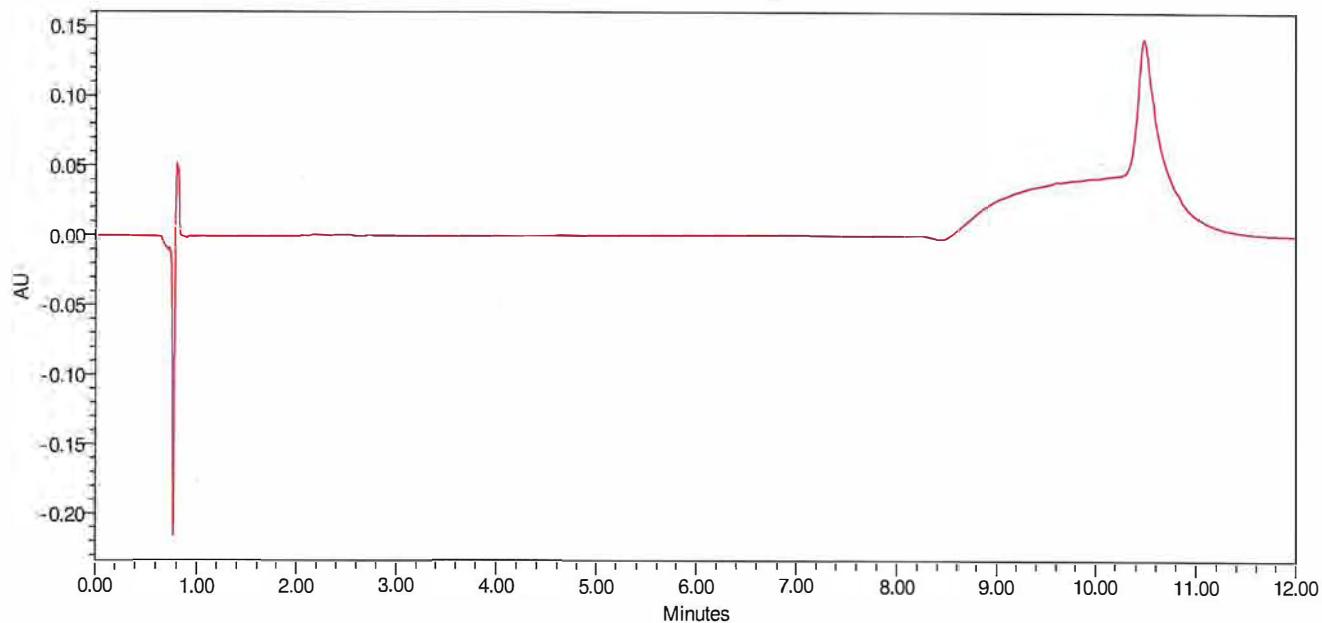
Auto-Scaled Chromatogram



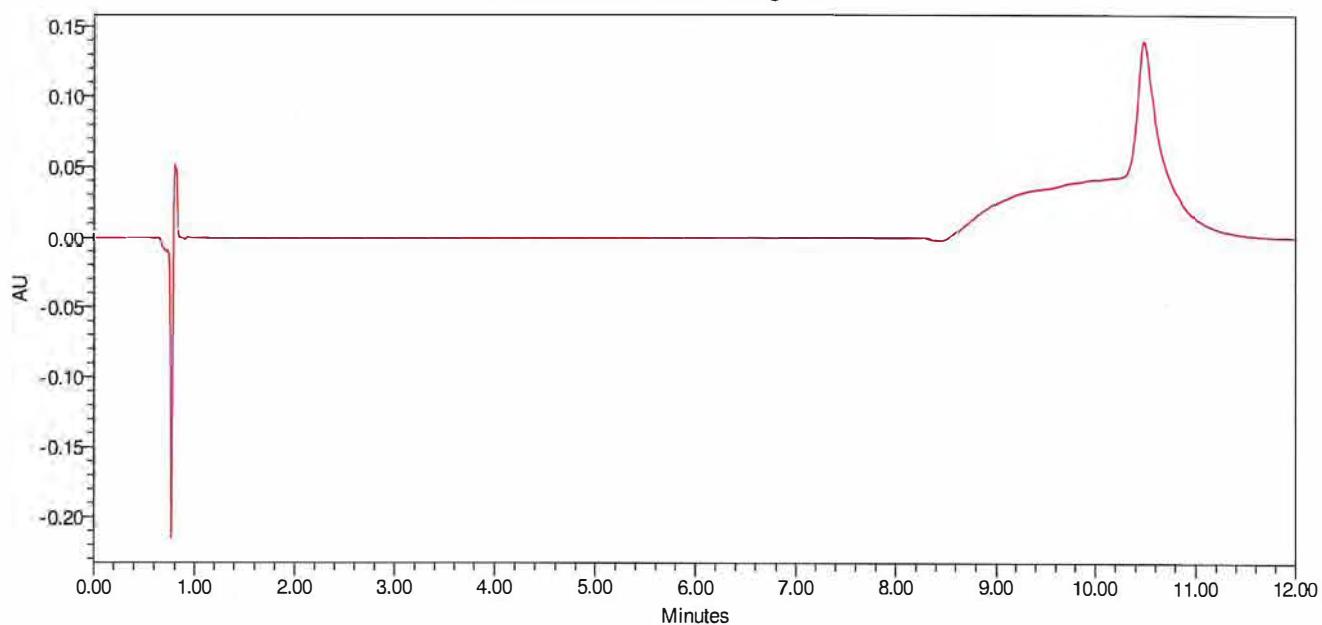
Auto-Scaled Chromatogram



Auto-Scaled Chromatogram



Auto-Scaled Chromatogram



Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 4 of 7

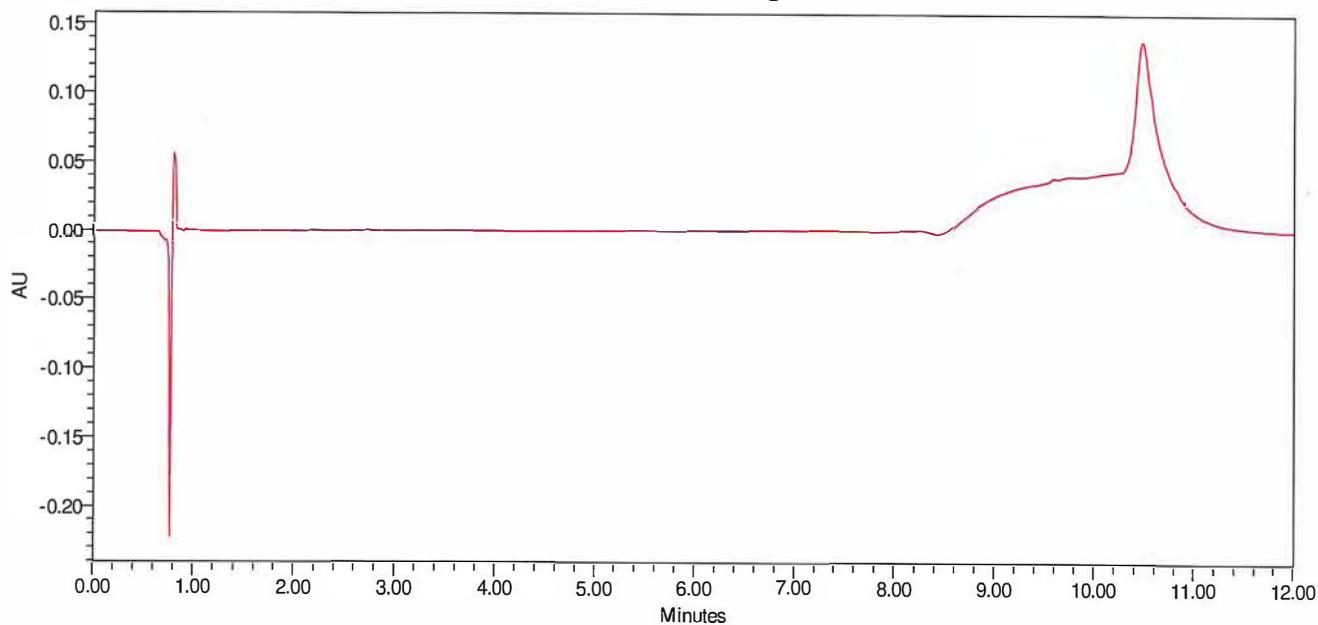
Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

10:53:36 AM US/Pacific

Auto-Scaled Chromatogram



Peak Results

	Name	RT	Area	Height	Amount	Units
1	CBDA	2.158				
2	CBDA	2.158				
3	CBDA	2.158				
4	CBDA	2.158				
5	CBDA	2.158				
6	CBDA	2.158				
7	CBDA	2.158				
8	CBDA	2.158				
9	CBG	2.369				
10	CBG	2.369				
11	CBG	2.369				
12	CBG	2.369				
13	CBG	2.369				
14	CBG	2.369				
15	CBG	2.369				
16	CBG	2.369				
17	CBD	2.506				
18	CBD	2.506				
19	CBD	2.506				
20	CBD	2.506				
21	CBD	2.506				
22	CBD	2.506				
23	CBD	2.506				

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 5 of 7

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

10:53:36 AM US/Pacific

Peak Results

	Name	RT	Area	Height	Amount	Units
24	CBD	2.506				
25	THCV	2.706				
26	THCV	2.706				
27	THCV	2.706				
28	THCV	2.706				
29	THCV	2.706				
30	THCV	2.706				
31	THCV	2.706				
32	THCV	2.706				
33	CBN	3.633				
34	CBN	3.633				
35	CBN	3.633				
36	CBN	3.633				
37	CBN	3.633				
38	CBN	3.633				
39	CBN	3.633				
40	CBN	3.633				
41	delta9-THC	4.546				
42	delta9-THC	4.546				
43	delta9-THC	4.546				
44	delta9-THC	4.546				
45	delta9-THC	4.546				
46	delta9-THC	4.546				
47	delta9-THC	4.546				
48	delta9-THC	4.546				
49	delta8-THC	4.694				
50	delta8-THC	4.694				
51	delta8-THC	4.694				
52	delta8-THC	4.694				
53	delta8-THC	4.694				
54	delta8-THC	4.694				
55	delta8-THC	4.694				
56	delta8-THC	4.694				
57	CBC	5.636				
58	CBC	5.636				
59	CBC	5.636				
60	CBC	5.636				
61	CBC	5.636				
62	CBC	5.636				
63	CBC	5.636				
64	CBC	5.636				

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 6 of 7

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

10:53:36 AM US/Pacific

Peak Results

	Name	RT	Area	Height	Amount	Units
65	THCA	6.131				
66	THCA	6.131				
67	THCA	6.131				
68	THCA	6.131				
69	THCA	6.131				
70	THCA	6.131				
71	THCA	6.131				
72	THCA	6.131				

Reported by User: System

Report Method: Cannabinoids Quan Rep

Report Method ID: 13447

Page: 7 of 7

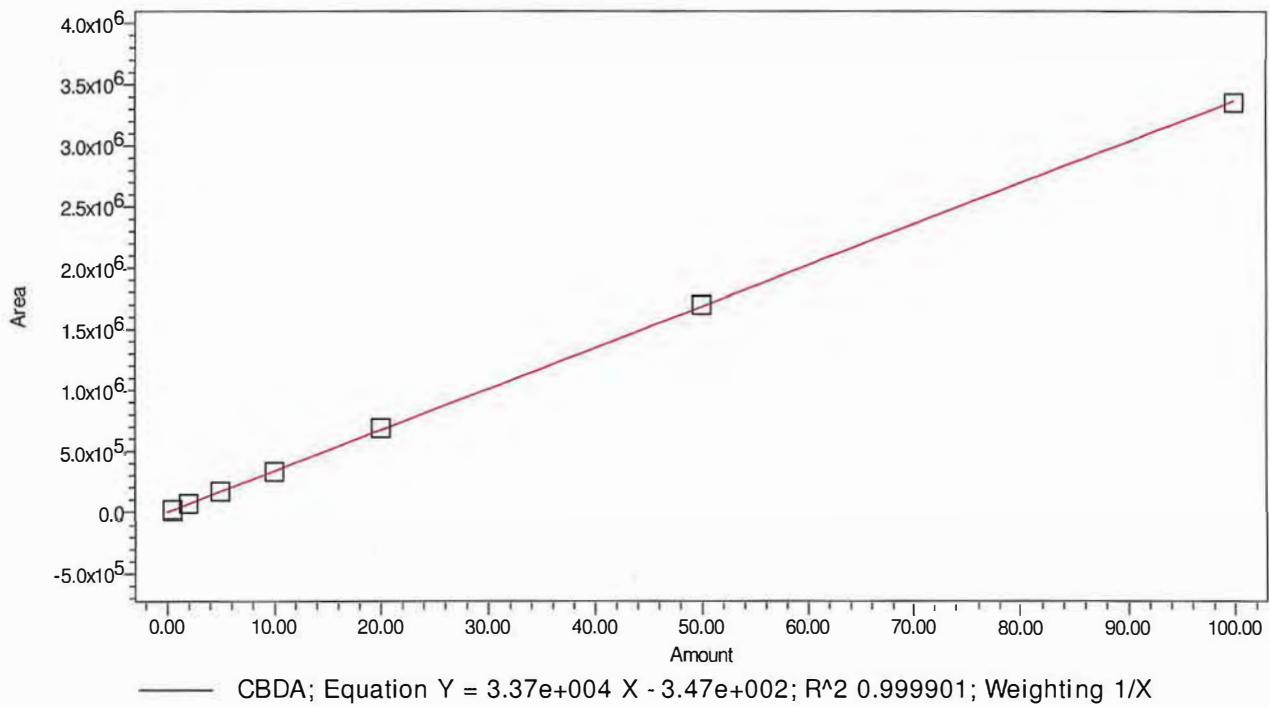
Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

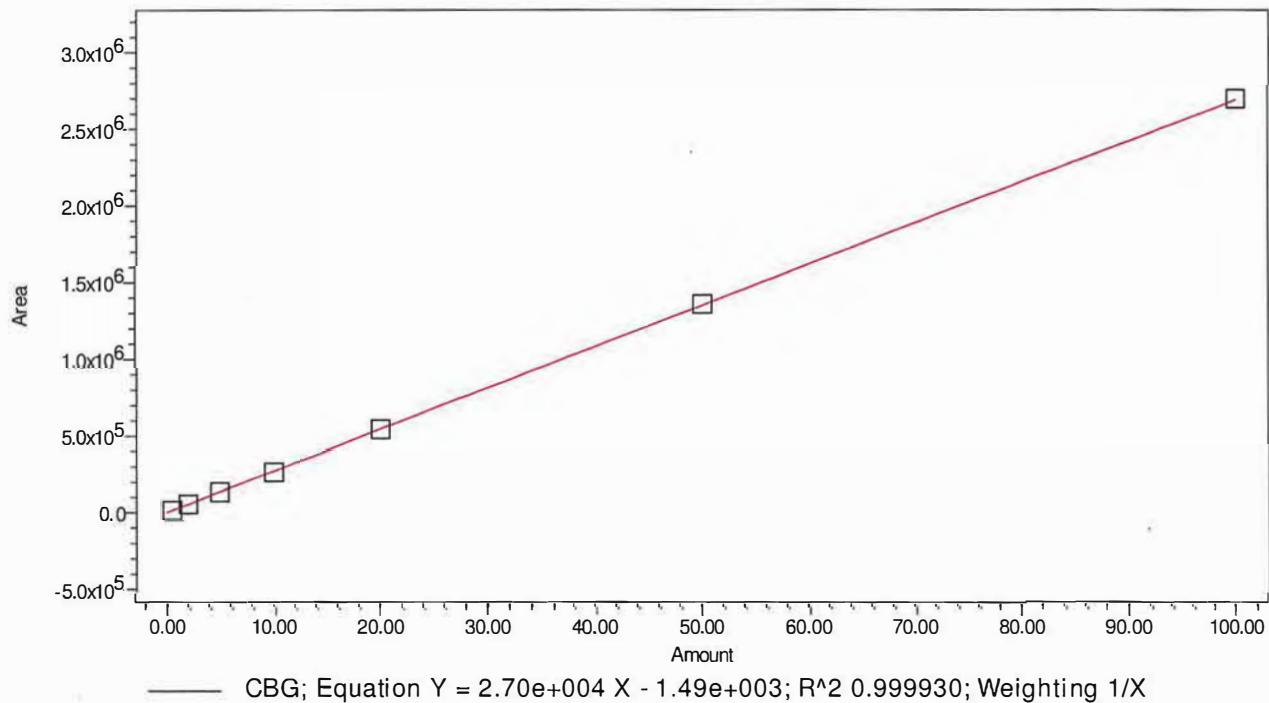
10:53:36 AM US/Pacific

Calibration Plot



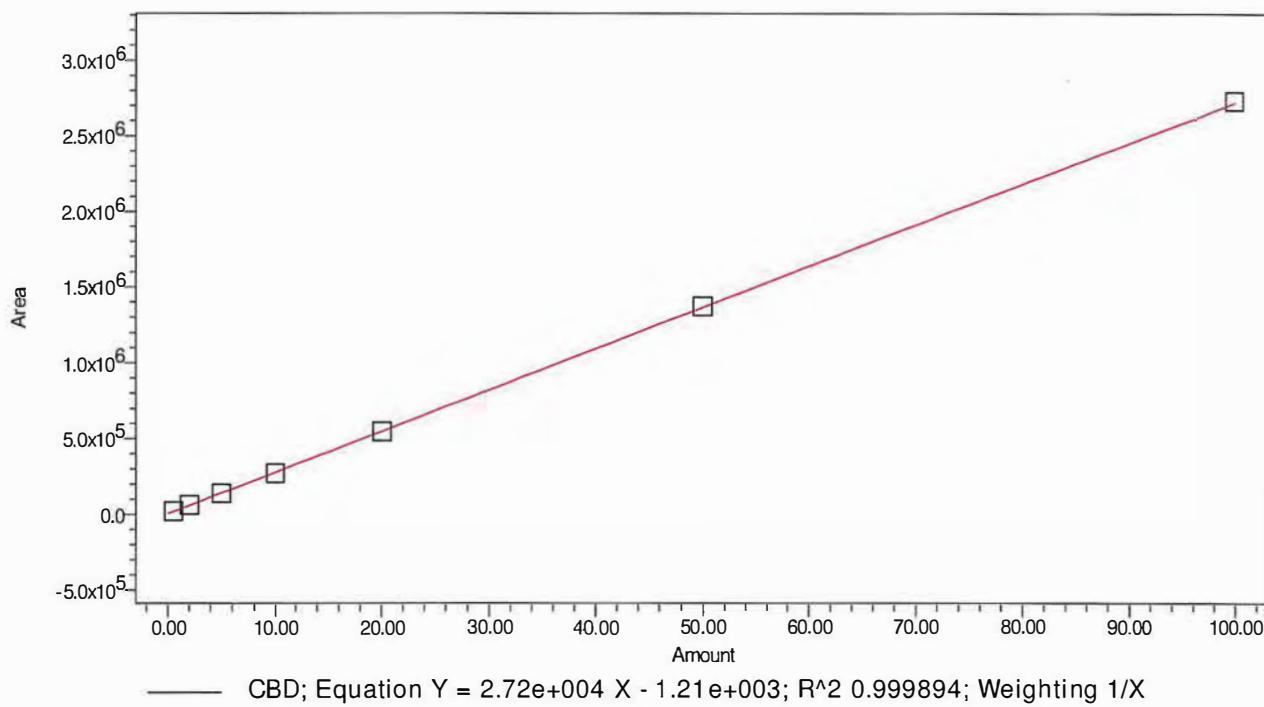
— CBDA; Equation $Y = 3.37e+004 X - 3.47e+002$; R^2 0.999901; Weighting 1/X

Calibration Plot

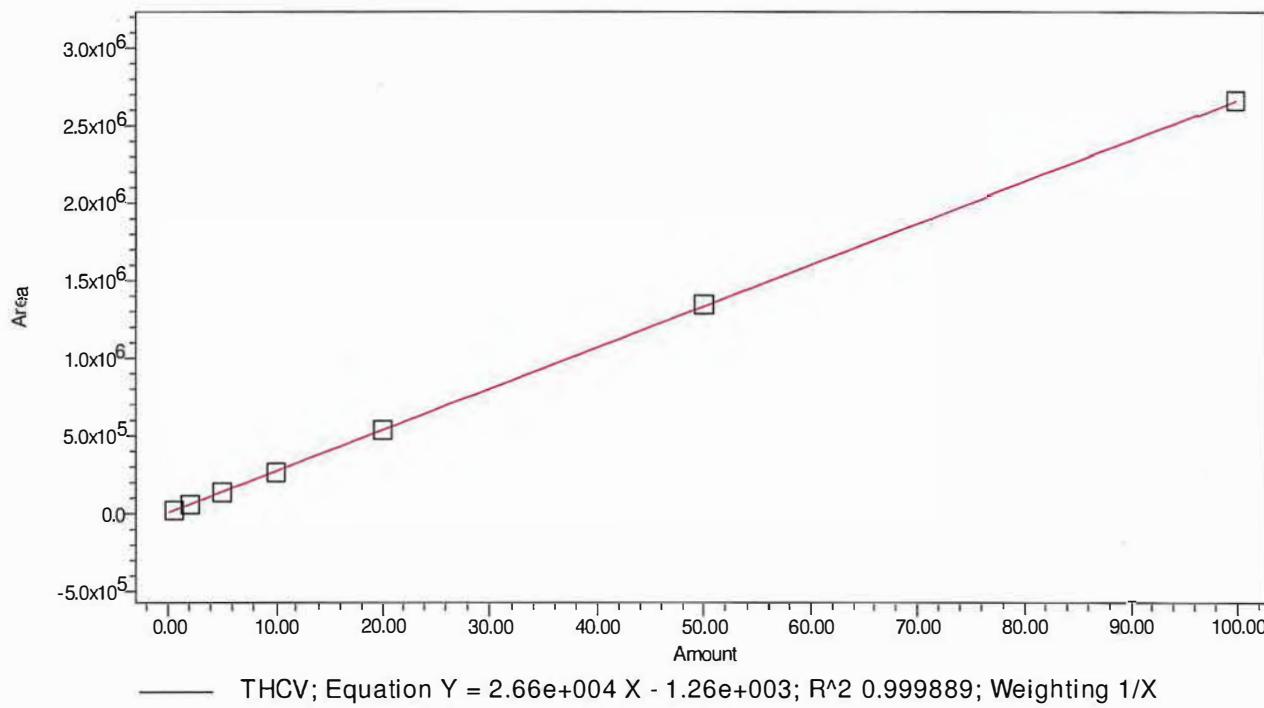


— CBG; Equation $Y = 2.70e+004 X - 1.49e+003$; R^2 0.999930; Weighting 1/X

Calibration Plot



Calibration Plot



Reported by User: System

Report Method: Calibration curves

Report Method ID: 12679

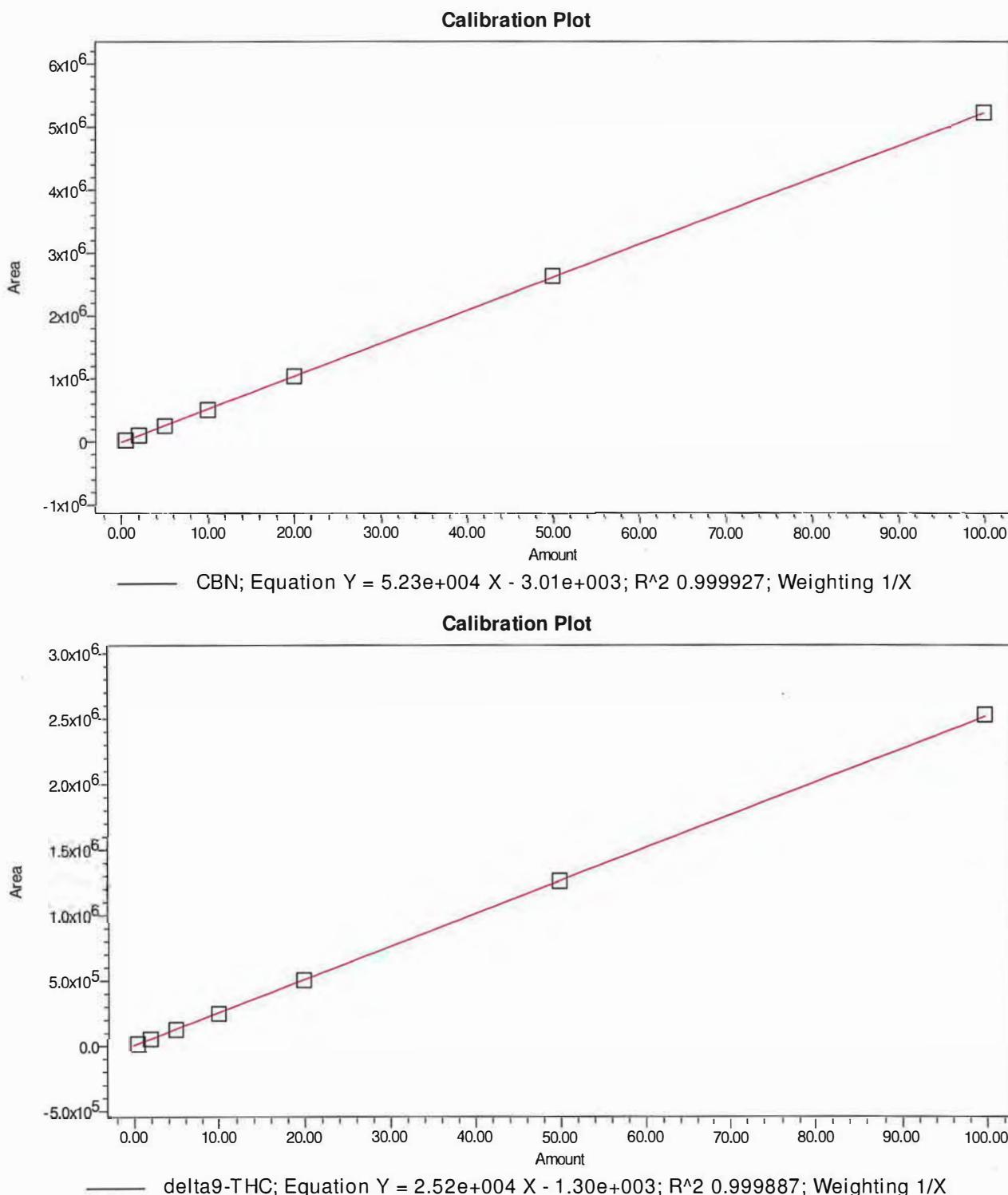
Page: 2 of 7

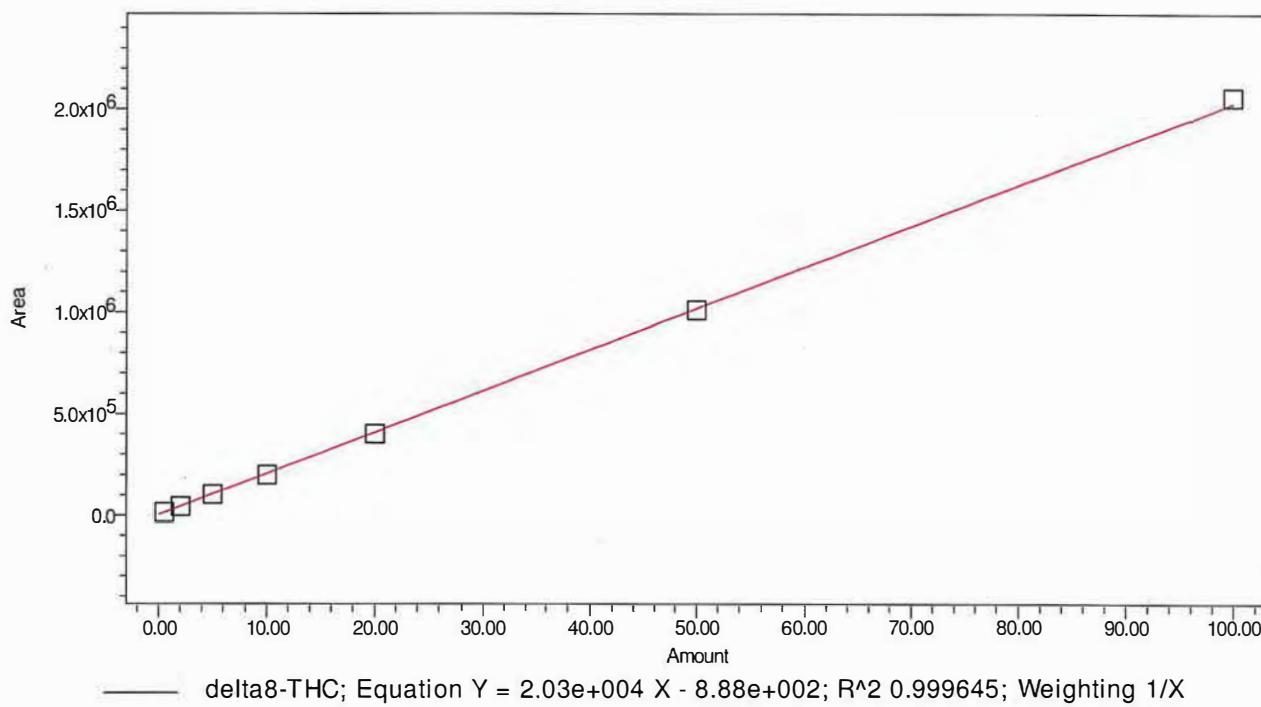
Project Name: 2021\Method Development Miao

Date Printed:

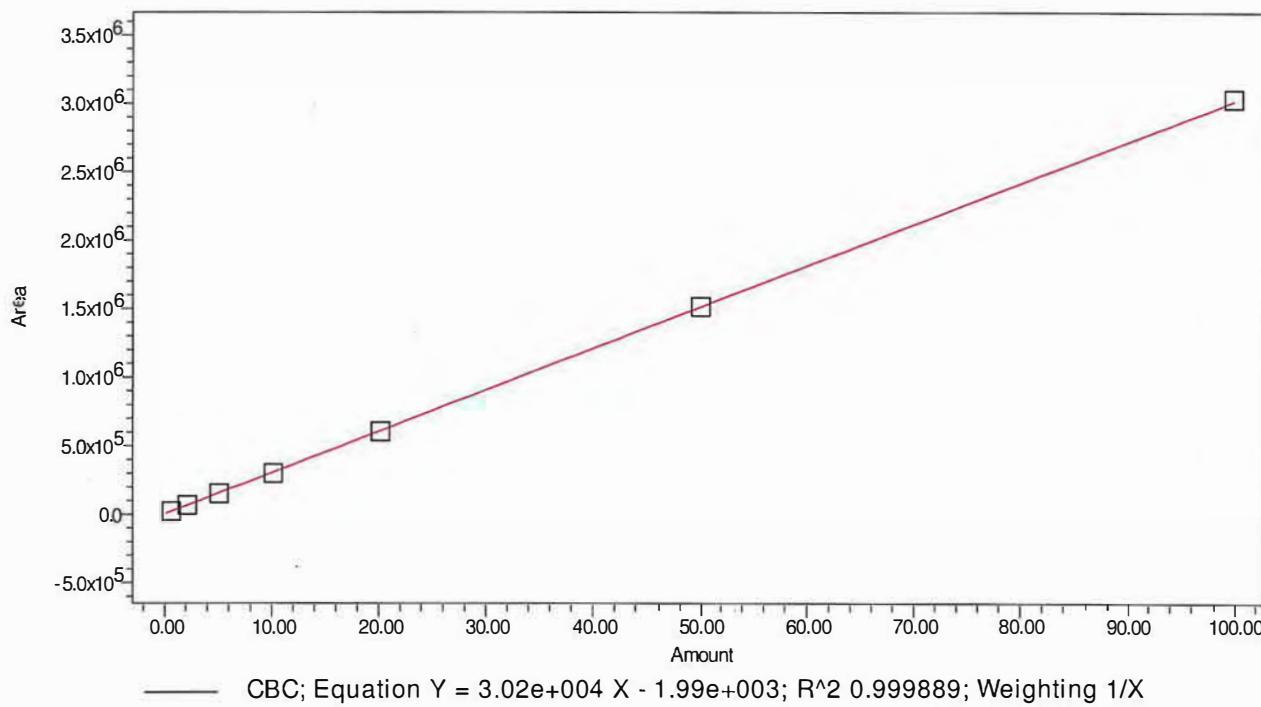
3/24/2022

11:15:19 AM US/Pacific



Calibration Plot

— delta8-THC; Equation Y = 2.03e+004 X - 8.88e+002; R^2 0.999645; Weighting 1/X

Calibration Plot

— CBC; Equation Y = 3.02e+004 X - 1.99e+003; R^2 0.999889; Weighting 1/X

Reported by User: System

Report Method: Calibration curves

Report Method ID: 12679

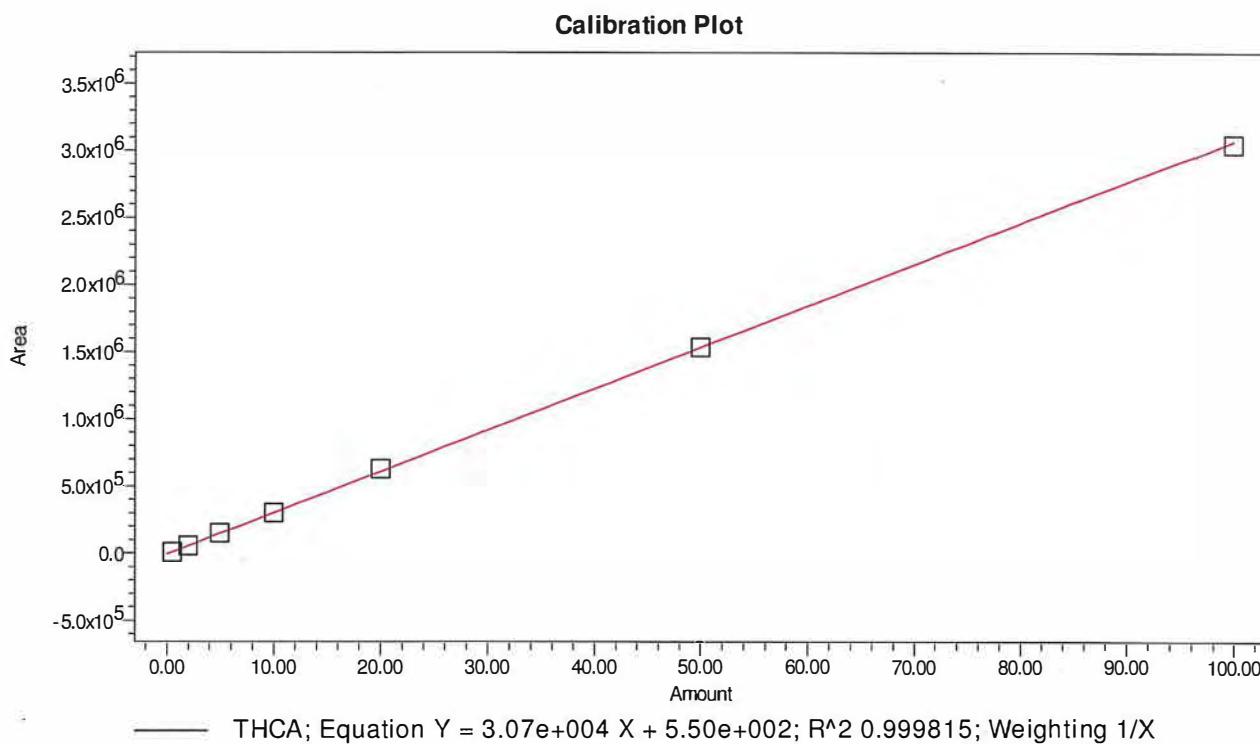
Page: 4 of 7

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

11:15:19 AM US/Pacific



Peak: CBDA

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	CBDA	Level 1	2.165	16656	14.400	5517	0.500000	0.504395	ppm	0.879	No
2	CBDA	Level 2	2.169	66641	12.400	22598	2.000000	1.987203	ppm	-0.640	No
3	CBDA	Level 3	2.169	167058	12.500	57246	5.000000	4.966077	ppm	-0.678	No
4	CBDA	Level 4	2.166	330910	12.200	114092	10.000000	9.826759	ppm	-1.732	No
5	CBDA	Level 5	2.167	687249	13.400	241200	20.000000	20.397598	ppm	1.988	No
6	CBDA	Level 6	2.169	1697463	12.900	606827	50.000000	50.365698	ppm	0.731	No
7	CBDA	Level 7	2.169	3352155	12.700	1210273	100.000000	99.452270	ppm	-0.548	No

Peak: CBG

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	CBG	Level 1	2.385	12751	8.400	3964	0.500000	0.528063	ppm	5.613	No
2	CBG	Level 2	2.389	51765	9.700	16073	2.000000	1.974538	ppm	-1.273	No
3	CBG	Level 3	2.390	130332	9.300	40657	5.000000	4.887463	ppm	-2.251	No
4	CBG	Level 4	2.386	261726	9.600	81390	10.000000	9.759038	ppm	-2.410	No
5	CBG	Level 5	2.390	536090	9.600	167789	20.000000	19.931323	ppm	-0.343	No
6	CBG	Level 6	2.393	1353691	9.400	426796	50.000000	50.244625	ppm	0.489	No
7	CBG	Level 7	2.394	2700396	9.500	851077	100.000000	100.174950	ppm	0.175	No

Reported by User: System

Report Method: Calibration curves

Report Method ID: 12679

Page: 5 of 7

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

11:15:19 AM US/Pacific

Peak: CBD

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	CBD	Level 1	2.523	13432	11.500	4010	0.500000	0.537191	ppm	7.438	No
2	CBD	Level 2	2.527	51971	11.700	16055	2.000000	1.951509	ppm	-2.425	No
3	CBD	Level 3	2.528	132212	11.400	40433	5.000000	4.896217	ppm	-2.076	No
4	CBD	Level 4	2.525	263109	11.400	80432	10.000000	9.699889	ppm	-3.001	No
5	CBD	Level 5	2.528	540158	11.300	165611	20.000000	19.867048	ppm	-0.665	No
6	CBD	Level 6	2.531	1366156	11.400	416550	50.000000	50.179636	ppm	0.359	No
7	CBD	Level 7	2.532	2733770	11.400	819960	100.000000	100.368508	ppm	0.369	No

Peak: THCV

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	THCV	Level 1	2.724	13015	14.200	3981	0.500000	0.536232	ppm	7.246	No
2	THCV	Level 2	2.729	50373	15.000	16035	2.000000	1.939256	ppm	-3.037	No
3	THCV	Level 3	2.730	129683	18.500	40547	5.000000	4.917764	ppm	-1.645	No
4	THCV	Level 4	2.727	256745	18.500	80543	10.000000	9.689619	ppm	-3.104	No
5	THCV	Level 5	2.730	529433	22.200	166401	20.000000	19.930547	ppm	-0.347	No
6	THCV	Level 6	2.732	1340753	31.800	419832	50.000000	50.399974	ppm	0.800	No
7	THCV	Level 7	2.733	2663775	32.900	829426	100.000000	100.086608	ppm	0.087	No

Peak: CBN

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	CBN	Level 1	3.673	24354	16.600	6194	0.500000	0.523541	ppm	4.708	No
2	CBN	Level 2	3.677	100852	19.300	25481	2.000000	1.986933	ppm	-0.653	No
3	CBN	Level 3	3.678	252368	19.300	63935	5.000000	4.885396	ppm	-2.292	No
4	CBN	Level 4	3.673	506755	23.300	128004	10.000000	9.751757	ppm	-2.482	No
5	CBN	Level 5	3.679	1042628	30.000	263324	20.000000	20.002886	ppm	0.014	No
6	CBN	Level 6	3.682	2629314	36.400	663411	50.000000	50.355810	ppm	0.712	No
7	CBN	Level 7	3.682	5224113	36.300	1311556	100.000000	99.993678	ppm	-0.006	No

Peak: delta9-THC

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	delta9-THC	Level 1	4.597	12242	10.400	2656	0.500000	0.537979	ppm	7.596	No
2	delta9-THC	Level 2	4.602	47905	11.100	10414	2.000000	1.954362	ppm	-2.282	No
3	delta9-THC	Level 3	4.603	121819	17.700	26509	5.000000	4.889926	ppm	-2.201	No
4	delta9-THC	Level 4	4.598	243079	15.900	52890	10.000000	9.705816	ppm	-2.942	No
5	delta9-THC	Level 5	4.607	498629	15.100	108856	20.000000	19.855162	ppm	-0.724	No
6	delta9-THC	Level 6	4.607	1257571	13.200	275334	50.000000	49.996977	ppm	-0.006	No

Reported by User: System

Report Method: Calibration curves

Report Method ID: 12679

Page: 6 of 7

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

11:15:19 AM US/Pacific

Peak: delta9-THC

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
7	delta9-THC	Level 7	4.607	2530692	13.300	553855	100.000000	100.559779	ppm	0.560	No

Peak: delta8-THC

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	delta8-THC	Level 1	4.749	10434	14.200	2047	0.500000	0.557104	ppm	11.421	No
2	delta8-THC	Level 2	4.756	38689	16.700	7968	2.000000	1.947391	ppm	-2.630	No
3	delta8-THC	Level 3	4.756	97417	18.100	19992	5.000000	4.837131	ppm	-3.257	No
4	delta8-THC	Level 4	4.751	194067	19.100	39977	10.000000	9.592750	ppm	-4.072	No
5	delta8-THC	Level 5	4.760	397396	20.300	82150	20.000000	19.597541	ppm	-2.012	No
6	delta8-THC	Level 6	4.761	1006809	24.600	206672	50.000000	49.583708	ppm	-0.833	No
7	delta8-THC	Level 7	4.760	2059562	40.800	415683	100.000000	101.384374	ppm	1.384	No

Peak: CBC

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	CBC	Level 1	5.710	14207	15.800	2583	0.500000	0.536389	ppm	7.278	No
2	CBC	Level 2	5.721	57157	19.700	10309	2.000000	1.959214	ppm	-2.039	No
3	CBC	Level 3	5.722	145984	22.300	26195	5.000000	4.901789	ppm	-1.964	No
4	CBC	Level 4	5.717	290873	25.600	52276	10.000000	9.701519	ppm	-2.985	No
5	CBC	Level 5	5.727	595972	24.900	107062	20.000000	19.808514	ppm	-0.957	No
6	CBC	Level 6	5.729	1509636	23.500	271106	50.000000	50.075459	ppm	0.151	No
7	CBC	Level 7	5.725	3032311	23.800	546055	100.000000	100.517116	ppm	0.517	No

Peak: THCA

	Name	Level	Retention Time (min)	Area ($\mu\text{V}^*\text{sec}$)	Width (sec)	Height (μV)	X Value	Calc. Value	Units	% Deviation	Manual
1	THCA	Level 1	6.178	14964	19.600	2305	0.500000	0.469529	ppm	-6.094	No
2	THCA	Level 2	6.180	62915	28.400	9620	2.000000	2.031469	ppm	1.573	No
3	THCA	Level 3	6.172	156904	30.200	24431	5.000000	5.093050	ppm	1.861	No
4	THCA	Level 4	6.158	307980	29.600	48253	10.000000	10.014210	ppm	0.142	No
5	THCA	Level 5	6.155	634683	29.400	100386	20.000000	20.656185	ppm	3.281	No
6	THCA	Level 6	6.142	1535555	30.500	244487	50.000000	50.001138	ppm	0.002	No
7	THCA	Level 7	6.126	3046987	30.500	482026	100.000000	99.234419	ppm	-0.766	No

Reported by User: System

Report Method: Calibration curves

Report Method ID: 12679

Page: 7 of 7

Project Name: 2021\Method Development Miao

Date Printed:

3/24/2022

11:15:19 AM US/Pacific