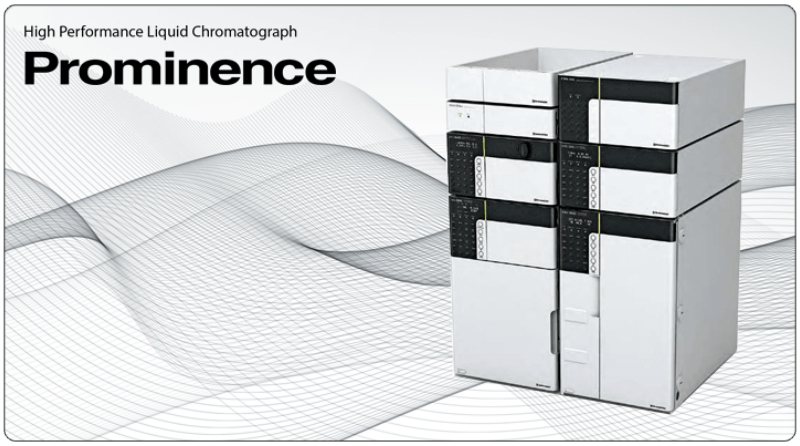
SHIMADZU INSTITUTE
FOR RESEARCH TECHNOLOGIES
THE UNIVERSITY OF TEXAS AT ARLINGTON

Date	Report No.	Prepared By
07-14-20	[071420]	Eric Weaver

Sample Analysis Report

CBD Analysis by HPLC



CBD Analysis by HPLC

Company:	Grassroots International
Contact:	Chad Harman [redacted]
Type of Analysis:	Quantitation
Instrument Used:	HPLC
SIRT Center:	Shimadzu Center for Advanced Analytical Chemistry scaac@uta.edu 817-272-1157
Analyst:	Eric Weaver eric.weaver@uta.edu 817-272-1157
Date:	10 July, 2020

Summary: Analysis of CBD oil sample was performed utilizing HPLC. Phytocannabinoid Mixture 11 (CRM) from Shimadzu Scientific Instruments (SSI Inc.) was used as calibration standard for quantification of: 1) CBDV 2) THCV 3) CBD 4) CBG 5) CBDA 6) CBGA 7) CBN 8) d9-THC 9) d8-THC 10) CBC 11) THCA-A

Method: Approximately 50 mg of each sample was dissolved in 0.950 mL of isopropanol, mixed for 30s, then 1 mL of methanol was added and mixed again for 30s. The mixture was then filtered through a 0.45 um nylon membraned and diluted 1:500 into acetonitrile for analysis and injected in triplicate.

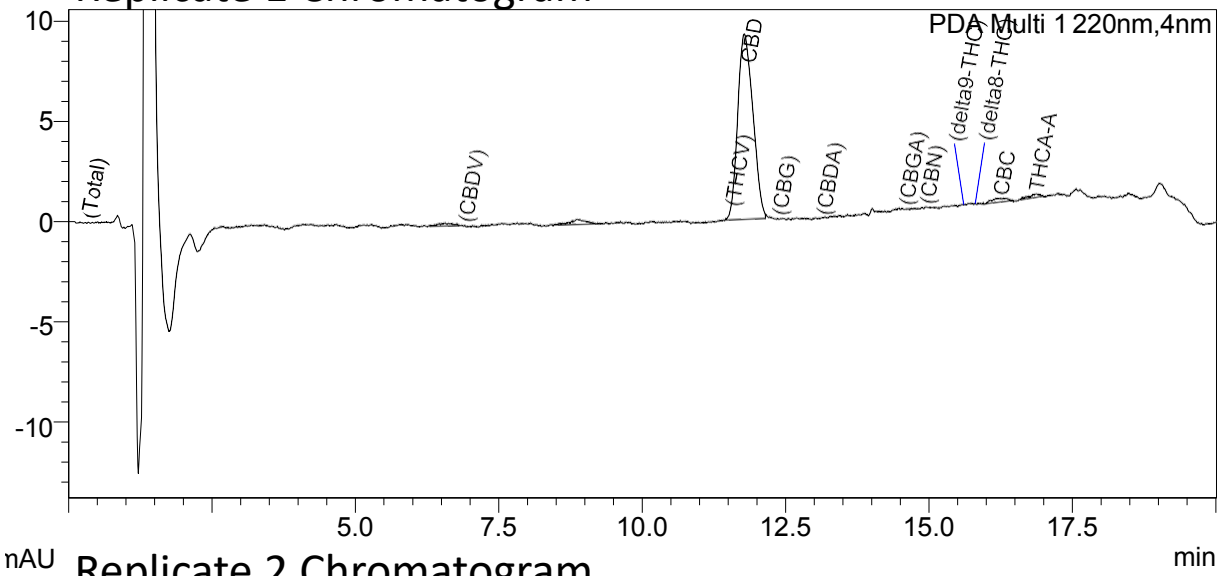
HPLC Column: Phenomenex AERIS XR-C18, 2.6 µm, 2.1 x 150 mm
Column Temp: 50° Celsius
Mobile Phase A: H2O w/ 0.1 Formic Acid
Mobile Phase B: Acetonitrile/Methanol 25/75 (vol/vol) w/ 0.1% Formic Acid
Gradient: 20 minutes total, 65% B --> 72% B 3.5-10.6 min, 72% B --> 95% B 10.6-14.6 min, 95% B 14.6-17 min, 95%-->65% B 17-20 min
LOD = 250 ppb (Level of Detection = 250 parts per billion)

Results: Calibration curves covering a range of 0.250 µg/mL to 93.19 µg/mL were produced for all 11 of the components in the CRM mixture. The sample extraction was diluted 1:500 and analyzed in triplicate. Sample results were compared to the standard curves for relative quantification of each component identified in the samples. Percent weight of each compound that was measured from the samples was back calculated to correct for extraction dilution and initial extraction weight amount.

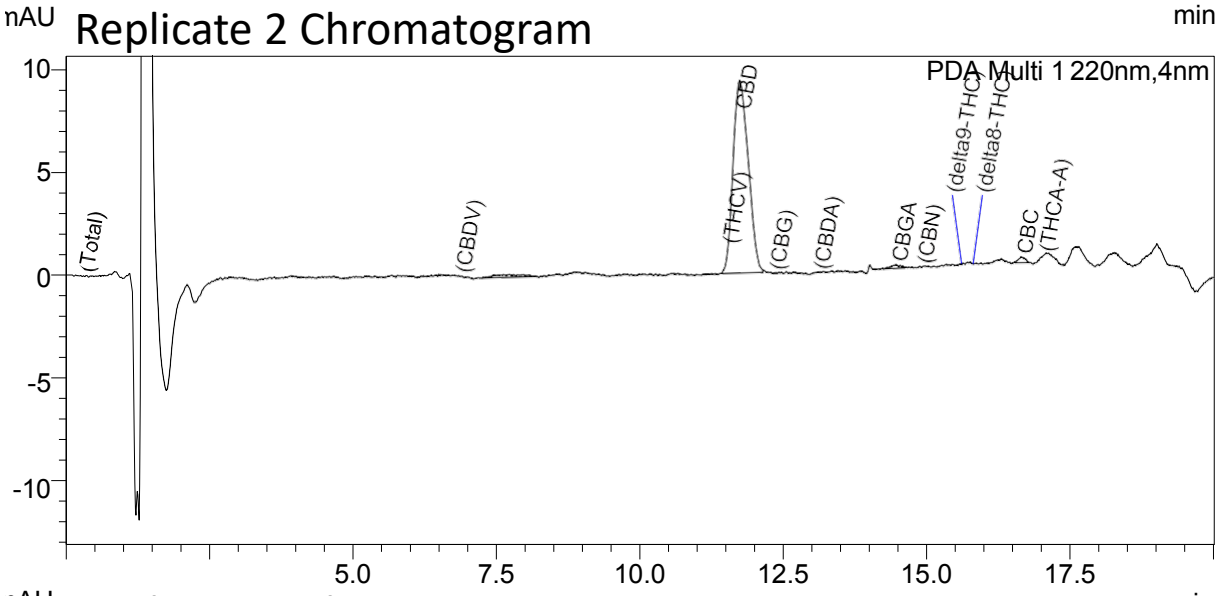
Conclusions: CBD is the main component quantified in the oil sample provided with a average Weight % of 19.73. No other components from the 11 part CRM mixture were detected above the 250 ppb (0.250 µg/mL) level of detection for this analysis.

CBDermaceuticals Analysis- Sample Chromatograms

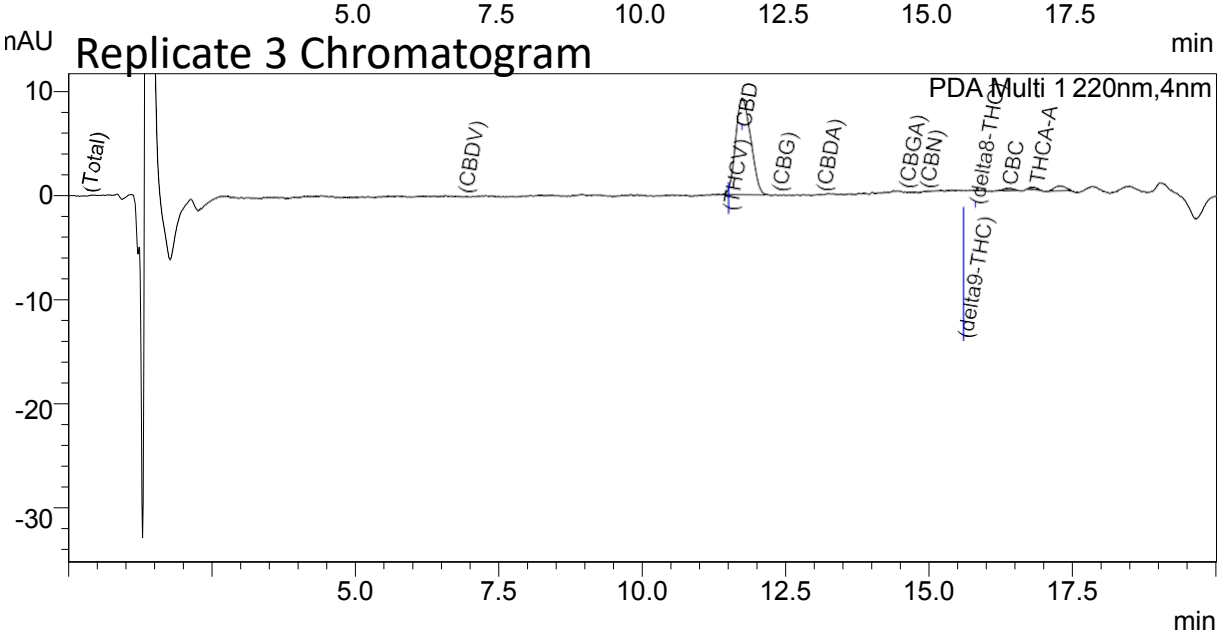
Replicate 1 Chromatogram



Replicate 2 Chromatogram



Replicate 3 Chromatogram



CBDermaceuticals Analysis- Quantitative Results

Quantitative Results Replicate #1

ID#	Name	Ret. Time	Conc.	Unit
1	CBDV	6.859	ND	ug/mL
2	THCV	11.509	ND	ug/mL
3	CBD	11.787	10.836	ug/mL
4	CBG	12.331	ND	ug/mL
5	CBDA	13.099	ND	ug/mL
6	CBGA	14.539	ND	ug/mL
7	CBN	14.901	ND	ug/mL
8	delta9-THC	15.605	ND	ug/mL
9	delta8-THC	15.808	ND	ug/mL
10	CBC	16.192	ND	ug/mL
11	THCA-A	16.811	ND	ug/mL

Quantitative Results Replicate #2

ID#	Name	Ret. Time	Conc.	Unit
1	CBDV	6.859	ND	ug/mL
2	THCV	11.509	ND	ug/mL
3	CBD	11.744	10.978	ug/mL
4	CBG	12.331	ND	ug/mL
5	CBDA	13.099	ND	ug/mL
6	CBGA	14.464	ND	ug/mL
7	CBN	14.901	ND	ug/mL
8	delta9-THC	15.605	ND	ug/mL
9	delta8-THC	15.808	ND	ug/mL
10	CBC	16.640	ND	ug/mL
11	THCA-A	17.024	ND	ug/mL

Quantitative Results Replicate #3

ID#	Name	Ret. Time	Conc.	Unit
1	CBDV	6.859	ND	ug/mL
2	THCV	11.509	ND	ug/mL
3	CBD	11.744	10.800	ug/mL
4	CBG	12.331	ND	ug/mL
5	CBDA	13.099	ND	ug/mL
6	CBGA	14.539	ND	ug/mL
7	CBN	14.901	ND	ug/mL
8	delta9-THC	15.605	ND	ug/mL
9	delta8-THC	15.808	ND	ug/mL
10	CBC	16.341	ND	ug/mL
11	THCA-A	16.821	ND	ug/mL

Summary of Quantitative Results

ID#	Name	Replicate 1	Replicate 2	Replicate 3	Average (ug/mL)	Standard Deviation	%RSD
3	CBD	10.84	10.98	10.80	10.87	0.0768	0.707

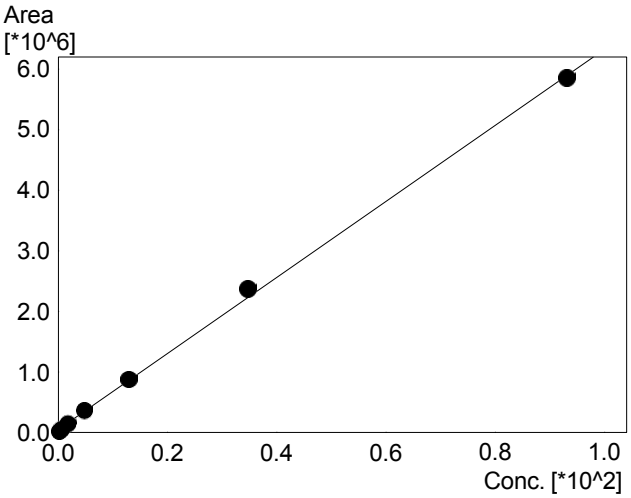
Weight % of Quantified Components

ID#	Name	Sample Dilution	Sample Extraction Amt (mg)	Average % Weight
3	CBD	1000	55.09	19.73

Calibration Curves

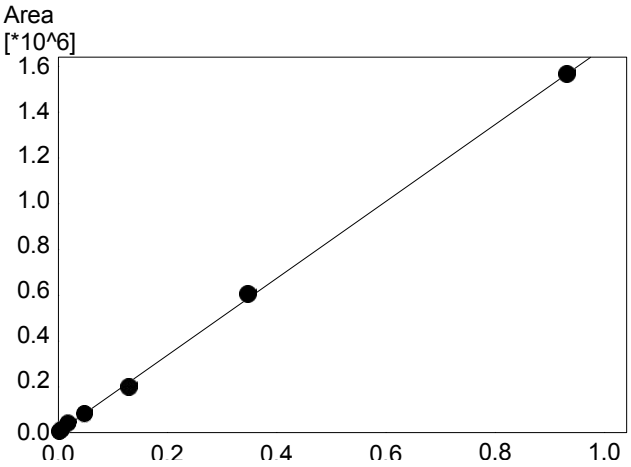
Calibration standard: Phytocannabinoid Mixture 11 CRM from Shimadzu Scientific Instruments (SSI, Inc)
Standard Peaks: 1) CBDV 2) THCV 3) CBD 4) CBG 5) CBDA 6) CBGA 7) CBN 8) d9-THC 9) d8-THC 10) CBC 11) THCA-A
HPLC Column: Phenomenex AERIS XR-C18 2.6 micron, 2.1 x 150mm
Column Temp: 50° Celsius
Mobile Phase A: H2O w/ 0.1 Formic Acid
Mobile Phase B: Acetonitrile/Methanol 25/75 (vol/vol) w/ 0.1% Formic Acid
Gradient: 20 minutes total, 65% B --> 72% B 3.5-10.6 min, 72% B --> 95% B 10.6-14.6 min, 95% B 14.6-16.6 min, 95%-->65% B 17-20 min
Linear concentration range: 0.250 ug/mL to 93.19 ug/mL, triplicate injections were averaged together for each concentration, 5 ul injection volume

ID# : 1
Name : CBDV
Quantitative Method : External Standard
Function : f(x)=62773.6*x+52007.9
Rr2=0.9990559 RFSD: 9.703048e+003
FitType : Linear
ZeroThrough : Not Through
Weighted Regression : None
Detector Name : PDA



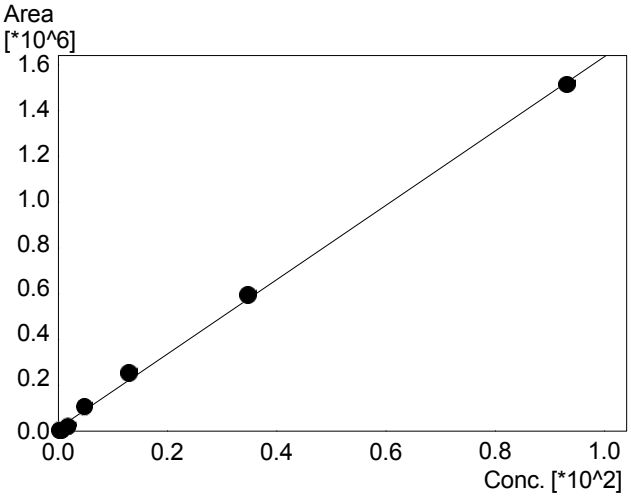
#	Conc.(Ratio)	MeanArea	Area%RSD
1	0.25	21843	13.856793
2	0.671	56644	3.262417
3	1.8	145446	1.011993
4	4.83	361428	0.180899
5	12.95	876220	0.149115
6	34.74	2370677	0.154953
7	93.19	5849346	0.137324

ID# : 2
Name : THCV
Quantitative Method : External Standard
Function : f(x)=16793.0*x+3417.71
Rr2=0.9995215 RFSD: 7.318671e+003
FitType : Linear
ZeroThrough : Not Through
Weighted Regression : None
Detector Name : PDA



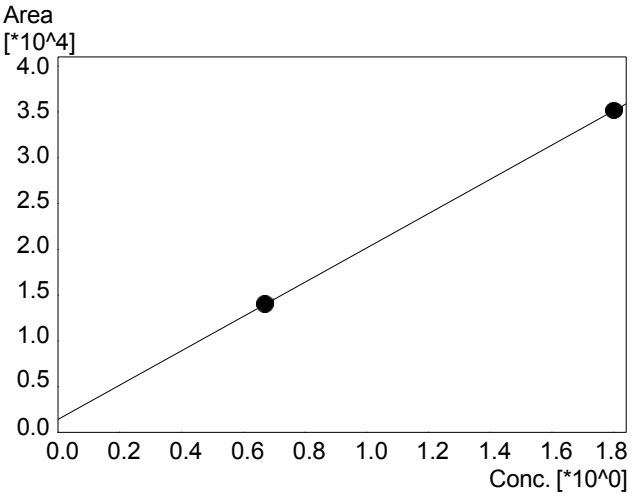
#	Conc.(Ratio)	MeanArea	Area%RSD
1	0.25	7715	29.648615
2	0.671	16345	35.992329
3	1.8	43147	37.514146
4	4.83	82483	1.173695
5	12.95	197779	0.280029
6	34.74	603977	0.461728
7	93.19	1565073	1.454968

ID# : 3
Name : CBD
Quantitative Method : External Standard
Function : f(x)=16229.1*x+12851.5
Rr2=0.9986460 RFSD: 5.447571e+003
FitType : Linear
ZeroThrough : Not Through
Weighted Regression : None
Detector Name : PDA



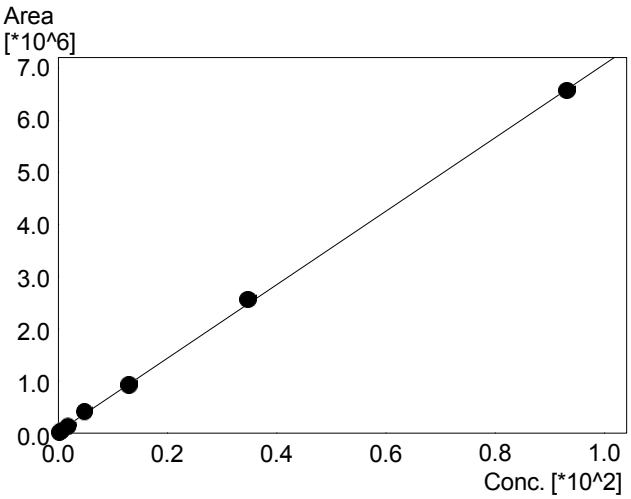
#	Conc.(Ratio)	MeanArea	Area%RSD
1	0.25	4935	0.316913
2	0.671	5503	16.631751
3	1.8	21435	52.804421
4	4.83	104191	30.238686
5	12.95	253313	0.501679
6	34.74	595644	2.290663
7	93.19	1513842	2.145674

ID# : 4
Name : CBG
Quantitative Method : External Standard
Function : f(x)=18739.3*x+1417.09
Rr2=1.000000 RFSD: 9.366563e+002
FitType : Linear
ZeroThrough : Not Through
Weighted Regression : None
Detector Name : PDA



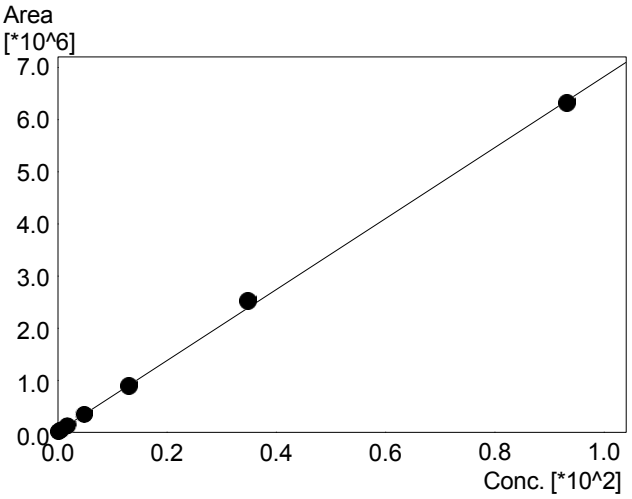
#	Conc.(Ratio)	MeanArea	Area%RSD
2	0.671	13991	0.000000
3	1.8	35148	0.000000

ID# : 5
Name : CBDA
Quantitative Method : External Standard
Function : f(x)=70447.9*x+31871.4
Rr2=0.9996842 RFSD: 1.210649e+004
FitType : Linear
ZeroThrough : Not Through
Weighted Regression : None
Detector Name : PDA



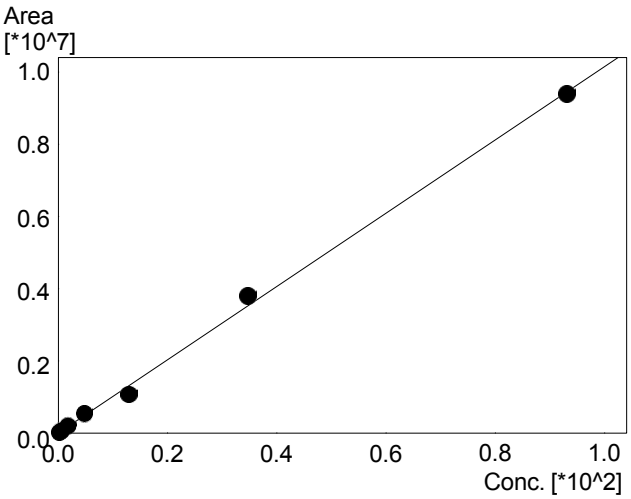
#	Conc.(Ratio)	MeanArea	Area%RSD
1	0.25	24752	10.952596
2	0.671	57269	13.494591
3	1.8	137037	15.567464
4	4.83	409116	0.397945
5	12.95	922510	14.526913
6	34.74	2560850	5.592089
7	93.19	6568225	0.361104

ID# : 6
Name : CBGA
Quantitative Method : External Standard
Function : f(x)=68026.0*x+23325.1
Rr2=0.9993376 RFSD: 2.031308e+003
FitType : Linear
ZeroThrough : Not Through
Weighted Regression : None
Detector Name : PDA



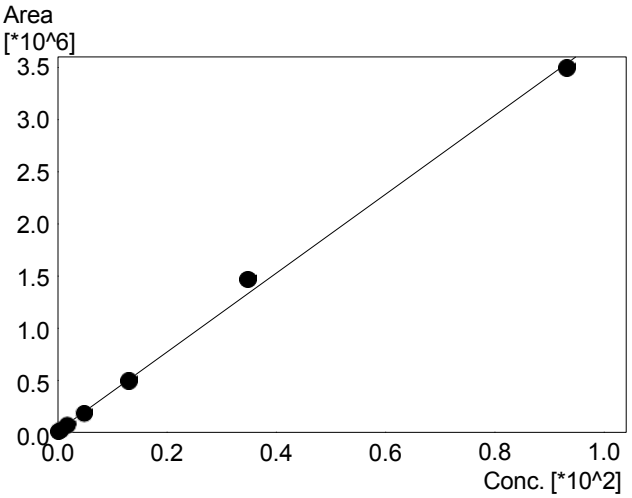
#	Conc.(Ratio)	MeanArea	Area%RSD
1	0.25	18278	1.335515
2	0.671	47207	2.261287
3	1.8	126264	0.290337
4	4.83	344812	2.182005
5	12.95	888518	1.294024
6	34.74	2518882	0.807354
7	93.19	6316484	0.471940

ID# : 7
Name : CBN
Quantitative Method : External Standard
Function : f(x)=101410*x+7993.20
Rr2=0.9980604 RFSD: 1.264919e+004
FitType : Linear
ZeroThrough : Not Through
Weighted Regression : None
Detector Name : PDA



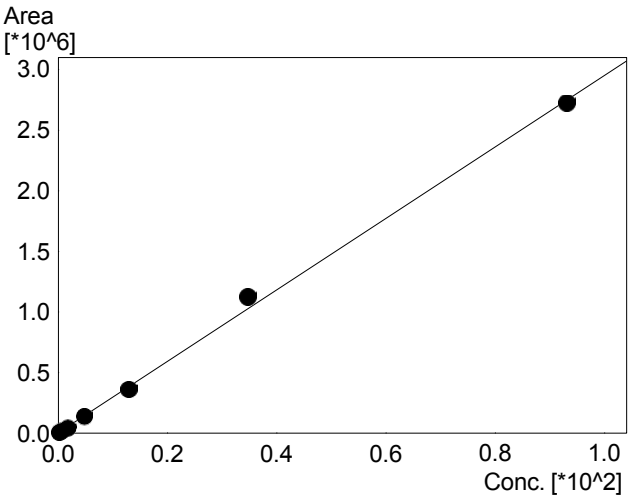
#	Conc.(Ratio)	MeanArea	Area%RSD
1	0.25	31060	2.148671
2	0.671	76488	1.171189
3	1.8	205708	0.447586
4	4.83	539939	1.374710
5	12.95	1068796	2.847435
6	34.74	3793073	0.338360
7	93.19	9393338	0.120699

ID# : 8
Name : delta9-THC
Quantitative Method : External Standard
Function : f(x)=37797.0*x+17774.1
Rr2=0.9978115 RFSD: 2.376309e+003
FitType : Linear
ZeroThrough : Not Through
Weighted Regression : None
Detector Name : PDA



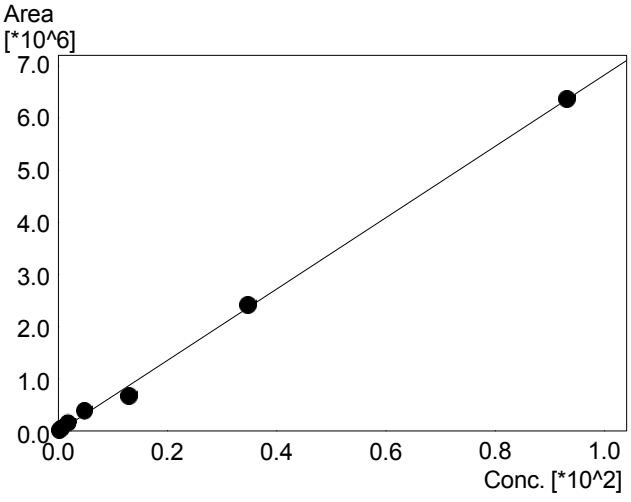
#	Conc.(Ratio)	MeanArea	Area%RSD
1	0.25	9961	7.417536
2	0.671	24311	7.058542
3	1.8	69575	1.763471
4	4.83	181589	6.105511
5	12.95	490223	1.117907
6	34.74	1465177	2.428784
7	93.19	3493832	1.051479

ID# : 9
Name : delta8-THC
Quantitative Method : External Standard
Function : f(x)=29502.1*x+3736.48
Rr2=0.9981794 RFSD: 3.666062e+003
FitType : Linear
ZeroThrough : Not Through
Weighted Regression : None
Detector Name : PDA



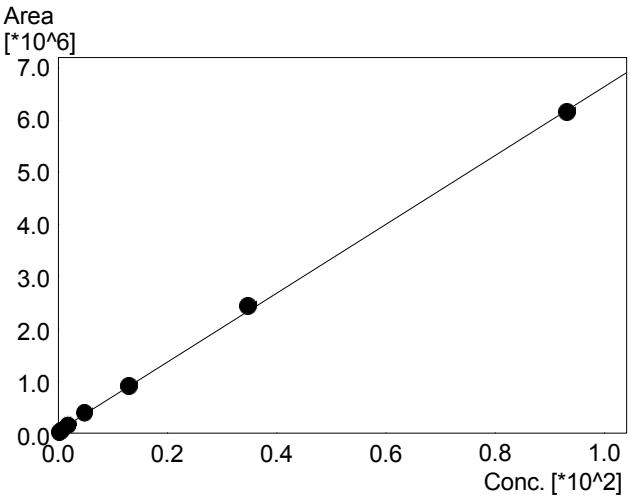
#	Conc.(Ratio)	MeanArea	Area%RSD
1	0.25	5728	9.501901
2	0.671	16019	8.929504
3	1.8	41009	3.815324
4	4.83	137038	4.985691
5	12.95	359851	4.658441
6	34.74	1123351	2.228670
7	93.19	2722188	2.685730

ID# : 10
Name : CBC
Quantitative Method : External Standard
Function : f(x)=68408.7*x-14239.8
Rr2=0.9985141 RFSD: 1.186447e+004
FitType : Linear
ZeroThrough : Not Through
Weighted Regression : None
Detector Name : PDA



#	Conc.(Ratio)	MeanArea	Area%RSD
1	0.25	21112	6.736307
2	0.671	56856	5.312864
3	1.8	151411	0.329109
4	4.83	376796	0.593103
5	12.95	672464	4.089130
6	34.74	2408711	7.350802
7	93.19	6366947	0.267304

ID# : 11
Name : THCA-A
Quantitative Method : External Standard
Function : f(x)=66028.8*x+44302.1
Rr2=0.9995377 RFSD: 8.893487e+003
FitType : Linear
ZeroThrough : Not Through
Weighted Regression : None
Detector Name : PDA



#	Conc.(Ratio)	MeanArea	Area%RSD
1	0.25	22374	7.620920
2	0.671	57857	3.585695
3	1.8	149085	1.478185
4	4.83	377996	0.469463
5	12.95	907551	1.152932
6	34.74	2436372	0.482952
7	93.19	6159604	0.494824