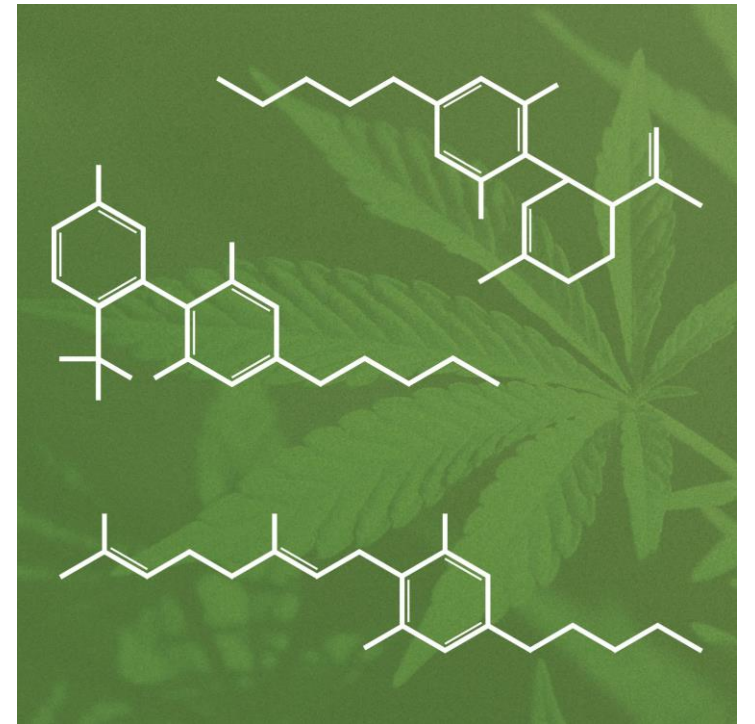


Cannabinoid Extraction Efficiency for Potency Analysis: An in Depth Look of Multiple Techniques

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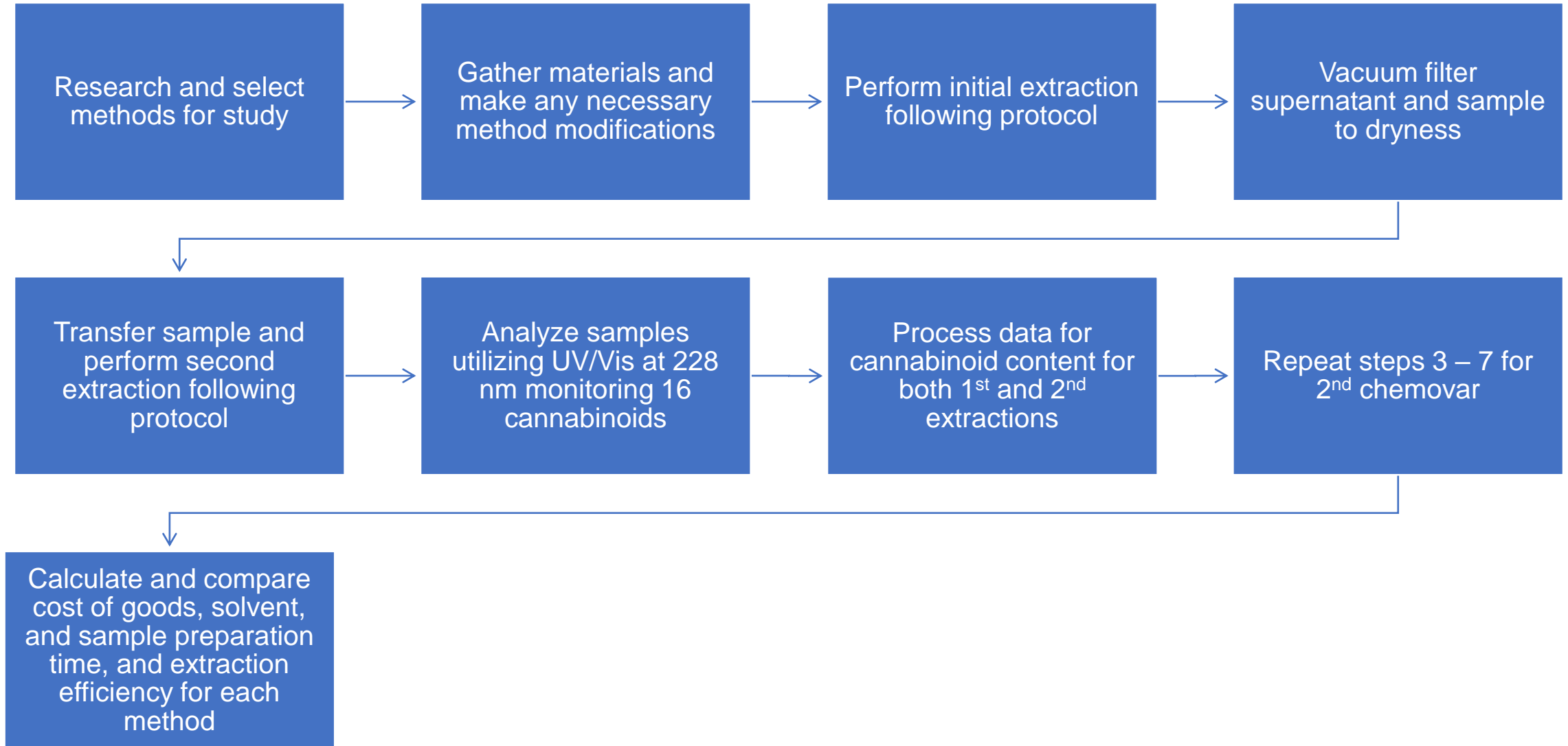
Importance of Potency Testing

- **Properly informs the customer**
- **Provides accurate dosages**
- **Sets market value**
- **Defines legal composition**

The Concern

- **Uncertainty in choosing a method**
 - Numerous testing methods
 - Cost effectiveness
 - Ease of use
 - Least labor intensive
 - Efficiency
- **Extraction efficiency study/experiment not completed**
 - Lack of historical data to base decision
- **Does the same extraction work on multiple chemovars?**

The Experiment



Methods

- Method 1
- Method 2
- Restek
- Association of Official Analytical Collaboration (AOAC) International
- American Society for Testing and Materials (ASTM)
- Department of Cannabis Control (DCC)

❖ **United States Department of Agriculture (USDA) recommends the use of AOAC method for hemp**

Method Breakdown – Modifications

- Method 1**
1. Weigh 200 mg flower into a 50 mL centrifuge tube
 2. Add 20 mL MeOH
 3. Vortex/shake 10 min
 4. Aliquot 1 mL aliquot into new vial
 5. Centrifuge 5000 RPM 5min
 6. Transfer 50 µL of supernatant to a new vial. Add 950 µL MeOH Mix briefly (final dilution 2,000-fold)
 7. Filter using 4 mm 0.45 µm regenerated cellulose (RC) syringe filter



- Method 1**
1. Weigh 200 mg flower into a 50 mL centrifuge tube
 2. Add 20 mL MeOH
 3. Vortex/shake 10 min
 4. Aliquot 1 mL aliquot into new vial
 5. Centrifuge 5000 RPM 5min
 6. Filter using 4 mm 0.45 µm regenerated cellulose (RC) syringe filter
 7. Supernatant diluted 10 and 100 fold w/ 25:75 H2O:ACN

- Method 2**
1. Weigh 500 mg flower into 50 mL centrifuge tube
 2. Add 20 mL EtOH vortex briefly
 3. Shake on horizontal shaker 30 min 250 RPM
 4. Centrifuge 4000 RPM 5 min
 5. Pour supernatant into amber 50 mL volumetric flask set aside
 6. Repeat steps 2-4
 7. Add extract to to 50mL volumetric flask containing 1st extraction
 8. Fill flask with ethanol and mix well
 9. Perform 1:10 dilution and 1:100 dilution with MeOH
 10. Filter into HPLC vials using 0.2 µm PTFE membrane



- Method 2**
1. Weigh 500 mg flower into 50 mL centrifuge tube
 2. Add 20 mL EtOH vortex briefly
 3. Shake on horizontal shaker 30 min 250 RPM
 4. Centrifuge 4000 RPM 5 min
 5. Pour supernatant into amber 50 mL volumetric flask set aside
 6. Repeat steps 2-4
 7. Add extract to to 50mL volumetric flask containing 1st extraction
 8. Fill flask with ethanol and mix well
 9. Filter into HPLC vials using 0.2 µm PTFE membrane
 10. Supernatant diluted 10 and 100 fold w/ 25:75 H2O:ACN

- ASTM**
1. Weigh 100 mg into 15 mL centrifuge tube
 2. Add 5 mL 80:20 MeOH: Water
 3. Vortex 90 sec
 4. Centrifuge 5000 RPM 5 min
 5. Transfer supernatant to clean 15 mL tube
 6. Repeat steps 2-4 add to tube containing 1st extraction
 7. Vortex mix 5-10 sec
 8. Transfer to glass screw cap vial with glass inserts



- ASTM**
1. Weigh 100 mg into 15 mL centrifuge tube
 2. Add 5 mL 80:20 MeOH: Water
 3. Vortex 90 sec
 4. Centrifuge 4000 RPM 5 min
 5. Transfer supernatant to clean 15 mL tube
 6. Repeat steps 2-4 add to tube containing 1st extraction
 7. Vortex mix 5-10 sec
 8. Supernatant diluted 10 and 100 fold w/ 25:75 H2O:ACN

Method Breakdown – Modifications

AOAC

1. Weigh 500 mg flower into 50 mL centrifuge tube
2. Add 20 mL EtOH briefly shake or vortex
3. Shake 30 min on horizontal shaker 250 RPM
4. Centrifuge sample at >3000 RPM for 5 min
5. Filter supernatant using grade 390 filter paper into a 50 mL volumetric flask
6. Transfer material back into the 50 mL centrifuge tube
7. Repeat steps 2-5
8. Dilute flask to volume w EtOH
9. Filter 3mL Aliquot using 0.22µm syringe filter into 15mL centrifuge tube
10. Perform 10- and 100 fold dilution w/ MeOH into 10mL volumetric flask
11. Transfer aliquots into 2 mL amber vials and vortex briefly



AOAC

1. Weigh 500 mg flower into 50 mL centrifuge tube
2. Add 20 mL EtOH briefly shake or vortex
3. Shake 30 min on horizontal shaker 250 RPM
4. Centrifuge sample at 4000 RPM for 5 min
5. Filter supernatant using grade 390 filter paper into a 50 mL volumetric flask
6. Transfer material back into the 50 mL centrifuge tube
7. Repeat steps 2-5
8. Dilute flask to volume w EtOH
9. Filter using 0.2 µm filter vials
10. Supernatant diluted 10 and 100 fold w 25:75 H2O:ACN

DCC

1. Weigh 200 mg flower into 50 mL centrifuge tube
2. Add 40 mL 80:20 Acetonitrile: MeOH
3. Vortex 1 min
4. Sonicate in water ice bath 30 min
5. Centrifuge 3900 RPM for 15 min
6. Aliquot 1.5 mL through 0.2 µm PTFE filter into an HPLC vial
7. Dilute



DCC

1. Weigh 200 mg flower into 50 mL centrifuge tube
2. Add 40 mL 80:20 Acetonitrile: MeOH
3. Vortex 1 min
4. Sonicate in water ice bath 30 min
5. Centrifuge 3900 RPM for 15 min
6. Aliquot 1.5 mL through 0.2 µm PTFE filter into an HPLC vial
7. Supernatant diluted 10 and 100 fold w 25:75 H2O:ACN

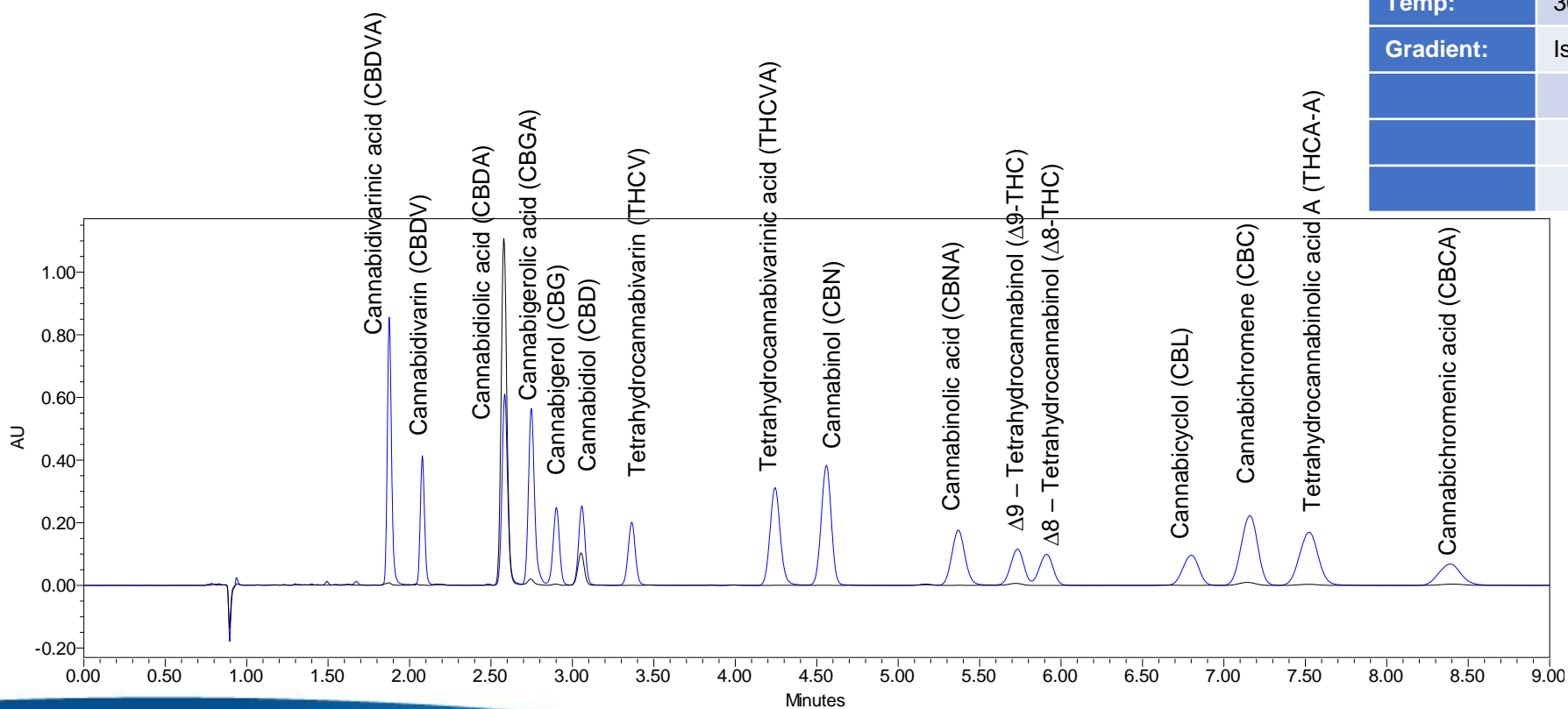
Restek

1. Weigh 500 mg flower into 15mL centrifuge tube
2. Add 5mL MeOH
3. Vortex 15 sec sonicate 2.5 min (x3)
4. Centrifuge 4000 RPM for 5 min
5. Repeat steps 2-3
6. Filter using 0.2 µm filter vial
7. Supernatant diluted 10 and 100 fold w/ 25:75 H2O:ACN

Method Conditions

Chemovar 2 (black)
Standards 100 ppm (blue)

Column:	Raptor ARC-18 2.7 μ m 150 mm x 4.6 mm (Cat# 9314A65)	
Guard:	Raptor ARC-18 2.7 μ m 5 mm x 4.6 mm ID (Cat# 9314A0250)	
Standards:	Acids 7 (Cat# 34144) and Neutrals 9 (Cat# 34132)	
Diluent:	25:75 Water / Acetonitrile	
Inj. Vol.	5 μ L	
MP A:	5 mM ammonium formate + 0.1% formic acid in water	
MP B:	0.1% formic acid in acetonitrile	
Flow:	1.5 mL/min	
Detector	UV/Vis @ 228 nm	
Temp:	30 $^{\circ}$ C	
Gradient:	Isocratic 25:75	
	Time (min)	(%) B
	0	25
	9	STOP



Extraction The Cannabinoid Breakdown – Chemovar 1

Chemovar 1	Method 1		Method 2		AOAC		Restek		ASTM		DCC 200		C of A	
	mg/g	wt %	mg/g	wt %	mg/g	wt %	mg/g	wt %	mg/g	wt %	mg/g	wt %	mg/g	wt %
Cannabidivarinic Acid (CBDVA)		ND		ND		ND		ND		ND				ND
Cannabidivarin (CBDV)	0.49	0.05		ND		ND	0.52	0.05	0.18	0.02				ND
Cannabidioloic acid (CBDA)		ND		ND		ND	0.10	0.01		ND				ND
Cannabigerolic acid (CBGA)	73.47	7.35	66.66	6.67	45.36	4.54	64.69	6.47	82.23	8.22	59.68	5.97	113.50	11.35
Cannabigerol (CBG)	147.44	14.74	20.46	2.05	13.56	1.36	19.34	1.93	20.58	2.06	38.52	3.85	6.00	0.60
Cannabidiol (CBD)	1.66	16.58		ND		ND	0.15	0.01		ND			0.8	0.08
Tetrahydrocannabivarin (THCV)	0.36	0.04	0.18	0.02	0.13	0.01	0.16	0.02	0.18	0.02				ND
Tetrahydrocannabivarinic acid (THCVA)	0.23	0.02		ND		ND	0.08	0.01	0.12	0.01				ND
Cannabinol (CBN)		ND		ND		ND		ND		ND				ND
Cannabinolic acid (CBNA)		ND		ND		ND	0.10	0.01		ND				ND
Δ9 - Tetrahydrocannabinol (Δ9-THC)	0.78	0.08	0.35	0.03	0.27	0.03	0.44	0.04	0.35	0.04				ND
Δ8 - Tetrahydrocannabinol (Δ8-THC)		ND		ND		ND		ND		ND				ND
Cannabicyclol (CBL)		ND		ND		ND		ND		ND				NA
Cannabichromene (CBC)	1.34	0.13	0.61	0.06	0.43	0.04	0.62	0.06	0.64	0.06				ND
Tetrahydrocannabinolic acid A (THCA-A)	0.68	0.07	0.31	0.03		ND	0.10	0.01	0.35	0.04				ND
Cannabichromenic acid (CBCA)	1.64	0.16	0.73	0.07	0.58	0.06	1.04	0.10	0.74	0.07				ND
Unique Cannabinoids Detected:	9		7		6		12		9		2		3	
Total Cannabinoid Content:	243.00	24.30	89.29	8.93	60.32	6.03	87	8.73	105.39	10.54	98.21	9.82	120.3	12.03
Total THC Content:		0.14		0.06		0.03		0.05		0.07		0.00		ND
Total CBD Content:		1.66		0.00		0.00		0.02		0.00		0.00		0.08

$$\text{Cannabinoid (wt\%)} = (\text{Concentration of Component, ppm}) \left(\frac{\text{Extraction vol, mL}}{\text{Sample Aliquot, mg}} \right) (\text{Dilution factor})(\text{Conversion mL to L}) * 100$$

$$\text{Total THC (wt.\%)} = \text{conc. } \Delta 9\text{-THC (wt.\%)} + (\text{conc. THCA (wt.\%)} \times 0.877)$$

$$\text{Total CBD (wt.\%)} = \text{conc. CBD (wt.\%)} + (\text{conc. CBD (wt.\%)} \times 0.877)$$

Extraction The Cannabinoid Breakdown – Chemovar 2

Chemovar 2	Method 1		Method 2		AOAC		Restek		ASTM		DCC 200		C of A	
	mg/g	wt %	mg/g	wt %	mg/g	wt %	mg/g	wt %	mg/g	wt %	mg/g	wt %	mg/g	wt %
Cannabidivarinic Acid (CBDVA)	1.15	0.11	0.11	0.01		ND	1.12	0.11	0.76	0.08			0.90	0.09
Cannabidivarin (CBDV)	2.17	0.22	0.68	0.07	0.54	0.05	1.24	0.12	1.10	0.11	0.88	0.09		ND
Cannabidiolic acid (CBDA)	177.05	17.70	146.37	14.64	129.75	12.97	151.06	15.11	188.10	18.81	160.10	16.01	195.00	19.5
Cannabigerolic acid (CBGA)	8.82	0.88	2.24	0.22	2.88	0.29	4.18	0.42	3.01	0.30	1.77	0.18	5.00	0.50
Cannabigerol (CBG)	3.01	0.30	1.77	0.18	2.20	0.22	2.40	0.24	2.73	0.27	34.51	3.45	0.60	0.06
Cannabidiol (CBD)	51.72	5.17	21.77	2.18	20.31	2.03	25.77	2.58	28.60	2.86			3.20	0.32
Tetrahydrocannabivarin (THCV)	1.47	0.15	2.70	0.27		ND	0.66	0.07	3.67	0.37	0.09	0.01		ND
Tetrahydrocannabivarinic acid (THCVA)		ND		ND		ND		ND		ND				ND
Cannabinol (CBN)		ND		ND		ND		ND		ND				ND
Cannabinolic acid (CBNA)	0.63	0.06	2.29	0.23	0.32	0.03	0.16	0.02	0.36	0.04				ND
Δ9 - Tetrahydrocannabinol (Δ9-THC)	8.17	0.82	4.79	0.48	4.33	0.43	7.06	0.71	5.91	0.59	7.54	0.75	1.7	0.17
Δ8 - Tetrahydrocannabinol (Δ8-THC)		ND		ND		ND		ND		ND			ND	ND
Cannabicyclol(CBL)	2.50	0.25	0.88	0.09	0.32	0.03	1.36	0.14	1.20	0.12	1.56	0.16	NA	NA
Cannabichromene (CBC)	6.56	0.66	3.47	0.35	3.06	0.31	4.50	0.45	3.87	0.39	5.98	0.60	0.20	0.02
Tetrahydrocannabinolic acid A (THCA-A)	6.98	0.70	3.94	0.39	3.80	0.38	5.74	0.57	5.23	0.52	3.24	0.32	7.60	0.76
Cannabichromenic acid (CBCA)	16.97	1.70	8.14	0.81	8.67	0.87	10.80	1.08	16.65	1.67	7.52	0.75	11.5	1.15
Unique Cannabinoids Detected:	13		13		11		13		13		10		9	
Total Cannabinoid Content:	287.20	28.72	199.13	19.91	176.18	17.62	216.07	21.61	261.19	26.12	223.18	22.32	225.7	22.57
Total THC Content:		1.43		0.82		0.77		1.21		1.05		1.04		0.8
Total CBD Content:		20.70		15.01		13.41		15.83		19.36		14.04		17.42

$$\text{Cannabinoid (wt\%)} = (\text{Concentration of Component, ppm}) \left(\frac{\text{Extraction vol, mL}}{\text{Sample Aliquot, mg}} \right) (\text{Dilution factor})(\text{Conversion mL to L}) * 100$$

$$\text{Total THC (wt.\%)} = \text{conc. } \Delta 9\text{-THC (wt.\%)} + (\text{conc. THCA (wt.\%)} \times 0.877)$$

$$\text{Total CBD (wt.\%)} = \text{conc. CBD (wt.\%)} + (\text{conc. CBD (wt.\%)} \times 0.877)$$

Extraction Efficiency

Chemovar 1	Total Cannabinoids Extracted		
Sample Prep Method	Cannabinoids Recovered 1 st Extraction (mg/g)	Cannabinoids Recovered 2 nd Extraction (mg/g)	Extraction Efficiency (%)
Method 1	243.0	1.31	98.93
Method 2	89.29	0.20	99.55
AOAC	60.32	0.28	99.09
Restek	87.34	2.09	95.33
ASTM	105.39	1.20	97.75
DCC	63.54	0.31	98.97

Chemovar 1
C of A
mg/g
120.3

$$\text{Extraction Efficiency (\%)} = \left(\frac{\left| \text{cannabinoids recovered 1st extraction (mg/g)} - \text{cannabinoids recovered 2nd extraction (mg/g)} \right|}{\text{cannabinoids recovered 1st extraction (mg/g)} + \text{cannabinoids recovered 2nd extraction (mg/g)}} \right) \times 100$$

Chemovar 2	Total Cannabinoids Extracted		
Sample Prep Method	Cannabinoids Recovered 1 st Extraction (mg/g)	Cannabinoids Recovered 2 nd Extraction (mg/g)	Extraction Efficiency (%)
Method 1	287.20	4.94	96.62
Method 2	199.13	0.43	99.57
AOAC	176.18	0.38	99.57
Restek	216.07	5.49	95.05
ASTM	261.19	2.39	98.19
DCC	223.18	1.30	98.84

Chemovar 2
C of A
mg/g
225.70

Comparison of Chemovars

Sample Prep Method	Chemovar 1	Chemovar 2	Percent Difference (%)
	Extraction Efficiency (%)	Extraction Efficiency (%)	
Method 1	98.93	96.62	2.36
Method 2	99.55	99.57	0.02
AOAC	99.09	99.57	0.48
Restek	95.33	95.05	0.29
ASTM	97.75	98.19	0.45
DCC	98.97	98.84	0.13

$$\text{Percent Difference}(\%) = \left(\frac{(|\text{chemovar 1 efficiency}(\%) - \text{chemovar 2 efficiency}(\%)|)}{\left(\frac{\text{chemovar 1 efficiency}(\%) + \text{chemovar 2 efficiency}(\%)}{2} \right)} \right) \times 100$$

5 out of 6 tested methods were < 0.5 % difference

Extraction Solvent Cost

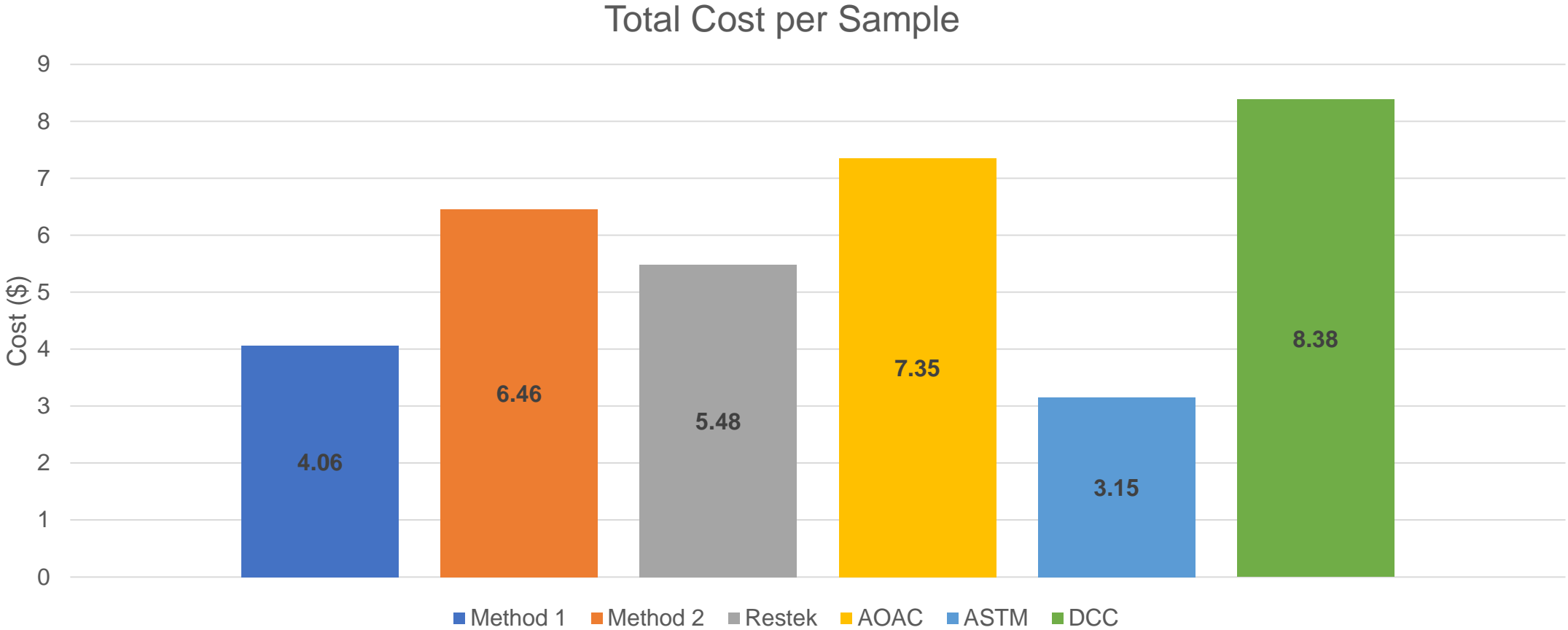
Sample Prep Method	Qty. of Solvent (mL)	Solvent Type	Cost Solvent / mL	Total Solvent Cost / sample
Method 1	20	MeOH	\$ 0.04	\$ 0.77
Method 2	50	EtOH	\$ 0.05	\$ 2.26
AOAC	50	EtOH	\$ 0.05	\$ 2.26
Restek	10	MeOH	\$ 0.04	\$ 0.38
ASTM	8	MeOH	\$ 0.04	\$ 0.42
	2	Water	\$ 0.06	
DCC	32	ACN	\$ 0.11	\$ 3.76
	8	MeOH	\$ 0.04	

Sample Prep Consumables Cost

Consumable	Ave. Cost
50 mL centrifuge tube	\$ 0.73
15 mL centrifuge tube	\$ 0.63
0.2 µm Filter Vial	\$ 3.84
Grade 390 Filter paper	\$ 0.56
Syringe Filter 0.45 µm	\$ 1.78
Syringe Filter 0.2 µm	\$ 1.91
Plastic Syringe	\$ 0.53
2 mL centrifuge vial	\$ 0.13
2 mL Amber vials	\$ 0.33
Screw Caps	\$ 0.40
Glass Vial inserts	\$ 0.74
Glass Pipette	\$ 0.15


Sample Prep Method	Consumables Cost / Sample
Method 1	\$ 3.29
Method 2	\$ 4.20
AOAC	\$ 5.09
Restek	\$ 5.09
ASTM	\$ 2.73
DCC	\$ 4.63

Total Sample Prep Cost



Time

Sample Prep Method	Time/sample (min)
Method 1	20
Method 2	80
AOAC	95
Restek	31.5
ASTM	18
DCC	51



*Does not include batch processing

Grading System

	Sample Prep Method	Solvent Cost
✗	DCC	\$3.76
✗	Method 2	\$2.26
✗	AOAC	\$2.26
✓	Method 1	\$0.77
✓	ASTM	\$0.42
✓	Restek	\$0.38

	Sample Prep Method	Sample Prep Time
✗	AOAC	90
✗	Method 2	80
✗	DCC	51
✓	Restek	31.5
✓	Method 1	20
✓	ASTM	18

	Sample Prep Method	Total Cost/sample
✗	DCC	\$8.38
✗	AOAC	\$7.35
✗	Method 2	\$6.46
✓	Restek	\$5.48
✓	Method 1	\$4.06
✓	ASTM	\$3.15

	Sample Prep Method	Efficiency
✗	Restek	95.19
✗	Method 1	97.73
✗	ASTM	97.97
✓	DCC	98.91
✓	AOAC	99.33
✓	Method 2	99.56

Best Overall Method:

Sample Prep Method	Qty ✓
ASTM	3
Restek	3
Method 1	3
Method 2	1
AOAC	1
DCC	1

Top Methods revised:

1. ASTM

- | | |
|-------------|---|
| ASTM | 1. Weigh 500 mg into 15 mL centrifuge tube |
| | 2. Add 5 mL 80:20 MeOH: Water |
| | 3. Vortex 90 sec |
| | 4. Centrifuge 4000 RPM 5 min |
| | 5. Transfer supernatant to clean 15 mL tube |
| | 6. Repeat steps 2-4 add to tube containing 1 st extraction |
| | 7. Vortex mix 5-10 sec |
| | 8. Supernatant diluted 10 and 100 fold w/ 25:75 H ₂ O:ACN |

2. Restek

- | | |
|---------------|--|
| Restek | 1. Weigh 500 mg flower into 15mL centrifuge tube |
| | 2. Add 5mL MeOH |
| | 3. Vortex 15 sec sonicate 2.5 min (x3) |
| | 4. Centrifuge 4000 RPM for 5 min |
| | 5. Repeat steps 2-3 |
| | 6. Filter using 0.2 µm filter vial |
| | 7. Supernatant diluted 10 and 100 fold w/ 25:75 H ₂ O:ACN |

3. Method 1

- | | |
|-----------------|--|
| Method 1 | 1. Weigh 500 mg flower into a 50 mL centrifuge tube |
| | 2. Add 20 mL MeOH |
| | 3. Vortex/shake 10min |
| | 4. Aliquot 1 mL aliquot into new vial |
| | 5. Centrifuge 5000 RPM 5min |
| | 6. Filter using 4 mm 0.45 µm regenerated cellulose (RC) syringe filter |
| | 7. Supernatant diluted 10 and 100 fold w/ 25:75 H ₂ O:ACN |

Apples to Apples

Chemovar 2 (500 mg)	Method 1		Restek		ASTM		DCC 500		C of A	
	mg/g	wt %	mg/g	wt %	mg/g	wt %	mg/g	wt %	mg/g	wt %
Cannabidivarinic Acid (CBDVA)	0.67	0.07	1.12	0.11	0.54	0.05	0.21	0.02	0.90	0.09
Cannabidivarin (CBDV)	1.32	0.13	1.24	0.12	1.30	0.13	1.23	0.12		ND
Cannabidioloic acid (CBDA)	147.01	14.70	151.06	15.11	169.17	16.92	162.88	16.29	195.00	19.5
Cannabigerolic acid (CBGA)	3.80	0.38	4.18	0.42	4.00	0.40	3.89	0.39	5.00	0.50
Cannabigerol (CBG)	1.70	0.17	2.40	0.24	2.58	0.26	2.16	0.22	0.60	0.06
Cannabidiol (CBD)	34.00	3.40	25.77	2.58	39.10	3.91	33.56	3.36	3.20	0.32
Tetrahydrocannabivarin (THCV)	0.22	0.02	0.66	0.07	0.57	0.06	1.44	0.14		ND
Tetrahydrocannabivarinic acid (THCVA)	0.14	0.01		ND	0.17	0.02	0.99	0.10		ND
Cannabinol (CBN)				ND						ND
Cannabinolic acid (CBNA)	1.78	0.18	0.16	0.02	1.92	0.19				ND
Δ9 - Tetrahydrocannabinol (Δ9-THC)	12.10	1.21	7.06	0.71	7.89	0.79	5.77	0.58	1.7	0.17
Δ8 - Tetrahydrocannabinol (Δ8-THC)				ND			0.00		ND	ND
Cannabicyclol(CBL)	1.13	0.11	1.36	0.14	1.37	0.14	2.77	0.28	NA	NA
Cannabichromene (CBC)	8.15	0.82	4.50	0.45	5.56	0.56	4.44	0.44	0.20	0.02
Tetrahydrocannabinolic acid A (THCA-A)	2.02	0.20	5.74	0.57	4.71	0.47	2.43	0.24	7.60	0.76
Cannabichromenic acid (CBCA)	5.79	0.58	10.80	1.08	9.89	0.99	6.24	0.62	11.5	1.15
Unique Cannabinoids Detected:	14		13		14		14		9	
Total Cannabinoid Content:	219.83	21.98	216.07	21.61	248.78	24.88	227.99	22.80	225.7	22.57
Total THC Content:		1.39		1.21		1.20		0.79		0.8
Total CBD Content:		16.29		15.83		18.75		17.64		17.42

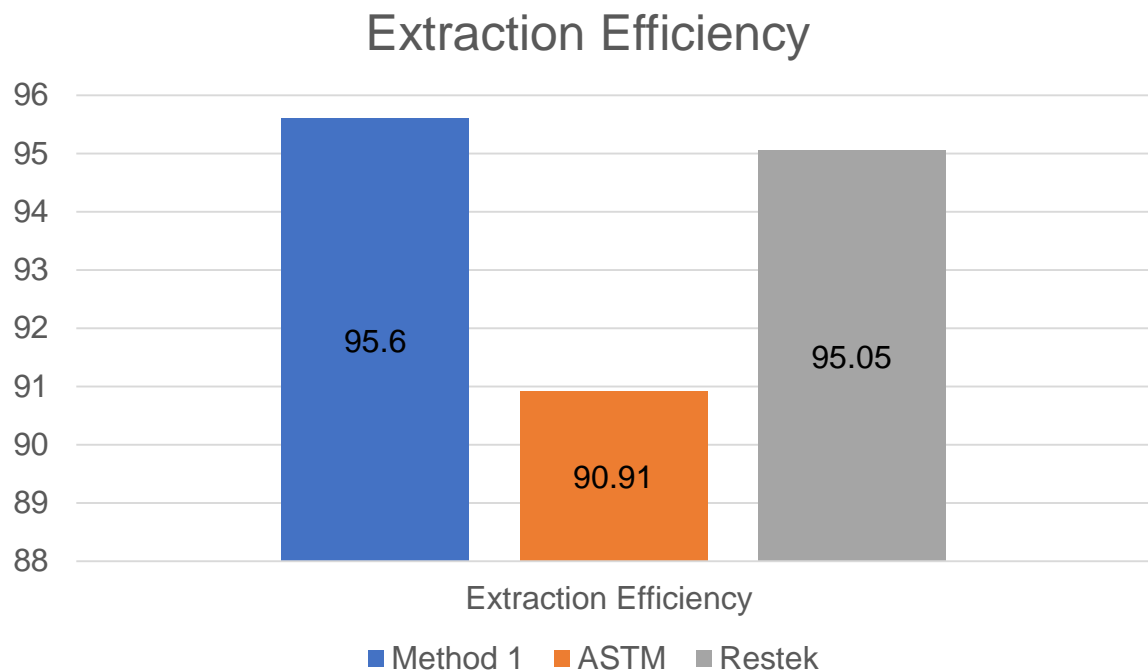
Efficiency compared – Prescribed vs. Modified

Prescribed wt.	Total Cannabinoids Extracted		
Sample Prep Method	Cannabinoids Recovered 1 st Extraction (mg/g)	Cannabinoids Recovered 2 nd Extraction (mg/g)	Extraction Efficiency (%)
Method 1 - 200 mg	287.20	4.94	96.62
Restek - 500 mg	216.07	5.49	95.05
ASTM - 100 mg	261.19	2.39	98.19
DCC - 200 mg	223.18	1.30	98.84

500 mg	Total Cannabinoids Extracted		
Sample Prep Method	Cannabinoids Recovered 1 st Extraction (mg/g)	Cannabinoids Recovered 2 nd Extraction (mg/g)	Extraction Efficiency (%)
Method 1	219.83	4.94	95.60
Restek	216.20	5.49	95.05
ASTM	243.62	11.60	90.91
DCC	227.00	2.74	97.62

Sample Prep Method	Prescribed wt.	@ 500 mg	Percent Difference (%)
	Extraction Efficiency (%)	Extraction Efficiency (%)	
Method 1	96.62	95.60	1.06
ASTM	98.19	90.91	7.70
DCC	98.84	97.62	1.24

Summary



	Technique	Result
Extraction Solvent Cost/ Sample (\$)	Method 1	\$ 0.77
	ASTM	\$ 0.42
	Restek	\$ 0.38
Extraction Efficiency (%) @ 500 mg	Method 1	95.60 %
	ASTM	90.91 %
	Restek	95.05 %
Sample Prep Time (min)	Method 1	20
	ASTM	18
	Restek	31.5
Extraction Consumable Cost/Sample (\$)	Method 1	\$ 3.29
	ASTM	\$ 2.73
	Restek	\$ 5.09

Best for Method for you?

- This is will be determined by each labs individual needs.
 - ❖ Quantity of cannabinoids detectable
 - ❖ Concentration of detected cannabinoids
 - ❖ State regulations/qualifications
 - ❖ Cost per sample – (i.e. solvent/labor/waste disposal/consumables)
 - ❖ Equipment availability – (i.e. glassware, vacuum manifolds, filter paper etc.)

Questions?

