# Removal of Purple Pigmentation from Cannabis using QuEChERS Extraction, ChloroFiltr® dSPE Clean-up and LC-MS/MS

## UCT Part Numbers

**ECMSSC-MP**
Mylar pouch containing 4g $MgSO_4$ and 1g NaCl

**CUMPSGGC182CT**
2mL dSPE tube containing 150 mg $MgSO_4$, 50 mg PSA, 50 mg C18 and 50 mg ChloroFiltr®

**SLAQ100ID21-3UM**
Selectra® Aqueous C18 HPLC column, 100 × 2.1 mm, 3 µm

**SLAQGDC20-3UM**
Selectra® Aqueous C18 guard cartridge, 10 × 2.1 mm, 3 µm

**SLGRDHLDR**
Guard cartridge holder

ENVIRO


## Summary:

Cannabis testing laboratories have the challenge of removing a variety of unwanted matrix components from plant material prior to running extracts on their LC-MS/MS or GC-MS. The complexity of the cannabis plant presents additional analytical challenges that do not need to be accounted for in other agricultural products. Up to a third of the overall mass of cannabis seed, half of usable flower, and nearly all of extracts can be contributed to essential oils such as terpenes, flavonoids and actual cannabinoid content (1). The biodiversity of this plant is exhibited in the over 2,000 unique strains that have been identified, each with their own pigmentation, cannabinoid profile and overall suggested medicinal use (2). While novel methods have been developed for the removal of chlorophyll, few, if any, sample preparation methods have been devoted to removal of other colored pigments from cannabis.

This application note outlines a QuEChERS extraction procedure for the analysis of 5 mycotoxins and 47 pesticides in cannabis. Using first an unbuffered QuEChERS salt blend, 7 dSPE configurations were evaluated for the removal of purple pigmentation, in addition to chlorophyll present in the plant material. Most of the LC-MS/MS amenable compounds on the Massachusetts and Nevada monitoring lists of pesticides and mycotoxins are included. Liquid chromatography, using a Selectra® Aqueous C18 column, coupled to tandem mass spectrometry (LC-MS/MS) is used for analysis of the pesticides and mycotoxins.

## QuEChERS Procedure:

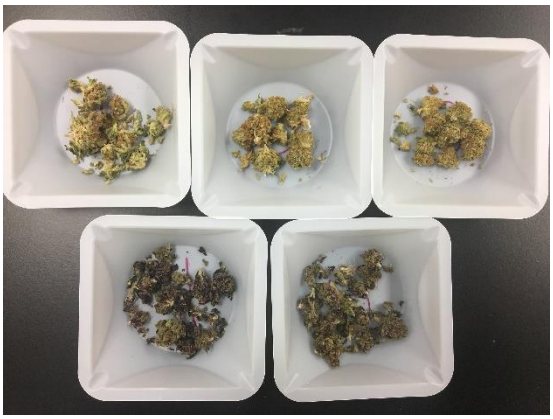

**Figure 1.** Cannabis strains used (clockwise from top left):
Agent Orange, Tahoe OG, Blue Skunk, Grand Daddy and Grape Drink

### Sample Extraction:

1. Weigh 1 g of cannabis sample into a 50 mL polypropylene centrifuge tube.
2. Add internal standard(s).
3. Add 10 mL ultrapure water, vortex briefly, and allow sample to hydrate for 15 min (improves extraction efficiency).
4. Add 10 mL acetonitrile containing 2% formic acid.
5. Add the contents of the **ECMSSC-MP** Mylar pouch and shake for a minimum of 5 minutes (by hand or mechanically). For this work a Spex 2010 Geno/Grinder® was used (1500 RPM).
6. Centrifuge the sample at ≥ 3000 rcf for 5 minutes.

### dSPE Clean-up:

1. Transfer 1 ml of supernatant to a dSPE cleanup tube (**CUMPSGGC182CT**).
2. Vortex the sample for 30 seconds.
3. Centrifuge the sample at ≥ 3000 rcf for 5 minutes.
4. Transfer the purified and filtered sample extract into an autosampler vial for analysis.

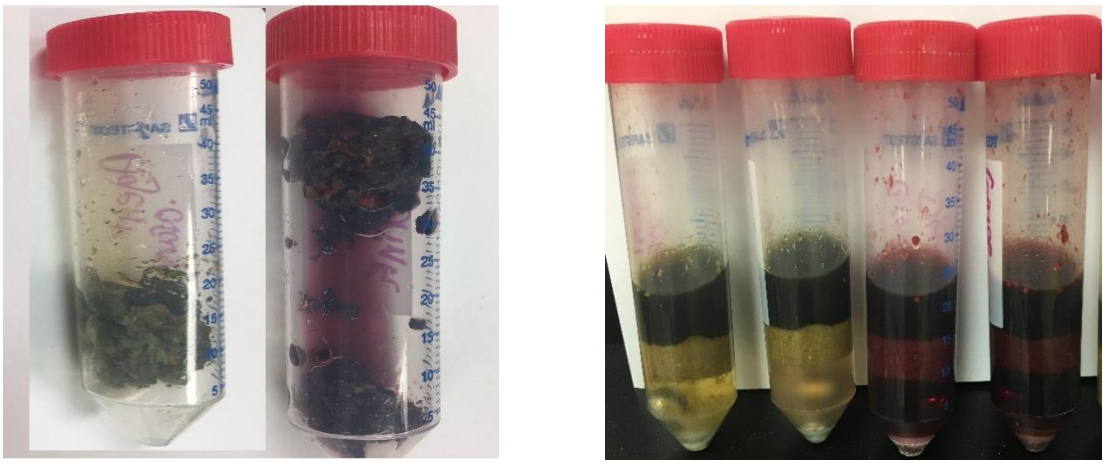

**Figure 2.** Cannabis samples following hydration (left) and QuEChERS extraction (right)

ENVIRO

| Table 1. dSPE Blends Evaluated | |
|---|---|
| A | 150 mg MgSO4, 50 mg PSA, 50 mg C18, 50 mg Chlorofiltr® |
| B | 150 mg MgSO4, 50 mg PSA |
| C | 150 mg MgSO4, 25 mg C18 |
| D | 150 mg MgSO4, 50 mg PSA, 50 mg C18 |
| E | 150 mg MgSO4, 25 mg PSA, 7.5 mg GCB |
| F | 150 mg MgSO4, 50 mg PSA, 50 mg C18, 50 mg GCB |
| G | 150 mg MgSO4, 50 mg C18, 50 mg Chlorofiltr® |

## LC-MS/MS Parameters:

| Table 2. Instrumentation | |
|---|---|
| **HPLC system** | Thermo Scientific™ Dionex™ Ultimate™ 3000 |
| **MS system** | Thermo Scientific™ TSQ Vantage™ (MS/MS) |
| **HPLC column** | UCT Selectra® Aqueous C18, 100 × 2.1 mm, 3 µm (p/n: SLAQ100ID21-3UM) |
| **Guard column** | UCT Selectra® Aqueous C18, 10 × 2.1 mm, 3 µm (p/n: SLAQGDC20-3UM) |
| **Guard column holder** | p/n: SLGRDHLDR |
| **Column temperature** | 40°C |
| **Flow rate** | 300 µL/min |
| **Injection volume** | 5 µL |

| Table 3. Mobile Phase Gradient | | |
|---|---|---|
| **Time (min)** | **% Mobile Phase A (Water + 5mM $NH_4HCO_2$ + 0.1% formic acid)** | **% Mobile Phase B (Methanol + 5mM $NH_4HCO_2$ + 0.1% formic acid)** |
| 0.0 | 100 | 0 |
| 2.0 | 50 | 50 |
| 5.0 | 50 | 50 |
| 5.5 | 40 | 60 |
| 9.0 | 40 | 60 |
| 12.0 | 0 | 100 |
| 15.0 | 0 | 100 |
| 15.1 | 100 | 0 |
| 20.0 | 100 | 0 |

| Table 4. MS Parameters and Retention Times | | | | | | |
|---|---|---|---|---|---|---|
| **Analyte** | **RT** | **Parent ion** | **Product 1** | **CE 1** | **Product 2** | **CE 2** |
| Abamectin ($M+NH_4$) | 14.00 | 890.5 | 305.0 | 24 | 567.2 | 9 |
| Acephate | 3.75 | 184.0 | 95.1 | 23 | 143.0 | 6 |
| Acequinocyl | 13.75 | 384.4 | 119.1 | 31 | 177.1 | 13 |
| Acetochlor | 11.00 | 270.1 | 148.1 | 18 | 224.1 | 10 |
| Aflatoxin B1 | 7.65 | 313.0 | 241.0 | 36 | 285.1 | 21 |
| Aflatoxin B2 | 7.25 | 315.1 | 259.1 | 28 | 287.1 | 24 |
| Aflatoxin G1 | 6.65 | 329.0 | 199.0 | 48 | 243.0 | 25 |
| Aflatoxin G2 | 6.35 | 331.1 | 189.0 | 39 | 245.1 | 28 |
| Aldicarb sulfoxide | 4.35 | 207.1 | 69.2 | 17 | 89.1 | 13 |
| Atrazine | 8.60 | 216.1 | 68.1 | 34 | 174.1 | 16 |
| Bifenazate | 10.90 | 301.1 | 170.1 | 18 | 198.1 | 6 |
| Carbaryl | 7.50 | 202.1 | 127.1 | 29 | 145.1 | 11 |
| Chlorpyrifos | 13.85 | 349.9 | 97.0 | 32 | 197.9 | 19 |
| Cyprodinil | 12.45 | 226.1 | 77.1 | 43 | 93.1 | 33 |
| DEET | 8.60 | 192.1 | 91.1 | 29 | 119.1 | 17 |
| Dichlorvos | 6.80 | 220.9 | 109.1 | 18 | 127.1 | 13 |
| Dichrotophos | 5.05 | 238.1 | 112.1 | 12 | 127.0 | 18 |
| Dimethomorph | 10.80 | 388.2 | 165.1 | 30 | 301.1 | 19 |
| Etoxazole | 14.00 | 360.3 | 113.1 | 54 | 141.1 | 30 |
| Fenamiphos sulfone | 7.30 | 336.1 | 188.0 | 26 | 266.0 | 19 |
| Fenamiphos sulfoxide | 7.45 | 320.1 | 108.1 | 40 | 233.0 | 24 |
| Fenhexamid | 11.20 | 302.2 | 216.2 | 27 | 270.2 | 19 |
| Fenoxycarb | 12.30 | 302.1 | 88.1 | 17 | 116.1 | 7 |
| Flonicamid (ESI-) | 4.50 | 228.1 | 81.1 | 13 | 146.0 | 22 |
| Fludioxinil (ESI-) | 10.30 | 247.1 | 126.1 | 32 | 180.1 | 29 |
| Flutriafol | 8.10 | 302.1 | 70.1 | 17 | 123.0 | 28 |
| Imazilil | 8.10 | 297.1 | 159.0 | 24 | 201.0 | 17 |
| Imidacloprid | 5.30 | 256.1 | 175.1 | 17 | 209.1 | 17 |
| Malathion | 9.80 | 331.0 | 99.0 | 25 | 127.0 | 12 |
| Metamidophos | 3.10 | 142.0 | 94.1 | 14 | 125.0 | 13 |
| Myclobutanil | 10.80 | 289.2 | 70.1 | 18 | 125.1 | 31 |
| Ochratoxin A | 10.80 | 404.0 | 102.1 | 63 | 239.0 | 22 |
| Oxydemeton methyl | 4.70 | 247.0 | 109.0 | 27 | 169.0 | 13 |
| Paclobuterol | 9.80 | 294.1 | 70.1 | 19 | 125.0 | 33 |
| Piperonyl butoxide | 13.75 | 356.3 | 119.1 | 31 | 177.1 | 12 |
| Pymetrozine | 4.50 | 218.1 | 105.1 | 20 | 176.1 | 17 |
| Pyrazophos | 13.20 | 374.1 | 194.1 | 31 | 222.1 | 20 |
| Pyrethrin I ($M+NH_4$) | 10.95 | 346.2 | 170.1 | 22 | 198.1 | 12 |
| Pyrethrin II ($M+NH_4$) | 10.80 | 390.2 | 165.1 | 29 | 303.1 | 19 |
| Simazine | 7.65 | 202.1 | 124.1 | 16 | 132.0 | 19 |
| Spinetroram | 13.85 | 748.6 | 98.0 | 37 | 142.1 | 29 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Spinosyn A | 13.55 | 732.6 | 97.9 | 40 | 142.1 | 29 |
| Spinosyn D | 13.85 | 746.6 | 97.9 | 36 | 142.1 | 28 |
| Spiromesifen | 13.95 | 273.1 | 187.1 | 16 | 255.2 | 13 |
| Spirotetramat | 11.20 | 374.2 | 216.1 | 31 | 302.2 | 16 |
| Tebuconazole | 12.60 | 308.1 | 70.1 | 21 | 125.0 | 33 |
| Tebuthiuron | 7.60 | 229.1 | 116.0 | 26 | 172.1 | 16 |
| Thiabendazole | 5.70 | 202.0 | 131.1 | 31 | 175.1 | 25 |
| Thiabendazole-$^{13}C_6$ (IS) | 5.70 | 208.0 | 137.1 | 32 | 181.1 | 25 |
| Thiamethoxam | 4.80 | 292.1 | 181.1 | 21 | 211.1 | 11 |
| Triadimefon | 10.20 | 294.1 | 69.1 | 20 | 197.1 | 14 |
| Triethylphosphorothioate | 13.70 | 199.0 | 125.0 | 16 | 143.0 | 14 |
| Trifloxystrobin | 13.30 | 409.2 | 145.0 | 41 | 186.1 | 17 |
| Zoxamide | 12.45 | 336.0 | 159.0 | 38 | 187.0 | 21 |

## Results:

**Table 5. Recovery and Precision Data for Pesticides and Mycotoxins in Cannabis**

| (n=4) | Recovery | RSD | Recovery | RSD | Recovery | RSD | Recovery | RSD |
|---|---|---|---|---|---|---|---|---|
| **Mycotoxins** | | | | | | | | |
| Conc. in sample | **20 ng/g** | | **50 ng/g** | | **100 ng/g** | | **200 ng/g** | |
| Conc. in extract | **2 ng/mL** | | **5 ng/mL** | | **10 ng/mL** | | **20 ng/mL** | |
| Aflatoxin B1 | 67.6 | 1.92 | 73.8 | 1.39 | 72.4 | 1.11 | 79.3 | 1.23 |
| Aflatoxin B2 | 67.4 | 2.26 | 77.0 | 2.26 | 75.3 | 2.70 | 81.0 | 1.55 |
| Aflatoxin G1 | 69.5 | 5.37 | 76.6 | 1.78 | 75.1 | 2.06 | 80.0 | 1.71 |
| Aflatoxin G2 | 75.3 | 3.72 | 77.5 | 1.31 | 73.3 | 1.91 | 79.4 | 2.42 |
| Ochrotoxin A | 22.6 | 29.38 | 47.0 | 5.82 | 48.6 | 2.08 | 52.7 | 3.19 |
| **Pesticides** | | | | | | | | |
| Conc. in sample | **50 ng/g** | | **100 ng/g** | | **200 ng/g** | | **500 ng/g** | |
| Conc. in extract | **5 ng/mL** | | **10 ng/mL** | | **20 ng/mL** | | **50 ng/mL** | |
| Abamectin | ND | ND | ND | ND | ND | ND | 88.2 | 6.50 |
| Acephate | 44.9 | 4.09 | 65.4 | 3.72 | 67.3 | 3.99 | 75.7 | 2.60 |
| Acetochlor | 89.7 | 5.08 | 86.4 | 1.71 | 86.0 | 1.33 | 82.7 | 2.02 |
| Aldicarb sulfoxide | < LOD | < LOD | 52.9 | 5.85 | 67.2 | 4.89 | 72.6 | 3.19 |
| Atrazine | 91.4 | 1.33 | 91.1 | 3.09 | 88.8 | 3.13 | 86.3 | 2.13 |
| Bifenazate | 84.0 | 3.76 | 80.4 | 1.41 | 78.9 | 2.57 | 77.8 | 2.78 |
| Carbaryl | 78.7 | 2.56 | 76.0 | 6.54 | 89.2 | 2.04 | 80.6 | 0.55 |
| Chlorpyrifos | < LOD | < LOD | 79.7* | 9.39* | 79.7 | 3.71 | 85.0 | 2.60 |
| DEET | 92.6 | 2.38 | 88.2 | 3.92 | 92.0 | 4.02 | 84.2 | 2.13 |
| Dichlorvos | 83.4 | 8.99 | 81.2 | 4.44 | 83.3 | 3.94 | 81.7 | 2.45 |
| Dichrotophos | 81.4 | 2.83 | 81.0 | 3.18 | 85.3 | 3.35 | 81.1 | 2.05 |
| Dimethomorph | 85.4 | 2.98 | 81.6 | 3.87 | 85.0 | 2.73 | 81.7 | 2.03 |
| Etoxazole | 74.3 | 3.05 | 72.6 | 1.40 | 72.7 | 3.25 | 72.1 | 1.42 |
| Fenamiphos sulfone | 86.2 | 5.54 | 84.2 | 5.35 | 89.1 | 2.74 | 84.1 | 1.28 |
| Fenamiphos sulfoxide | 81.5 | 2.65 | 79.4 | 3.57 | 83.0 | 2.68 | 78.3 | 0.96 |
| Fenhexamid | 84.3 | 1.22 | 82.4 | 5.55 | 83.6 | 2.13 | 79.4 | 1.61 |
| Fenoxycarb | 85.6 | 1.72 | 81.9 | 3.89 | 79.5 | 4.55 | 80.7 | 2.08 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Flonicamid | 82.6 | 2.74 | 87.5 | 3.00 | 83.8 | 4.95 | 80.2 | 1.79 |
| Fludioxinil | 77.8 | 6.43 | 76.1 | 2.87 | 78.4 | 3.32 | 74.6 | 1.61 |
| Flutriafol | 84.7 | 1.56 | 77.7 | 3.08 | 82.0 | 2.76 | 78.1 | 1.55 |
| Imazilil | 92.6 | 1.19 | 86.2 | 4.20 | 85.2 | 1.98 | 78.7 | 1.26 |
| Imidacloprid | 72.7 | 5.24 | 76.8 | 3.22 | 81.6 | 1.87 | 77.9 | 6.85 |
| Malathion | 90.2 | 4.82 | 85.0 | 4.94 | 98.8 | 10.72 | 90.2 | 6.05 |
| Cyprodinil | 75.7 | 6.88 | 70.8 | 3.63 | 67.8 | 7.86 | 69.6 | 2.77 |
| Metamidophos | 71.2 | 7.19 | 64.6 | 1.42 | 63.4 | 2.91 | 62.8 | 2.94 |
| Myclobutanil | 90.5 | 2.06 | 83.9 | 2.78 | 85.4 | 3.32 | 81.6 | 0.42 |
| Oxydemeton methyl | 78.7 | 5.72 | 78.5 | 2.37 | 82.0 | 1.90 | 77.4 | 2.42 |
| Paclobuterol | 80.2 | 3.71 | 81.0 | 4.10 | 96.5 | 2.98 | 100.6 | 1.75 |
| Piperonyl butoxide | 64.2 | 6.46 | 69.7 | 1.92 | 73.6 | 5.05 | 76.0 | 1.76 |
| Pymetrozine | 34.2 | 4.83 | 28.7 | 12.97 | 24.7 | 4.55 | 24.2 | 9.18 |
| Pyrazophos | 79.1 | 2.60 | 76.6 | 7.81 | 78.6 | 1.12 | 83.2 | 1.27 |
| Pyrethrin I | < LOD | < LOD | < LOD | < LOD | 64.7 | 5.69 | 81.5 | 4.27 |
| Pyrethrin II | 73.6 | 6.82 | 73.2 | 3.12 | 79.9 | 0.37 | 76.5 | 1.32 |
| Simazine | 61.2 | 8.96 | 81.1 | 1.39 | 92.3 | 3.19 | 83.6 | 1.30 |
| Spinetoram | 84.3 | 3.19 | 78.9 | 5.19 | 83.8 | 3.07 | 79.1 | 3.68 |
| Spinosyn A | 82.0 | 2.73 | 78.0 | 6.75 | 79.9 | 3.32 | 75.8 | 0.60 |
| Spinosyn D | 79.5 | 2.59 | 77.2 | 6.74 | 81.5 | 3.23 | 75.3 | 0.60 |
| Spiromesifen | 37.5 | 11.95 | 59.2 | 3.31 | 67.3 | 1.07 | 67.9 | 3.08 |
| Spirotetramat | 77.2 | 4.69 | 73.8 | 6.37 | 78.3 | 2.82 | 79.1 | 1.56 |
| Tebuconazole | 80.2 | 3.68 | 79.3 | 3.43 | 78.1 | 5.70 | 78.1 | 1.02 |
| Tebuthiuron | 81.7 | 3.54 | 76.9 | 2.86 | 80.0 | 3.45 | 77.1 | 1.76 |
| Thiabendazole | 97.2 | 3.40 | 95.8 | 4.79 | 100.4 | 2.44 | 99.6 | 1.82 |
| Thiamethoxam | 86.1 | 3.97 | 80.5 | 3.78 | 81.9 | 4.21 | 79.8 | 3.25 |
| Triadimefon | 88.4 | 3.51 | 86.3 | 0.58 | 87.6 | 2.96 | 90.5 | 1.15 |
| Triethylphosphorothioate | < LOD | < LOD | 100.1 | 9.02 | 89.2 | 4.40 | 82.9 | 2.26 |
| Trifloxystrobin | 93.1 | 1.52 | 87.4 | 2.82 | 83.2 | 7.31 | 85.8 | 0.83 |
| Zoxamide | 82.6 | 4.19 | 77.6 | 4.56 | 77.9 | 1.51 | 80.6 | 1.63 |
| **Overall average** | **77.1** | **4.62** | **77.3** | **4.05** | **79.3** | **3.35** | **78.7** | **2.31** |

| Table 6. Comparison of ChloroFiltr® vs GCB | | | | |
|---|---|---|---|---|
| Conc = 200 or 500 ng/g | ChloroFiltr® | | GCB | |
| (n=4) | Recovery | RSD | Recovery | RSD |
| Aflatoxin B1 | 77.6 | 1.58 | 70.3 | 0.91 |
| Aflatoxin B2 | 78.6 | 1.04 | 63.0 | 0.66 |
| Aflatoxin G1 | 76.9 | 1.72 | 70.0 | 3.13 |
| Aflatoxin G2 | 77.6 | 1.65 | 70.5 | 2.05 |
| Ochrotoxin A | 53.9 | 3.30 | 62.2 | 3.46 |
| Abamectin | 93.0 | 6.87 | **ND** | ND |
| Acephate | 75.4 | 3.93 | 74.8 | 3.53 |
| Acetochlor | 80.7 | 0.63 | 74.7 | 1.14 |
| Aldicarb sulfoxide | 70.0 | 6.09 | 70.7 | 2.49 |
| Atrazine | 76.6 | 0.67 | 62.0 | 2.55 |
| Bifenazate | 74.7 | 1.66 | 77.2 | 0.67 |
| Carbaryl | 79.8 | 0.96 | 86.3 | 2.99 |
| Chlorpyrifos | 77.1 | 7.63 | **41.0** | 16.75 |
| DEET | 77.3 | 1.49 | 69.1 | 1.05 |
| Dichlorvos | 78.3 | 1.68 | 73.7 | 1.38 |
| Dichrotophos | 79.4 | 0.72 | 75.0 | 0.96 |
| Dimethomorph | 78.5 | 3.06 | 70.0 | 1.31 |
| Etoxazole | 70.9 | 2.10 | 64.5 | 1.60 |
| Fenamiphos sulfone | 82.0 | 1.20 | 76.8 | 0.51 |
| Fenamiphos sulfoxide | 76.7 | 1.44 | 72.6 | 1.23 |
| Fenhexamid | 76.2 | 2.04 | 73.3 | 0.75 |
| Fenoxycarb | 80.0 | 1.19 | 77.9 | 2.08 |
| Flonicamid | 77.4 | 4.44 | 69.4 | 4.78 |
| Fludioxinil | 72.3 | 1.84 | 71.0 | 1.30 |
| Flutriafol | 76.1 | 0.83 | 72.5 | 1.66 |
| Imazilil | 76.1 | 0.30 | 70.2 | 0.70 |
| Imidacloprid | 78.0 | 7.86 | 70.3 | 7.13 |
| Malathion | 85.8 | 6.95 | 78.9 | 8.48 |
| Cyprodinil | 66.6 | 6.58 | 17.0 | 3.42 |
| Metamidophos | 64.1 | 9.16 | 61.2 | 5.18 |
| Myclobutanil | 80.1 | 2.61 | 74.7 | 1.58 |
| Oxydemeton methyl | 75.6 | 1.06 | 71.2 | 1.21 |
| Paclobuterol | 93.4 | 3.90 | 88.0 | 7.71 |
| Piperonyl butoxide | 76.6 | 1.40 | 68.2 | 5.44 |
| Pymetrozine | 21.5 | 28.47 | 12.9 | 10.36 |
| Pyrazophos | 79.7 | 2.89 | 69.2 | 2.49 |
| Pyrethrin I | 77.5 | 4.84 | 70.1 | 9.29 |
| Pyrethrin II | 74.0 | 2.27 | 69.6 | 1.10 |
| Simazine | 81.0 | 0.93 | 61.7 | 3.20 |

| | | | | |
|---|---|---|---|---|
| Spinetoram | 77.4 | 2.70 | 61.6 | 1.73 |
| Spinosyn A | 73.9 | 0.56 | 63.6 | 2.30 |
| Spinosyn D | 73.4 | 0.56 | 63.8 | 2.99 |
| Spiromesifen | 66.0 | 2.08 | 65.8 | 2.20 |
| Spirotetramat | 75.5 | 0.59 | 71.1 | 0.81 |
| Tebuconazole | 76.7 | 2.32 | 72.8 | 1.87 |
| Tebuthiuron | 76.0 | 0.98 | 77.7 | 1.38 |
| Thiabendazole (no IS) | 60.0 | 2.67 | **19.8** | 2.92 |
| Thiamethoxam | 78.2 | 1.20 | 76.8 | 4.07 |
| Triadimefon | 83.2 | 3.43 | 76.8 | 1.84 |
| Triethylphosphorothioate | 82.4 | 2.77 | 79.2 | 6.79 |
| Trifloxystrobin | 82.5 | 2.77 | 69.6 | 2.60 |
| Zoxamide | 78.4 | 3.81 | 77.2 | 2.40 |
| **Overall average** | **75.6** | **3.18** | **67.6** | **3.14** |

**Note:** The sorbent combination was 150mg $MgSO_4$, 50mg PSA, 50mg C18, and either 50mg ChloroFiltr® or 7.5mg GCB. Significant variation in results are highlighted in red.

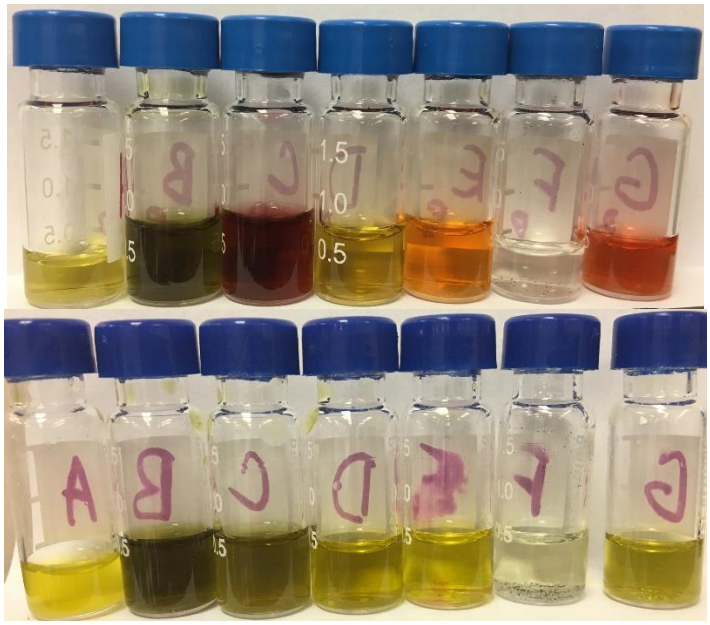

**Figure 3.** Extracts following various dSPE clean ups. Top: Grand Daddy Bottom: Tahoe OG

## Discussion:

A combination of MgSO4, C18, PSA and Chlorofiltr® (Blend A) allowed for the most sample clean up, without loss of pesticides and mycotoxins, for all cannabis samples tested. Average recovery of the 48 pesticides and five mycotoxins using the selected dSPE blend was 75.6% were as the average recovery when including GCB instead of Chlorofiltr® was 67.6%. Regardless of the sample's original pigmentation, this blend successfully removed both chlorophyll and purple hues from all strains tested. The other six dSPE blends evaluated were unable to provide the sample clean up needed or had previously demonstrated to be detrimental to the recovery of pesticides routinely analyzed in cannabis (3).

Blends B, C and G provided minimal sample cleanup for all strains of cannabis tested. As shown in Figure 3, the Grand Daddy strain still contained chlorophyll after treatment with Blend B whereas Blends C and G were unable to remove its purple hue in part to not containing any PSA. While Blend E contained 25 mg of PSA, this proved to be an inadequate amount of sorbent, as shown in Figure 3.

ENVIRO

Blend F, which contained 50 mg of GCB, provided the clearest final extracts. Previous pesticide recovery studies have demonstrated that this large of volume of GCB leads to poor recovery of planar pesticides. As states across America begin to expand their required pesticide testing lists for both recreational and medicinal cannabis laboratories, it is critical that all classes of compounds have adequate recoveries.

Blend D demonstrated removal of some chlorophyll as well as the purple pigmentation. Using this blend (150 mg MgSO4, 50 mg PSA, 50 mg C18) and including a minimal amount of GCB (7.5 mg) is commonly used in cannabis testing labs. To determine whether GCB or Chlorofiltr® provided the best sample cleanup and extraction efficiency, Blend A was compared to this additional configuration. As shown in Table 6, higher recoveries are achieved when Chlorofiltr ® is included in the dSPE blend, as opposed to GCB.

Following the use of unbuffered QuEChERS extraction salts, cannabis samples then require dSPE for optimal sample cleanup and analyte recovery. As additional cannabis strains become popular across the country, it is imperative that testing laboratories select sample preparation consumables that can remove not only chlorophyll but purple pigmentations as well. Using UCT's proprietary Chlorofiltr® in combination with PSA, both hues can be removed without comprising the recoveries of pesticides and mycotoxins.

## Conclusion:

The sample preparation technique selected by a cannabis lab for their plant material must be capable of removing both chlorophyll and other hues of pigmentation. Using a dSPE blend that contains UCT's novel Chlorofiltr®, in conjunction with PSA, C18 and MgSO4, both green and purple coloration is successfully removed from various strains of cannabis. Recovery of both pesticides and mycotoxins are maximized using the above blend, without loss of planar pesticides. Compared to typical dSPE products that utilized GCB instead of Chlorofiltr®, the blend selected has proven to be optimal for troublesome compounds that are found on a variety of state monitoring lists.

## References:


(1) Recommended methods for the identification and analysis of cannabis and cannabis products, United Nations Office of Drugs and Crime (2009)

(2) W. Ross, Newsweek, (2016)

(3) Koesukwiwat, Urairat, et al. "High Throughput Analysis of 150 Pesticides in Fruits and Vegetables Using QuEChERS and Low-Pressure Gas Chromatography Time-of-Flight Mass Spectrometry." Journal of Chromatography A, vol. 1217, no. 43, 2010, pp. 6692–6703., doi:10.1016/j.chroma.2010.05.012.





UCT, LLC • 2731 Bartram Road • Bristol, PA 19007 800.385.3153 • 215.781.9255
www.unitedchem.com Email: methods@unitedchem.com



ENVIRO