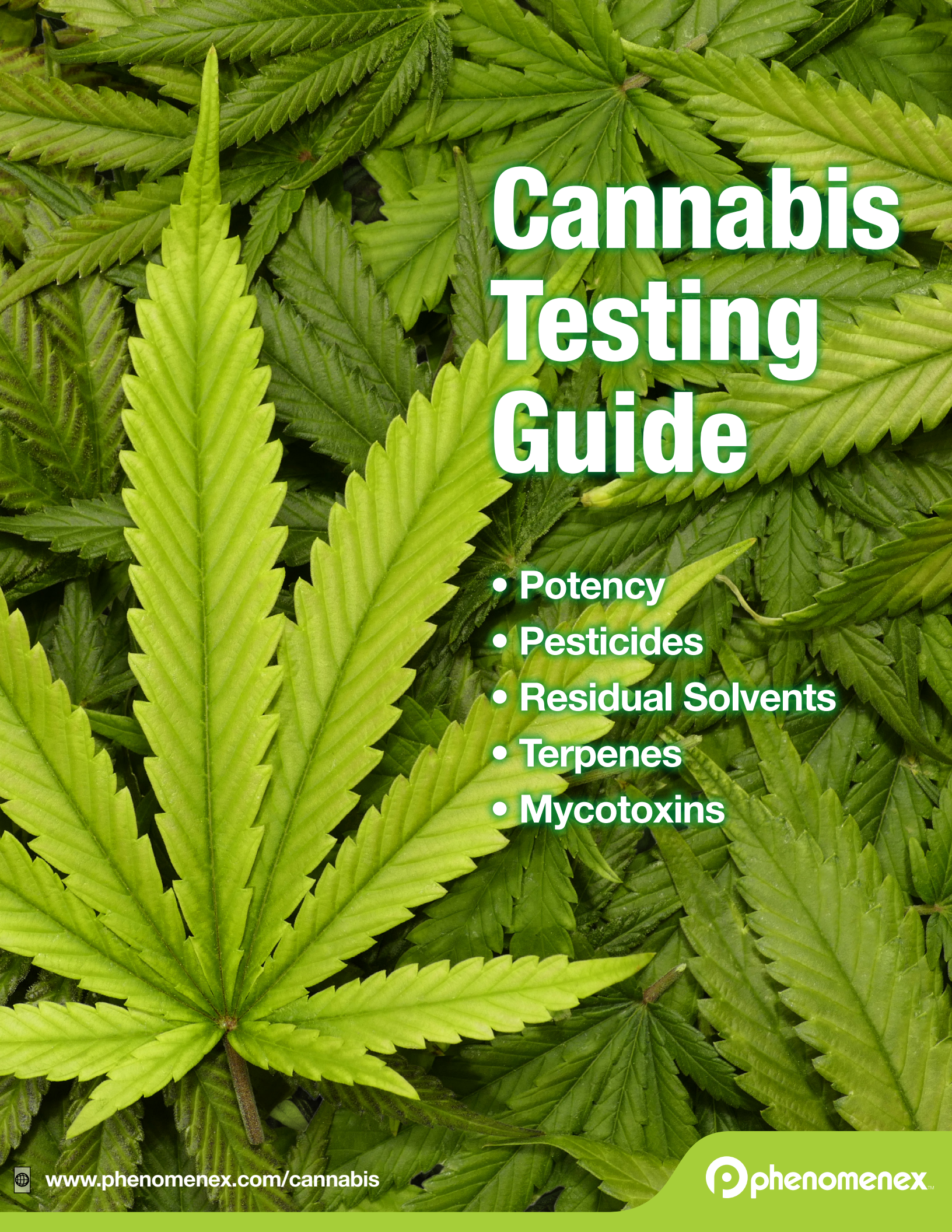


The background of the entire page is a close-up photograph of cannabis leaves. The leaves are a vibrant green color with serrated edges and a prominent central vein. They are densely packed, creating a textured, organic background.

# Cannabis Testing Guide

- Potency
- Pesticides
- Residual Solvents
- Terpenes
- Mycotoxins





# Table of Contents

**Cannabis Analysis Product Overview 03**

**Sample Preparation 04**

**HPLC / UHPLC Columns 08**

**GC Columns and Accessories 09**

**Cannabis Analysis Applications 10**

**Potency 11**

**Pesticides 15**

**Mycotoxins 22**

**Residual Solvents 23**

**Terpenes 28**

**Accessories 30**

**Ordering Information 30**



# Cannabis Analysis Product Overview

Sample Preparation

04

HPLC / UHPLC Columns

08

GC Columns and Accessories

09



# Sample Filtration

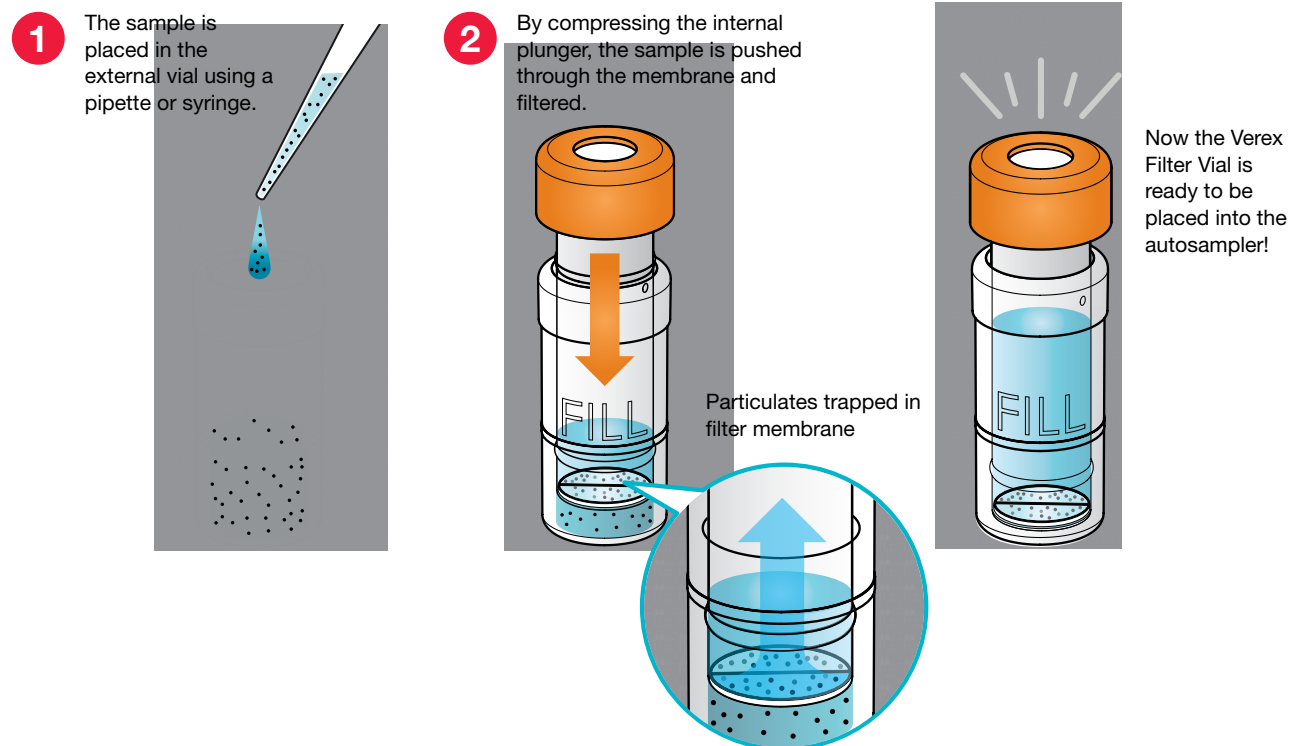
## Filter Vials



## Sample Preparation in Two Steps

Verex Filter Vials is an easy two-step sample preparation device that consists of two parts: an external vial to be filled with sample, and an internal plunger with a filtration membrane and cap with a pre-slit septa.

### Filter Vials



**Simply dispense your sample and filter!**

### Verex Filter Vial Offers:

- **All-in-one sample prep solution**  
Combines sample storage, transfer, and filtration
- **Identifiable colored caps**  
Easily find the correct membrane and pore size
- **Low dead-volume**  
Higher sample recovery and increased sensitivity

For a complete selection of Verex products and ordering part numbers visit  
[www.phenomenex.com/Products/VialDetail/VerexF](http://www.phenomenex.com/Products/VialDetail/VerexF)





# Sample Filtration

Phenex Syringe Filters

## Efficient and Rapid Filtration for a Particulate-Free Eluent



Wide variety of membranes for any application. Select your filter in three EASY steps:

### 1. What is your sample volume?

| ≤ 2 mL Sample Volume | 2 to 10 mL Sample Volume | 10 to 100 mL Sample Volume |
|----------------------|--------------------------|----------------------------|
| 4 mm Diameter        | 15 mm Diameter           | 25 - 28 mm Diameter        |
|                      |                          |                            |

### 2. What is your LC column ID?

| ≥ 3 µm  | < 3 µm  | OR                                                                                                                                                                      |
|---------|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.45 µm | 0.20 µm | Viscous samples such as serum, plasma, or other biological matrices. Solutions with high particulate load (e.g., some environmental or food and beverage applications). |
|         |         | Glass Fiber Filter with 0.45 µm membrane                                                                                                                                |

### 3. What type of sample are you working with?

| Aqueous |                                      |                                      | Solvents                                 |                                      |
|---------|--------------------------------------|--------------------------------------|------------------------------------------|--------------------------------------|
|         | Solvents Mixtures                    | Tissue Culture Media, Buffers        | Non-Aqueous                              | Aqueous Mixtures                     |
|         |                                      | Protein Analysis/ Biological Samples | Hydrophobic/ Strong Acids                | Hydrophilic                          |
|         | <b>RC</b><br>(Regenerated Cellulose) | <b>CA</b><br>(Cellulose Acetate)     | <b>PTFE</b><br>(Polytetrafluoroethylene) | <b>RC</b><br>(Regenerated Cellulose) |

### Other Applications:

| Application / Sample*               | Recommended Filter** | First Alternative |
|-------------------------------------|----------------------|-------------------|
| General GC and LC                   | RC                   | PTFE              |
| Aggressive or Pure Organic Solvents | PTFE                 | RC                |
| High Particulate Loads              | GF/NY                | GF + RC           |
| Dissolution Testing                 | GF/NY                | RC                |
| Ion Chromatography                  | RC                   | PES               |
| Trace Metals (ICP-MS, AAS)          | RC                   | PES               |
| Capillary Electrophoresis (CE)      | RC                   | PES               |
| Tissue Cultures, Media, Buffers     | GF/CA                | PES               |

\* Removal of high particulate matter with a glass fiber prefilter is critical before any drug, tox, or dirty environmental sample is filtered to ensure the highest syringe filter membrane performance.

\*\* For high load and particulate-laden samples you may consider placing a Glass Fiber (GF) prefilter, either integrated with the membrane as one unit (Phenex-GF/NY or -GF/CA) or in series with the membrane syringe filter of your choice.

Generally, 0.45 µm porosity filters are used to remove particulates from samples and mobile phase solutions. For sterile-filtration, a 0.20 µm porosity filter can be used.



# Sample Preparation

## Strata-X

### Solid Phase Extraction (SPE)

Targeted Extraction and Clean Up

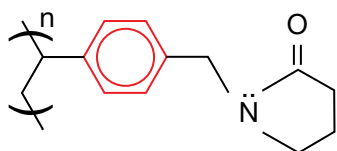
#### Strata-X

Strata-X polymeric sorbents are available in unique selectivities developed to cover a diverse spectrum of analytes and simplify the method development process for fast and efficient sample preparation.

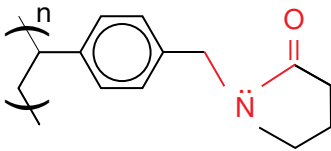
- **Tightly retain analytes**
- **Remove unwanted contaminants**
- **Easily cleanup large volume**

#### Mechanisms of Retention

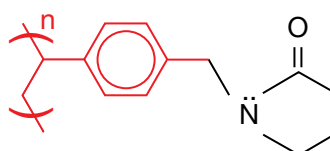
$\pi$ - $\pi$  Bonding



Hydrogen Bonding Dipole-Dipole Interactions



Hydrophobic Interaction



View all Strata-X products and ordering information

[www.phenomenex.com/StrataX](http://www.phenomenex.com/StrataX)



strata™  
Polymeric SPE

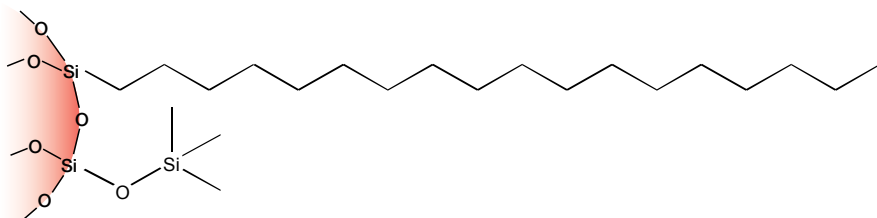


### Strata C18

SPE for extraction of hydrophobic or polar organic analytes from aqueous matrices.

#### Mechanisms of Retention

End-capped C18 sorbent that offers strong hydrophobic retention with negligible secondary polar interactions from active silanol groups.



View all Strata-X products and ordering information

[www.phenomenex.com/StrataC18](http://www.phenomenex.com/StrataC18)





# Sample Preparation

roQ QuEChERS Kits



## Why Choose roQ QuEChERS?

Improved with you in mind, roQ picks up where other QuEChERS kits fail. The unique design of the roQ QuEChERS kits eliminates common problems seen with current QuEChERS kits on the market.

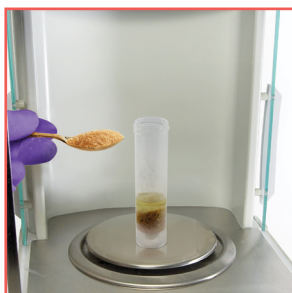
**roQ**  
QuEChERS Kits

## Ease of Use

### Built-in Removable Rack\*



### Stand Alone Extraction Tubes



### Easy Pour Salt Packets



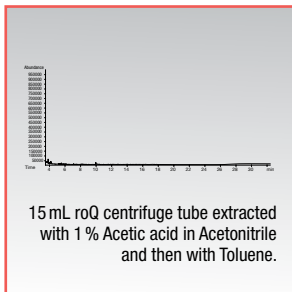
\*Applies to roQ Extraction Kits (excludes dSPE Kits)

## Quality

### Leak-Free Tubes



### Low Leachate Tubes



### Quality Management System Certified

- Validates processes to be fully established, functional, and meet international standards
- MSDS and Certificate of Analysis (CoA) available for all kits
- roQ QuEChERS kits are guaranteed for quality

QUALITY  
MANAGEMENT SYSTEM  
CERTIFIED BY DNV GL  
= 9001:2015 =

\*Applies to roQ Extraction Kits (excludes dSPE Kits)

### Salts and Sorbents used in roQ Kits

#### Extraction:

- Magnesium Sulfate ( $\text{MgSO}_4$ )
- Sodium Acetate ( $\text{NaOAc}$ )
- Sodium Chloride ( $\text{NaCl}$ )
- Sodium Citrate Tribasic Dihydrate (SCTD)
- Sodium Citrate Dibasic Sesquihydrate (SCDS)

#### Clean Up/dSPE:

- Magnesium Sulfate ( $\text{MgSO}_4$ )
- Primary/Secondary Amine (PSA)
- Endcapped C18 Sorbent (C18E)
- Graphitized Carbon Black (GCB)

For a complete selection of roQ QuEChERS and ordering part numbers visit  
[www.phenomenex.com/roQ](http://www.phenomenex.com/roQ)

# HPLC / UHPLC

## Columns



### Cutting Edge Fully Porous Silica Particle

Luna is one of the most recognized HPLC brands on the market, delivering high efficiency, ruggedness, reproducibility, and dependability for a wide range of analyses.

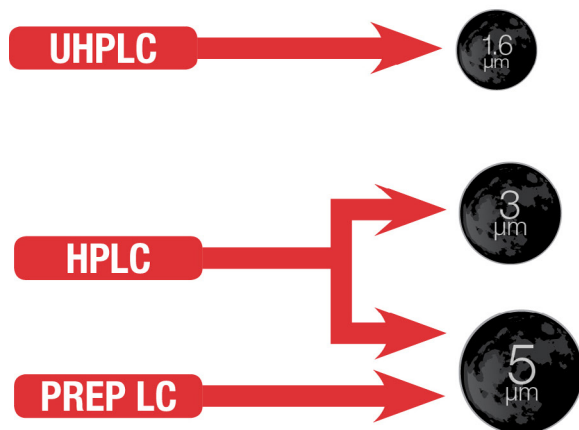


### The Chosen Core-Shell Brand

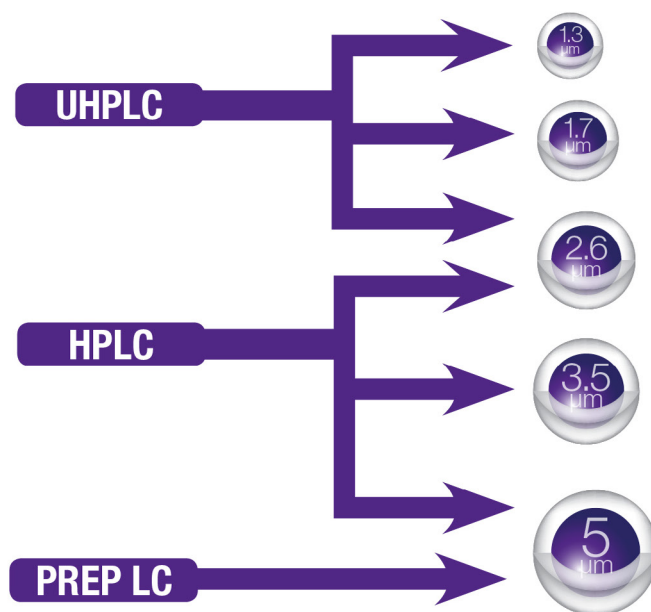
Kinetex Core-Shell Technology delivers dramatic improvements in efficiency over conventional fully porous media which can be leveraged to increase resolution, greatly improve productivity, reduce solvent consumption and decrease costs.

## Complete Scalable Solution from UHPLC to HPLC to PREP LC

### Luna Omega Particle Selection



### Kinetex Core-Shell Particle Selection



For a complete selection of HPLC and UHPLC columns and ordering part numbers visit [www.phenomenex.com/LCcolumns](http://www.phenomenex.com/LCcolumns)





## Explore the Options and Choose the Best Selectivity for Your Analysis

Zebtron GC Columns offer reliability, reproducibility, and robustness when performing cannabis testing for pesticides, terpenes, and residual solvents. Zebtron GC columns are designed to provide very low bleed levels, resulting in a gas chromatography column that offers increased sensitivity and stability over traditional GC columns on the market. Every Zebtron GC column is extensively tested to ensure: high efficiency, low bleed, optimal resolution, and best retention.

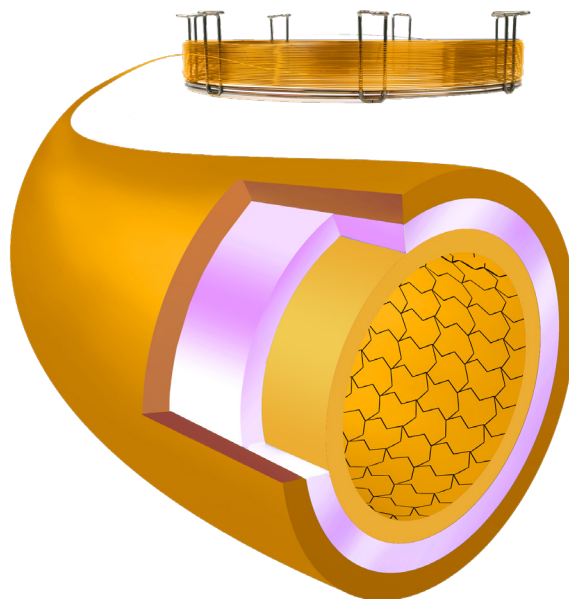
**Zebtron™**  
GC Columns

### Benefits of the ZB 624PLUS™ for Cannabis

- Superior deactivation for best resolution and enhanced peaks
- Increased sensitivity for high boiling solvent
- Extremely low bleed for GC-MS
- Robust column performance for high temperature bake outs

Click to access the selection tool to select the column with the best selectivity for your analysis.

| Column                                     | Recommended for             |
|--------------------------------------------|-----------------------------|
| <a href="#">ZB-624PLUS</a>                 | Residual Solvents, Terpenes |
| <a href="#">ZB-WAXPLUS</a>                 | Residual Solvents, Terpenes |
| <a href="#">ZB-5PLUS</a>                   | Potency, Pesticides         |
| <a href="#">ZB-MultiResidue-1 &amp; -2</a> | Pesticides                  |



## Don't Forget Your Gas Management Tools and Accessories

- Preserve the life and quality of your column and your analysis
- Avoid costly equipment failure and down-time



For a complete selection of GC columns and accessories, and ordering part numbers visit [www.phenomenex.com/Zebtron](http://www.phenomenex.com/Zebtron)



# Cannabis Analysis Applications

Potency

11

Pesticides

15

Mycotoxins

22

Residual Solvents

23

Terpenes

28





## 18 Cannabinoids for Potency Testing by LC-UV

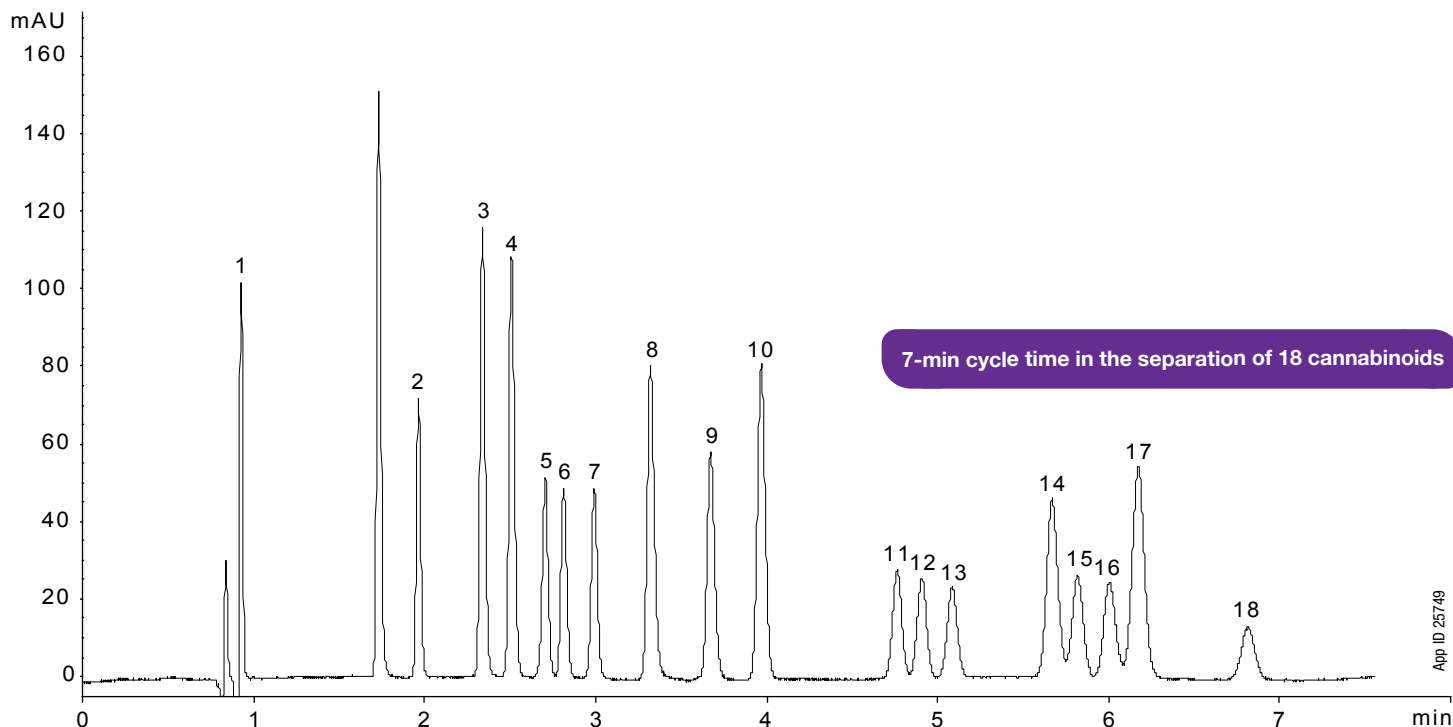


### LC-UV Conditions

**Column:** Kinetex 2.6  $\mu$ m C18  
**Dimensions:** 150 x 4.6 mm  
**Part No.:** [00F-4462-E0](#)  
**Mobile Phase:** A: 20 mM Ammonium Formate, pH 2.9 with Formic Acid  
B: Acetonitrile  
**Isocratic:** Isocratic 24:76 (A/B)  
**Flow Rate:** 1.5 mL/min  
**Injection Volume:** 2  $\mu$ L  
**Back Pressure:** ~260 bar  
**Temperature:** 40  $^{\circ}$ C  
**Flow Rate:** 1.5 mL/min  
**Detection:** UV @ 228 nm

**Analytes:**

|                                        |                                            |
|----------------------------------------|--------------------------------------------|
| 1. CBDVA Cannabidivarinic acid         | 10. CBN Cannabinol                         |
| 2. CBDV Cannabidivarin                 | 11. EXO-THC Exo-tetrahydrocannabinol       |
| 3. CBDA Cannabidiolic acid             | 12. D9-THC $\Delta$ 9-Tetrahydrocannabinol |
| 4. CBGA Cannabigerolic acid            | 13. D8-THC $\Delta$ 8-Tetrahydrocannabinol |
| 5. CBG Cannabigerol                    | 14. THCA-A Tetrahydrocannabinolic acid A   |
| 6. CBD Cannabidiol                     | 15. CBGA Cannabichromenic acid             |
| 7. THCV Tetrahydrocannabivarin         | 16. CBL Cannabicycol                       |
| 8. THCVA Tetrahydrocannabivarinic acid | 17. CBC Cannabichromene                    |
| 9. CBNA Cannabinolic acid              | 18. CBLA Cannabicyclolic acid              |



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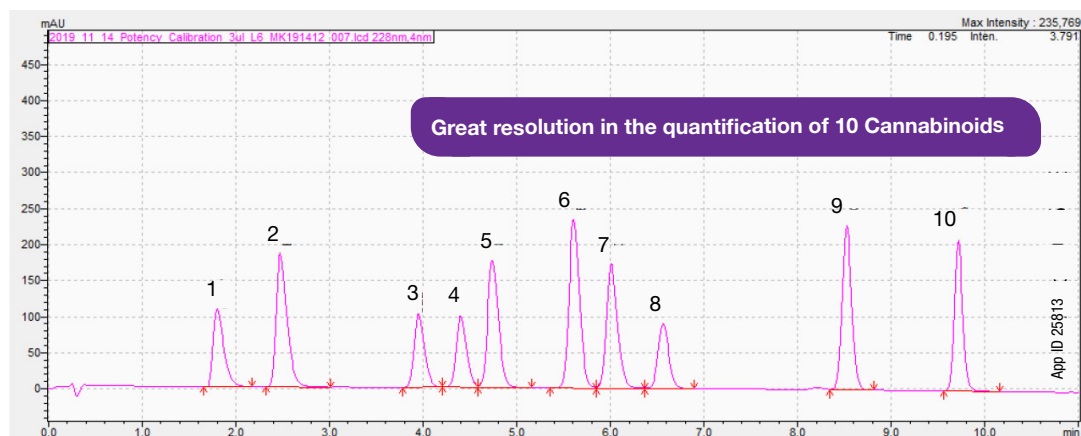


## Quantification of 10 Cannabinoids

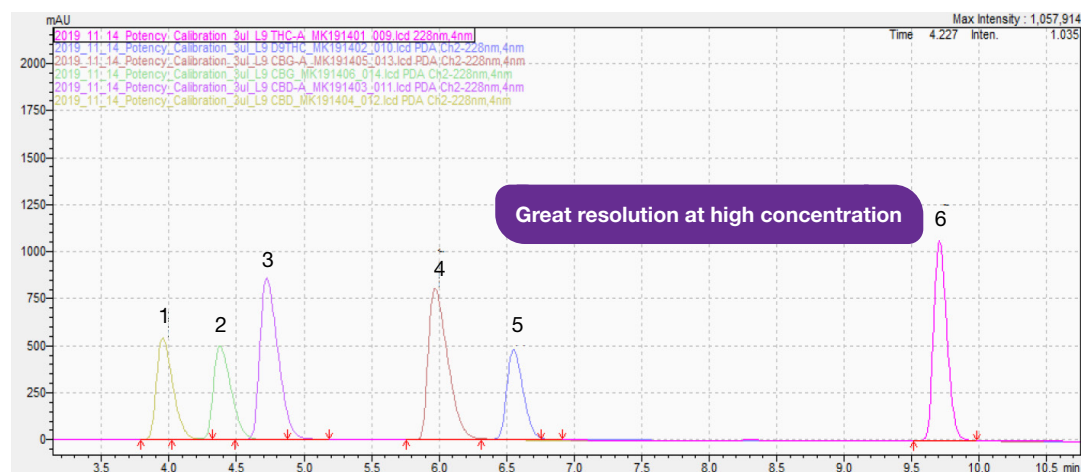


|                          |                                                                     |           |           |                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------|---------------------------------------------------------------------|-----------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Column:</b>           | Kinetex 2.6µm C18                                                   |           |           | <b>Analytes:</b> <ol style="list-style-type: none"><li>1. CBD-V Cannabidivarin</li><li>2. CBD-VA Cannabidivarinic acid</li><li>3. CBD Cannabidiol</li><li>4. CBG Cannabigerol</li><li>5. CBD-A Cannabidiolic acid</li><li>6. CBN Cannabinol</li><li>7. CBG-A Cannabigerolic acid</li><li>8. D9-THC Δ9-Tetrahydrocannabinol</li><li>9. CBC Cannabichromene</li><li>10. THC-A Cannabichromene</li></ol> |
| <b>Dimensions:</b>       | 50 x 2.1 mm                                                         |           |           |                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Part No.:</b>         | 00B-4462-AN                                                         |           |           |                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Mobile Phase:</b>     | A: 0.10 % Formic Acid in Water<br>B: 0.05 % Formic Acid in Methanol |           |           |                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Injection Volume:</b> | 3 µL                                                                |           |           |                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Detection:</b>        | UV @ 228 nm                                                         |           |           |                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Flow Rate:</b>        | 0.8 mL/min                                                          |           |           |                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Gradient:</b>         | <b>Time (min)</b>                                                   | <b>%A</b> | <b>%B</b> |                                                                                                                                                                                                                                                                                                                                                                                                       |
|                          | 0                                                                   | 40        | 60        |                                                                                                                                                                                                                                                                                                                                                                                                       |
|                          | 7                                                                   | 30        | 70        |                                                                                                                                                                                                                                                                                                                                                                                                       |
|                          | 10.9                                                                | 17        | 83        |                                                                                                                                                                                                                                                                                                                                                                                                       |
|                          | 11                                                                  | 0         | 100       |                                                                                                                                                                                                                                                                                                                                                                                                       |
|                          | 11.9                                                                | 0         | 100       |                                                                                                                                                                                                                                                                                                                                                                                                       |
|                          | 12                                                                  | 40        | 60        |                                                                                                                                                                                                                                                                                                                                                                                                       |
|                          | 13                                                                  | 40        | 60        |                                                                                                                                                                                                                                                                                                                                                                                                       |

## 10 analytes displayed at 100 µg/mL



## 6 Analytes (CBD, CBG, CBD-A, CBG-A, D9-THC, and THC-A) at 600 µg/mL With Full Resolution



- Analytes:** 1. CBD Cannabidiol  
2. CBG Cannabigerol  
3. CBD Cannabidiolic acid  
4. CBG-A Cannabigerolic acid  
5. d9 THC Δ9-Tetrahydrocannabinol  
6. THC-A Tetrahydrocannabinol

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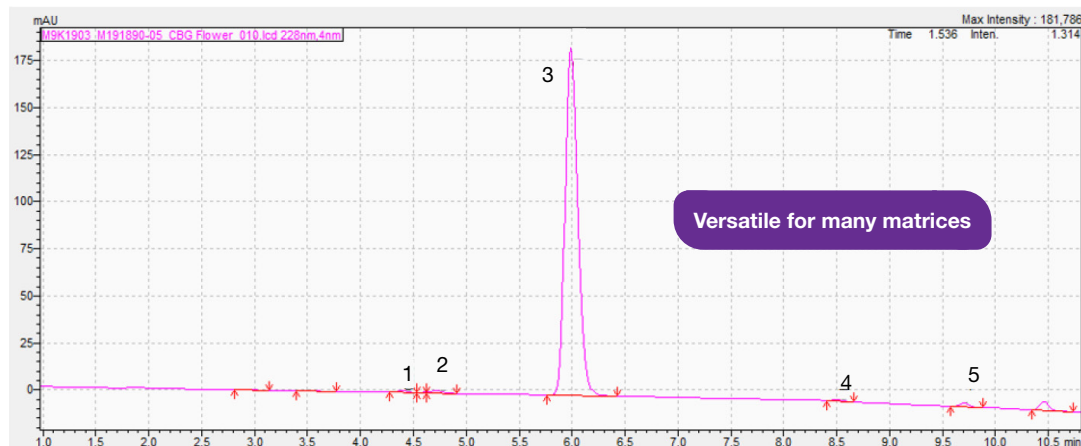


# Potency

## HPLC / UHPLC



### CBG-A Dominant Hemp Cultivar



- Analytes:**
1. CBG Cannabigerol
  2. CBD-A Cannabidiolic acid
  3. CBG-A Cannabigerolic acid
  4. CBG Cannabigerolic
  5. THC-A Tetrahydrocannabinol

[Download Complete Application Note](#)



[Order Now](#)



## HPLC / UHPLC Columns and Accessories

| Part No.                    | Description                       |
|-----------------------------|-----------------------------------|
| <a href="#">00F-4462-E0</a> | Kinetex 2.6µm C18 150 x 4.6 mm    |
| <a href="#">AJ0-8768</a>    | SecurityGuard Ultra (for 4.6 mm)  |
| <a href="#">00B-4462-AN</a> | Kinetex 2.6µm C18 50 x 2.1 mm     |
| <a href="#">AJ0-8782</a>    | SecurityGuard™ Ultra for (2.1 mm) |
| <a href="#">AJ0-9000</a>    | SecurityGuard Holder              |

For a complete selection of Kinetex products and ordering part numbers visit  
[www.phenomenex.com/Kinetex](http://www.phenomenex.com/Kinetex)



# Phenova

Certified Reference Materials

## Complete Cannabis Proficiency Testing Solutions

- Potency
- Pesticide Residues
- Residual Solvents
- Moisture/Water Activity

### Contact Phenova for Cannabis Proficiency Testing. Information in Your State!

- Flower, Oil and Alternative Matrix PT Standards
- ISO 17043/17025 Accredited PT Provider
- State Specific Analytes - Action Level Based
- Enroll in an Active PT Study Today!



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[www.phenova.com/cannabis](http://www.phenova.com/cannabis)



# Pesticides

HPLC / UHPLC



## 65 California Pesticides Analysis from Cannabis by LC-MS/MS using Luna Omega Polar C18 LC Column

explore

**LUNA**  
OMEGA

### Sample Preparation

1. 1 gram of homogenized flower or 0.02 grams of concentrate is vortexed in 10 mL of Acetonitrile
2. Sonicate for 15 minutes
3. Winterization at -20 °C or lower for at least 2 hours
4. Centrifuge at 4000 rpm
5. Injection volume of 2  $\mu$ L for LC-MS/MS analysis

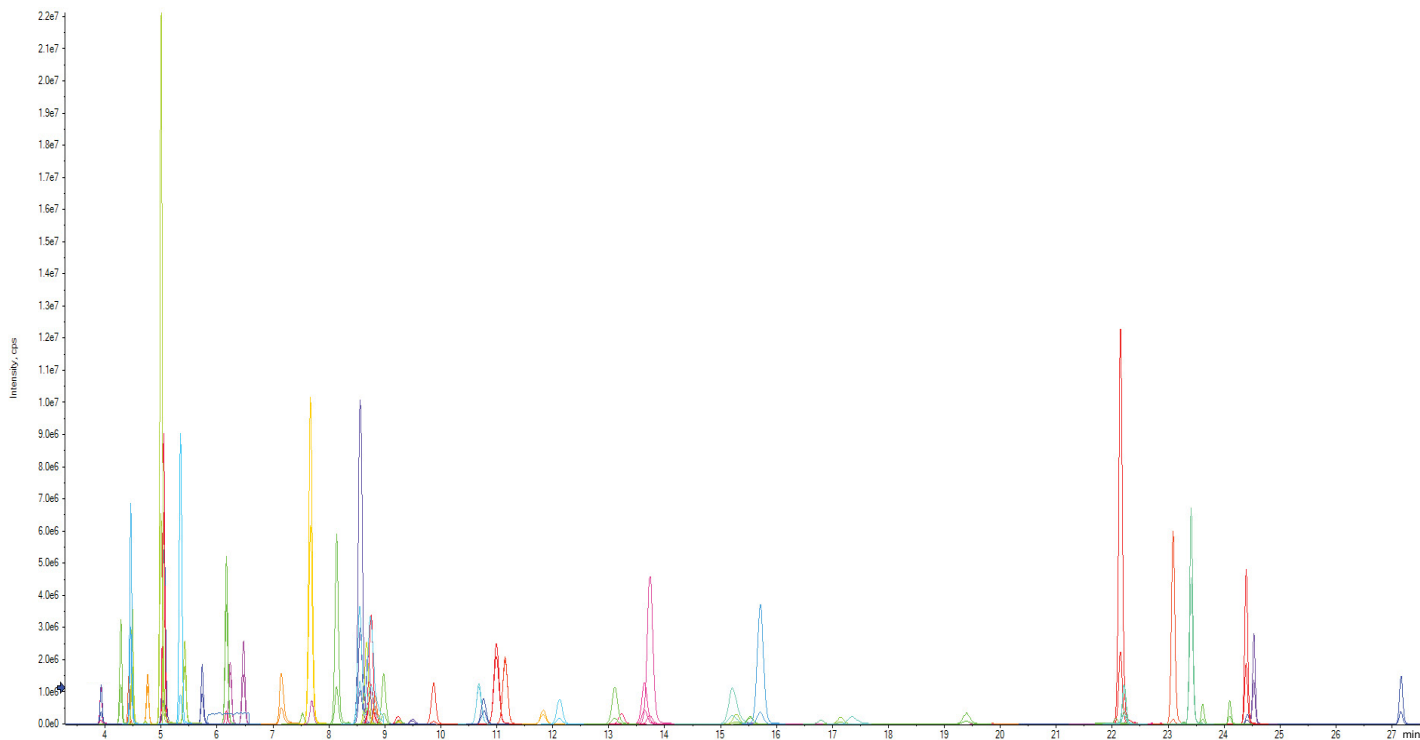
### LC-MS/MS Method

**Column:** Luna Omega 3  $\mu$ m Polar C18  
**Dimension:** 150 x 4.6 mm  
**Part No.:** [00F-4760-E0](#)  
**Mobile Phase:** A: 5 mM Ammonium Acetate + 0.1% Formic Acid  
B: Methanol/Water (98:2) + 5 mM Ammonium Acetate

| Gradient | Time (min) | % B |
|----------|------------|-----|
|          | 0          | 10  |
|          | 2          | 60  |
|          | 3          | 65  |
|          | 4          | 70  |
|          | 18         | 80  |
|          | 20         | 88  |
|          | 22         | 95  |
|          | 27         | 100 |
|          | 28         | 100 |
|          | 28.1       | 10  |
|          | 30         | 10  |

**Flow Rate:** 0.8 mL/min  
**Injection:** 2  $\mu$ L  
**Temperature:** 30 °C  
**Detection:** MS/MS  
**Instrument:** SCIEX™ QTRAP® 6500+ with DuoSpray APCI/ESI  
**Analytes:** For full list search APP ID 24863

Standards Chromatogram



App ID 24863

[Download Complete Application Note](#)

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## Defining Robustness of Pesticide and Mycotoxin Analysis in Cannabis Matrices

Using the SCIEX® Triple Quad 6500+ system



### Keep it clean to analyze more green

Sample clean-up is an important step for high-throughput LCMS/MS analyses. The more contaminants that are removed during the clean-up step, the longer the LC-MS/MS will be able to maintain the required sensitivity. Unfortunately, cannabis matrices contain high concentrations of cannabinoids, waxes, terpenes, and other secondary metabolites which present a significant analytical challenge. These compounds have the potential to interfere with the analysis of pesticides, making it difficult to meet the ng/g sensitivity levels required by most recreational United States regulations<sup>1-7</sup> and Canadian regulations<sup>8</sup>. In this study, the robustness of the SCIEX Triple Quad 6500+ system was evaluated by injecting a cannabis flower extract 830 times with no system maintenance. The cannabis flower was spiked with a mixture of commonly monitored cannabis pesticides and the peak area of these pesticides was monitored over time, with and without internal standard correction.

### Methods

**Sample preparation:** A 1:10 dilution was performed using 5 g of homogenized cannabis flower extracted in 50 mL of 0.1% formic acid in acetonitrile. Extracts were winterized at -20 °C for 2 hours before filtration with 0.2 µm PTFE syringe filters. The extract was fortified with an analytical pesticide mixture and vortexed before being dispensed into equal 1 mL aliquots to be stored at 4 °C prior to LC-MS/MS analysis.

**LC-MS/MS:** A 5-minute gradient was used to inject cannabis flower matrix repeatedly for analysis. An analytical 20-minute gradient representing a typical analysis strategy was injected every 10th sample for comparative analysis. The analytical column used was a Phenomenex 3 µm Luna Omega Polar C18 (3x150 mm) and chromatographic separation was achieved using 5 mM ammonium formate with 0.1% formic acid in water and methanol.



### Key features of the SCIEX Triple Quad 6500+ system for cannabis analysis

- Save 30 or more minutes per 96-well plate!
- At least 8x more sensitive than traditional 10mg SPE
- Elution volumes as low as 25 µL!

### Robustness data

Cannabis flower extracts are a particularly challenging matrix. Very few LC-MS/MS robustness studies have been conducted with this matrix, without MS system maintenance over a prolonged duration. When determining instrument stability using this type of robustness test, normalizing the analyte peak area to an internal standard (IS) area can be misleading, as the response from the internal standard and the native pesticide(s) are likely to change proportionately. Therefore, the IS ratio will stay consistent across many injections, as shown for carbofuran (Figure 1, left), inaccurately suggesting ideal system performance despite the harsh conditions employed in this study.

The true measure of instrument robustness must be an evaluation of the uncorrected peak area as a function of time. Without MS system maintenance and given the conditions of this study, a decrease in peak area may be expected, as observed when the raw carbofuran area is plotted (Figure 1, right).

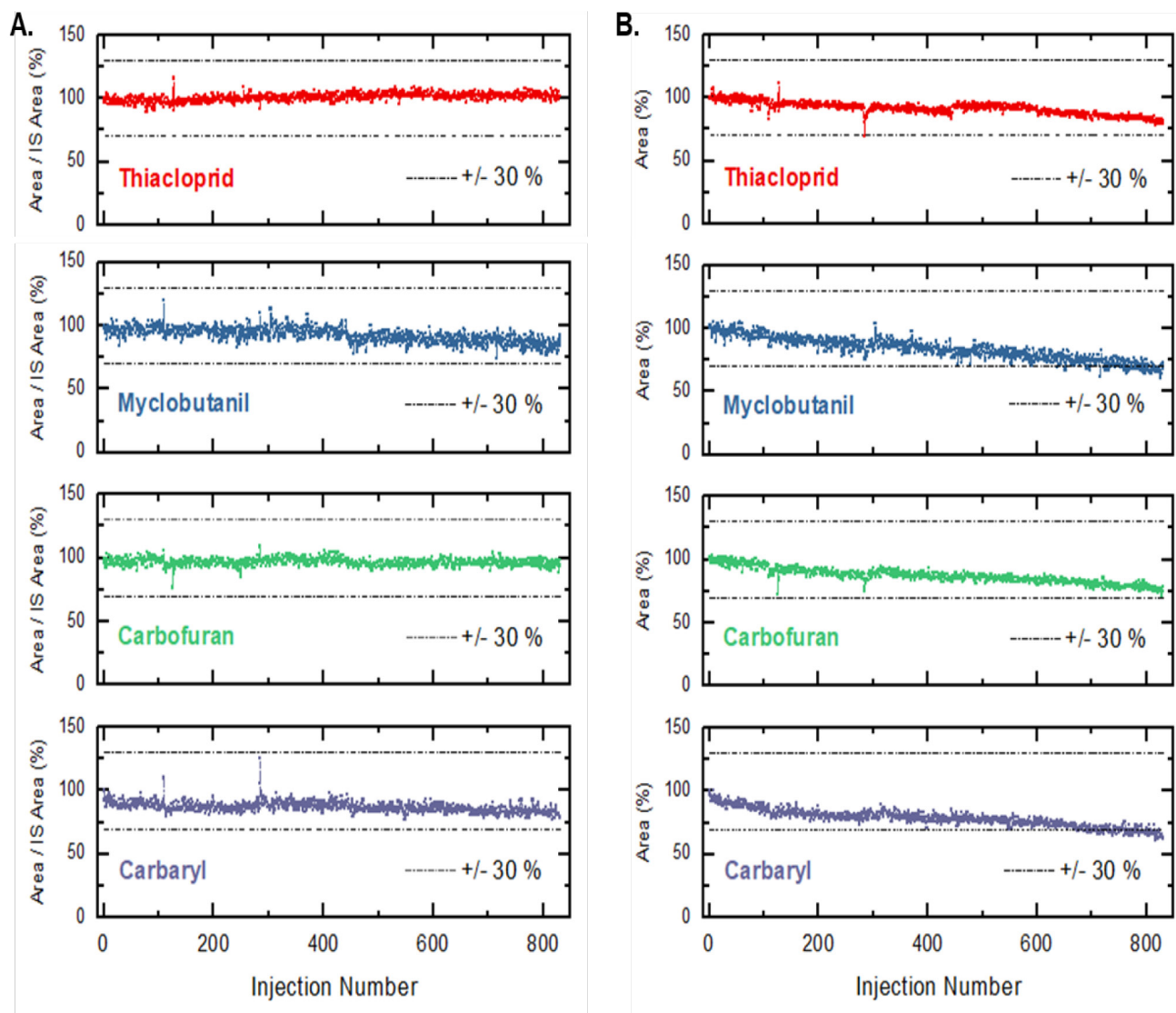
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# Pesticides

HPLC / UHPLC



**Figure 1. 830 replicate injections of cannabis flower matrix.** IS-corrected (A) and raw peak area (B) responses for several pesticides in cannabis flower extracts over 830 injections without instrument maintenance. Raw areas illustrate the true measure of system robustness. Pesticides were fortified to 0.05 ppm in cannabis flower. The 30% lines are relative to the analyte response for injection 1.

However, these data show that the SCIEX® Triple Quad 6500+ system achieves sensitivity that meets regulatory limits and reliably detects pesticides of interest in a complex matrix. These features persist over the analysis of 830 cannabis samples without cleaning the MS system.

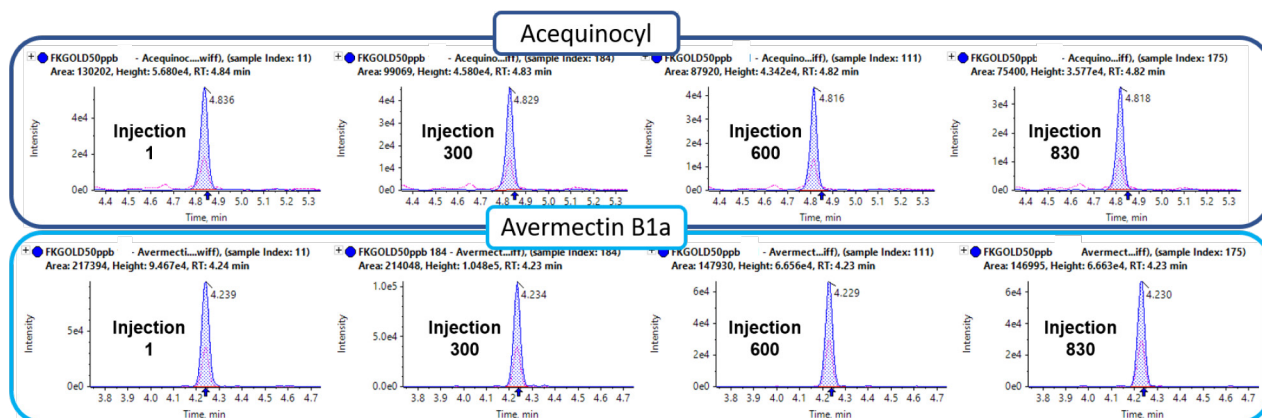
An example of this robust sensitivity can be seen with acequinocyl, which is hydrolytically unstable, has poor ionization efficiency and coelutes with numerous cannabinoids late in the gradient. For all 830 injections, acequinocyl was detected at a concentration 40x lower than Oregon regulatory limits<sup>1</sup> (Figure 2, top). Additionally, avermectin B1a, which is known for its thermal lability, was detected at a concentration 10x lower than Oregon regulatory limits<sup>5</sup> after the 830 matrix injections (Figure 2, bottom).

## Conclusion

The reality of analyzing a highly contaminating matrix is an inevitable decrease in sensitivity. In this application note, it is shown that the way instrument robustness data is organized and presented can fail to capture changes in sensitivity over time. It is therefore important to assess both the ion ratio reproducibility (Figure 2) and the raw peak area reproducibility (Figure 1), as this will inform practical considerations in a testing lab such as how often an MS system must be cleaned to maintain sensitivity requirements.

# Pesticides

HPLC / UHPLC



**Figure 2: Stable pesticide peak areas across 830 injections.** Acequinocyl is the last-eluting compound and normally is susceptible to cannabinoid suppression in matrix (top). Avermectin B1a is the primary component of Abamectin (bottom). Example chromatograms of each are shown throughout the instrument robustness test. Both quantifier and qualifier are clearly visible with no impact on ion ratio (blue and pink overlaid chromatograms) and excellent sensitivity is maintained, even under the extreme conditions employed for this robustness test.

## References

- 1) Bureau of Cannabis Control. Bureau of Cannabis Control Text of Regulations California Code of Regulations Title 16 Division 42. Bureau of Cannabis Control. Order of Adoption. **2018**.
- 2) Register of Arizona, A. Arizona Rules Division. A. Medical Cannabis; Code, A. A. 9 A.A.C. 17 Supp. 20-4. **2021**, 1–57.
- 3) Pennsylvania Department of Public Health. Program, M. M.; Marijuana, M. OFFICE OF MEDICAL MARIJUANA GUIDANCE FOR QUALITY TESTING AND SAMPLING Definitions. **2018**, 1–9.
- 4) Safety, L.; Facilities, C.; Regulation, M. M. Safety Compliance Facility. **2018**.
- 5) D.G., Farrer. (2016) Oregon Health Authority's Process to Determine Which Types of Contaminants to Test for in Cannabis Products, and Levels of Action. *Oregon Heal. Auth.* 1–14.
- 6) Massachusetts Department of Health. MassCommonwealth.Comment, W. Protocol for the Sampling and Analysis of Finished Marijuana Products and Marijuana Products for Marijuana Establishments, Medical Marijuana Treatment Centers and Colocated Marijuana Operations. **2020**.
- 7) Florida Department of Health. 64ER20-9. CMTL Regulations. **2019**.
- 8) Government of Canada. Mandatory Cannabis Testing for Pesticide. Health Canada **2019**.

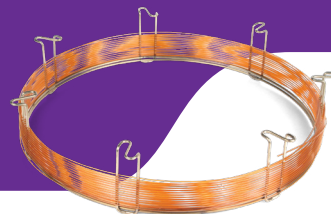
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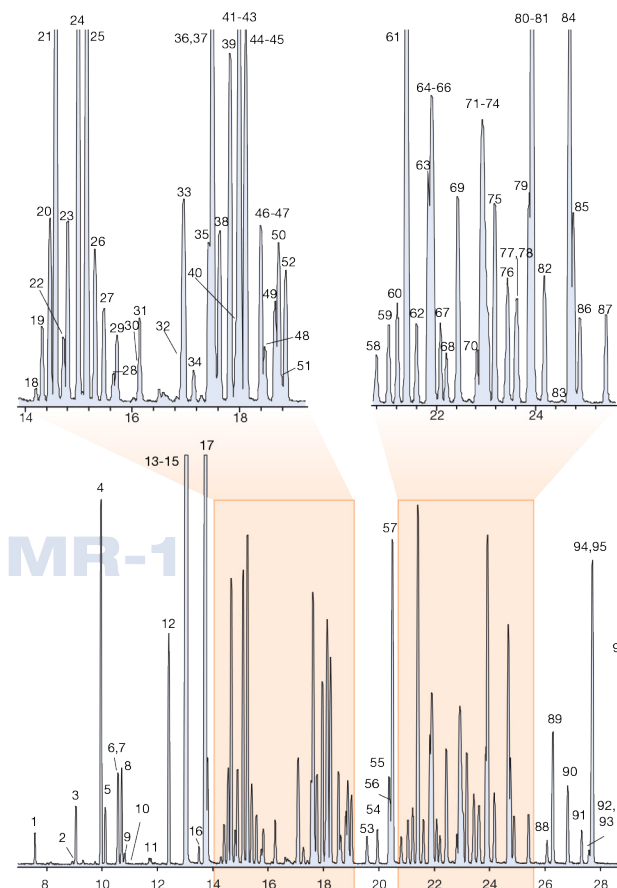
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## 112 Multi-Residue Pesticide Screening Method using GC/MS

**Zebron™**  
GC Columns



The low bleed performance of both Zebron MultiResidue™ MR-1 and MR-2 columns allow them to be used on GC/MS.

Retention time data is available for over 300 pesticides on a Zebron MultiResidue-1 column. Please contact your Phenomenex representative for more details.

**Column:** Zebron MultiResidue-1  
**Dimensions:** 30 meter x 0.25 mm x 0.25 µm  
**Part No.:** 7HG-G016-11  
**Injection:** Splitless @ 260 °C, 1 µL  
**Carrier Gas:** Helium @ 0.90 mL/min (constant flow)  
**Oven Program:** 80 °C for 0.5 min to 150 °C @ 10 °C/min to 240 °C @ 4 °C/min to 320 °C @ 15 °C/min for 3 min  
**Detector:** MSD @ 320 °C; 45-400 amu

- |                                              |                                      |                              |                      |
|----------------------------------------------|--------------------------------------|------------------------------|----------------------|
| 1. Dichlorvos                                | 33. Pentachlorophenol (methyl ester) | 63. Prometryn                | 95. Oxadiazon        |
| 2. DEET                                      | 34. Demeton                          | 64. Methyl parathion         | 96. Oxyfluorfen      |
| 3. EPTC                                      | 35. Atraton                          | 65. Ametryn                  | 97. Carboxin         |
| 4. 3,5-Dichlorobenzoic acid (methyl ester)   | 36. Profluralin                      | 66. Simetryn                 | 98. Tricyclazole     |
| 5. Butylate                                  | 37. Prometon                         | 67. Aspon                    | 99. Acifluorfen      |
| 6. 4-Nitrophenol (methyl ester) Vernolate    | 38. Silvex (methyl ester)            | 68. Metribuzin               | 100. Ethion          |
| 7. Mevinphos                                 | 39. Terbufos                         | 69. Terbutryn                | 101. Fensulfothion   |
| 8. Mevinphos isomer                          | 40. Dimethoate                       | 70. Malathion                | 102. Carbofenotion   |
| 9. Pebulate                                  | 41. Simazine                         | 71. Fenitrothion             | 103. Famfur          |
| 10. Trichlorfon                              | 42. Propazine                        | 72. Pichloram (methyl ester) | 104. Norflurazon     |
| 11. Dicamba (methyl ester)                   | 43. Atrazine                         | 73. Metolachlor              | 105. Hexazinone      |
| 12. Molinate                                 | 44. Diazinon                         | 74. Chlorpyrifos             | 106. EPN             |
| 13. Tebuthiuron                              | 45. Dioxathion                       | 75. DCPA                     | 107. Phosmet         |
| 14. MCPP (methyl ester)                      | 46. Terbutylazine                    | 76. Bromacil                 | 108. Leptophos       |
| 15. 1Tetraethyl pyrophosphate (methyl ester) | 47. Fonofos                          | 77. Fenthion                 | 109. Azinphos-methyl |
| 16. MCPA (methyl ester)                      | 48. Pronamide                        | 78. Trichloronate            | 110. Fenarimol       |
| 17. Demeton isomer                           | 49. Chloramben (methyl ester)        | 79. Triadimeton              | 111. Azinphos-ethyl  |
| 18. Thionazin                                | 50. 2,4,5-T Methyl ester             | 80. Isopropalin              | 112. Coumaphos       |
| 19. Dichloroprop (methyl ester)              | 51. Phosphamidon isomer              | 81. Parathion                |                      |
| 20. 2Propachlor                              | 52. Disulfoton                       | 82. MGK-624                  |                      |
| 21. Cycloate                                 | 53. Secbumeton                       | 83. Merphos                  |                      |
| 22. Ethoprop                                 | 54. Terbacil                         | 84. Pendimethalin            |                      |
| 23. Trifluralin                              | 55. Dinoseb (methyl ester)           | 85. Diphenamid               |                      |
| 24. Benefin                                  | 56. Dichlofenthion                   | 86. MGK-264 isomer           |                      |
| 25. 2,4-D (methyl ester)                     | 57. 2,4-DB (methyl ester)            | 87. Clofenvinphos            |                      |
| 26. Sulfotep                                 | 58. Phosphamidon                     | 88. Crotoxyphos              |                      |
| 27. 13C-1,2,3,4,6,7,8-HpCDD                  | 59. Chlorpyrifos methyl              | 89. Butachlor                |                      |
| 28. Naled                                    | 60. Alachlor                         | 90. Stirofos                 |                      |
| 29. Chlorpropham                             | 61. Bentazon (methyl ester)          | 91. Tokuthion                |                      |
| 30. Dicrotophos                              | 62. Ronnel                           | 92. Napropamide              |                      |
| 31. Phorate                                  | 63. Prometryn                        | 93. Fenamiphos               |                      |
| 32. Monocrotophos                            | 64. Methyl parathion                 | 94. Merphos Oxide            |                      |

Have Questions? Chat With Our Team





# Pesticides

List of recommended part numbers

## HPLC / UHPLC Columns & Accessories

| Part No.                    | Product Description                    |
|-----------------------------|----------------------------------------|
| <a href="#">00B-4760-E0</a> | Luna Omega 3 µm Polar C18 150 x 4.6 mm |
| <a href="#">00D-4760-AN</a> | Luna Omega 3 µm Polar C18 100 x 2.1 mm |
| <a href="#">AJ0-7601</a>    | SecurityGuard Cartridge (for 4.6 mm)   |
| <a href="#">AJ0-9000</a>    | SecurityGuard Holder                   |

For a complete selection of columns, accessories, and ordering part numbers visit [www.Phenomenex.com](http://www.Phenomenex.com)

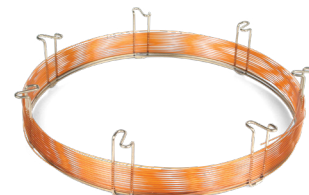


## GC Columns & Accessories

| Part No.                    | Product Description                                 |
|-----------------------------|-----------------------------------------------------|
| <a href="#">7HG-G016-11</a> | Zebtron ZB-MultiResidue™-1 30 m x 0.25 mm x 0.25 µm |
| <a href="#">7HG-G017-10</a> | Zebtron ZB-MultiResidue-2 30 m x 0.25 mm x 0.20 µm  |

Check the next generation of inertness for specialty applications, ZB-5MS™ and ZB-5MSPLUS™, featuring low bleed and suited for high sensitivity GC-MS and GC-MS/MS work.

Click below for to access complete product and ordering information  
[Zebtron ZB-5MS columns](#) [ZB-5MSPLUS columns](#)



## Sample Preparation – roQ Quechers

| Extraction               |                                                                                       |
|--------------------------|---------------------------------------------------------------------------------------|
| <a href="#">KS0-8910</a> | roQ QuEChERS, Original, 4.0 g MgSO <sub>4</sub> , 1.0 g NaC                           |
| <a href="#">KS0-8912</a> | roQ QuEChERS, Original, 6.0 g MgSO <sub>4</sub> , 1.5 g NaCl                          |
| <a href="#">KS0-8909</a> | roQ QuEChERS, EN Method, 4.0 g MgSO <sub>4</sub> , 1.0 g NaCl, 1.0 g SCTD, 0.5 g SCDS |
| Clean up/dSPE            |                                                                                       |
| <a href="#">KS0-9510</a> | roQ QuEChERS dSPE Kit - 15mL CT, 900 mg MgSO <sub>4</sub> , 150 mg PSA, 45 mg GCB     |
| <a href="#">KS0-9506</a> | roQ QuEChERS dSPE Kit - 2 mL CT, 150 mg MgSO <sub>4</sub> , 25 mg PSA, 7.5 mg GCB     |

For a complete selection of roQ Quechers and ordering part numbers visit [www.phenomenex.com/roQ](http://www.phenomenex.com/roQ)



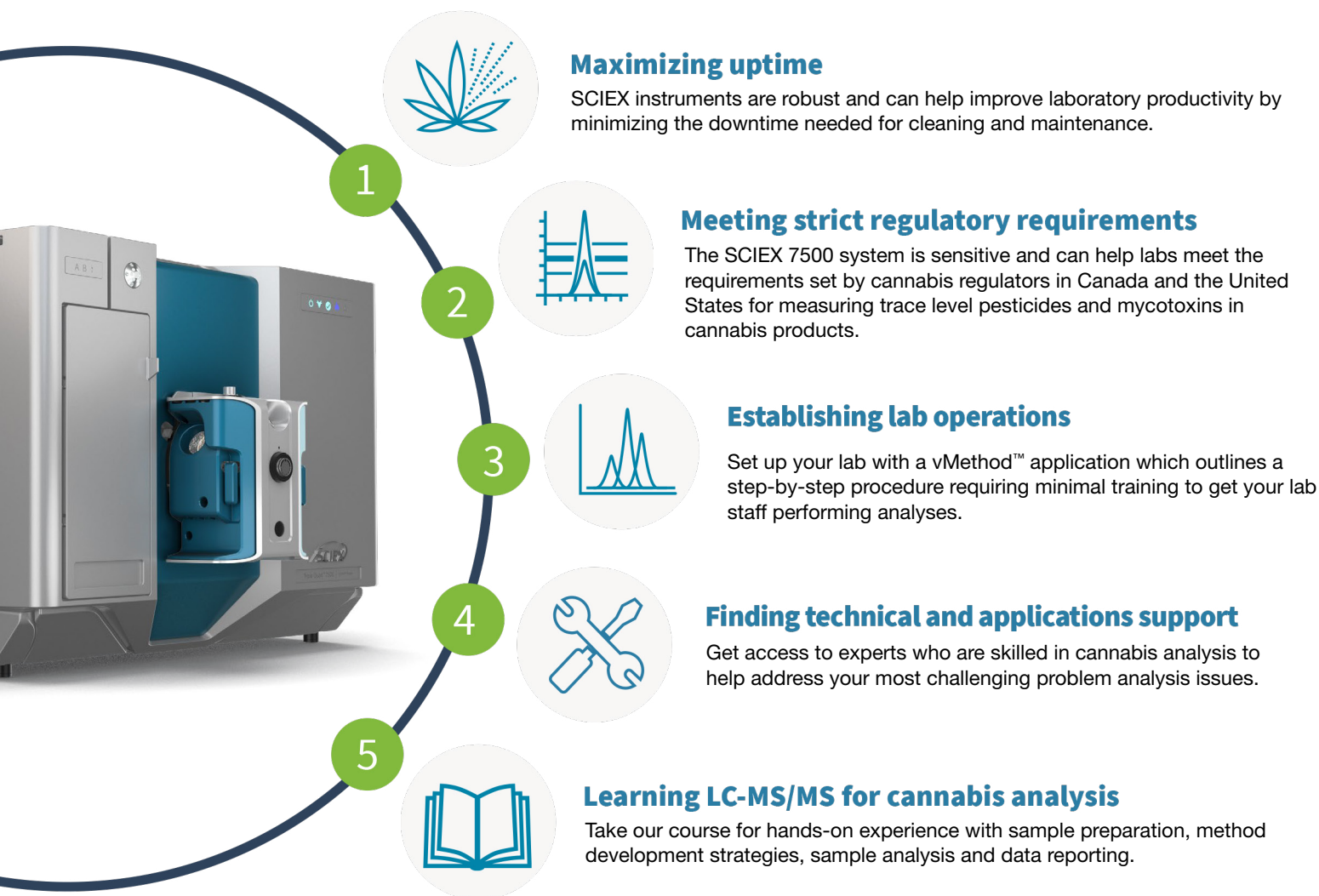
# Pesticides

SCIEX



## 5 Ways SCIEX Addresses Pesticide Challenges in Cannabis Testing

Making your laboratory operations easier and more productive



For more information visit: [sciex.li/cannabis](https://sciex.li/cannabis)



SCAN  
ME

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# Mycotoxins

HPLC / UHPLC



## Expanded Mycotoxins Analysis in Cannabis Matrices by LC-MS/MS

explore

**LUNA**  
OMEGA

### LC Method Parameters

**Column:** Luna Omega 3  $\mu$ m Polar C18  
**Dimension:** 150 x 2.1 mm  
**Part No.:** [00D-4760-AN](#)  
**Flow Rate:** 0.4 mL/min  
**Injection Volume:** 3  $\mu$ L  
**Mass Spec Detector:** Sciex® Triple Quad™ 5500  
Samples were ionized using electrospray with positive/negative ion-mode polarity switching

**Mobile Phase:** A: 1 mM Ammonium formate + 0.1% Formic Acid in Water  
B: Methanol

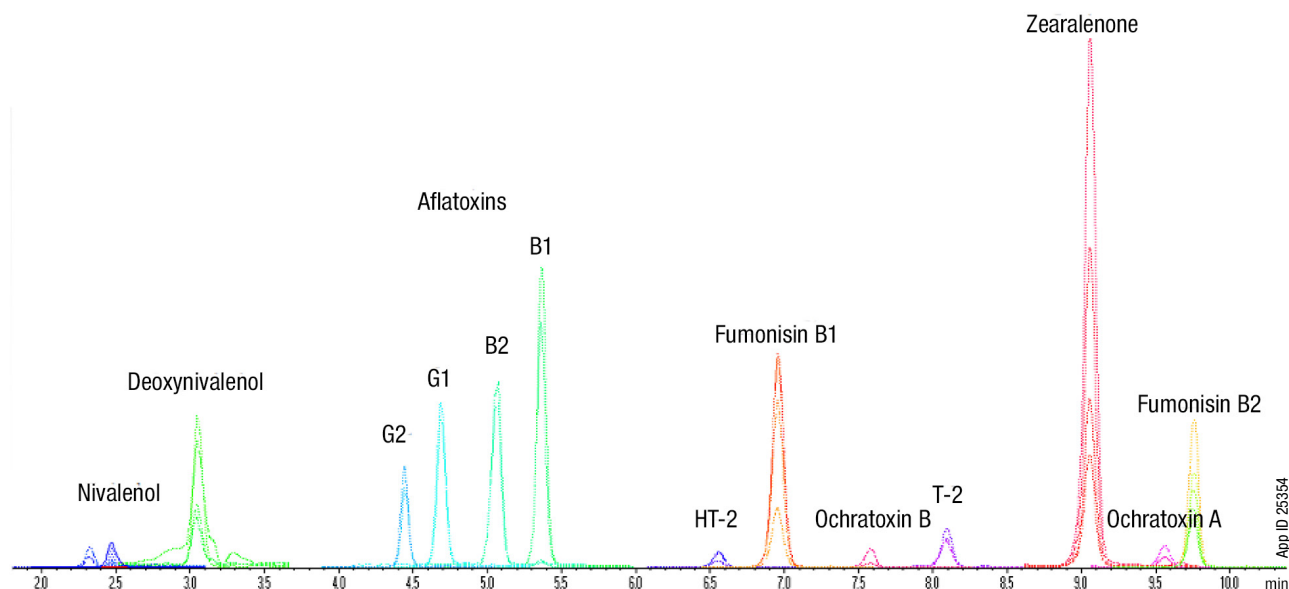
| Gradient | Time (min) | % B |
|----------|------------|-----|
|          | 0          | 5   |
|          | 3          | 35  |
|          | 10         | 90  |
|          | 12         | 90  |

**Temperature:** 40 °C  
**Injection Volume:** 3  $\mu$ L  
**Detection:** MS/MS – Sciex Triple Quad 5500

### Sample Preparation

1. Sample Preparation: Cannabis flower samples were ground in a Retsch GM 200 knife mill, and 0.5 g sample E soaked in 0.5 mL of 2 % Ascorbic Acid in water in a 50 mL falcon tube
2. 10 mL Acetonitrile were added, followed by a modified EN 15662 QuEChERS salt extraction (4 g MgSO<sub>4</sub>, 1 g NaCl, 1.5 g Sodium Citrate), shaken for 5 minutes, then centrifuged at 2500 RPM
3. The supernatant was diluted 5 x with aqueous Ammonium Formate buffer and filtered through a 0.45  $\mu$ m syringe filter prior to injection to HPLC

## Chromatography of expanded Mycotoxins overlayed MRMs



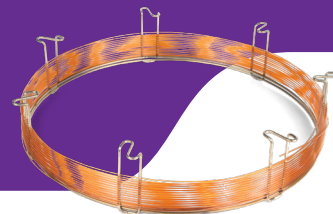
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# Residual Solvents

## Gas Chromatography



## Analysis of 21 Residual Solvents from Cannabis Matrix by FET Headspace on a ZB-624PLUS™ GC Column



### GC-MS Conditions

**Column:** Zebtron ZB-624PLUS  
**Dimensions:** 30 meter x 0.25 mm x 1.40 µm  
**Part No.:** [7HG-G040-27](#)  
**Injection:** Split 38:1 @ 250 °C  
Split Flow: 75 mL/min  
Purge Flow: 5 mL/min  
**Recommended Liner:** Zebtron PLUS Liner (Compatible with Agilent® & Thermofisher™ GC instrument), 4 mm ID Single Taper, Wool on Bottom  
**Liner Part No.:** [AG2-0A11-05](#)  
**Carrier Gas:** Helium @ 1.3 mL/min (constant flow)  
**Oven Program:**

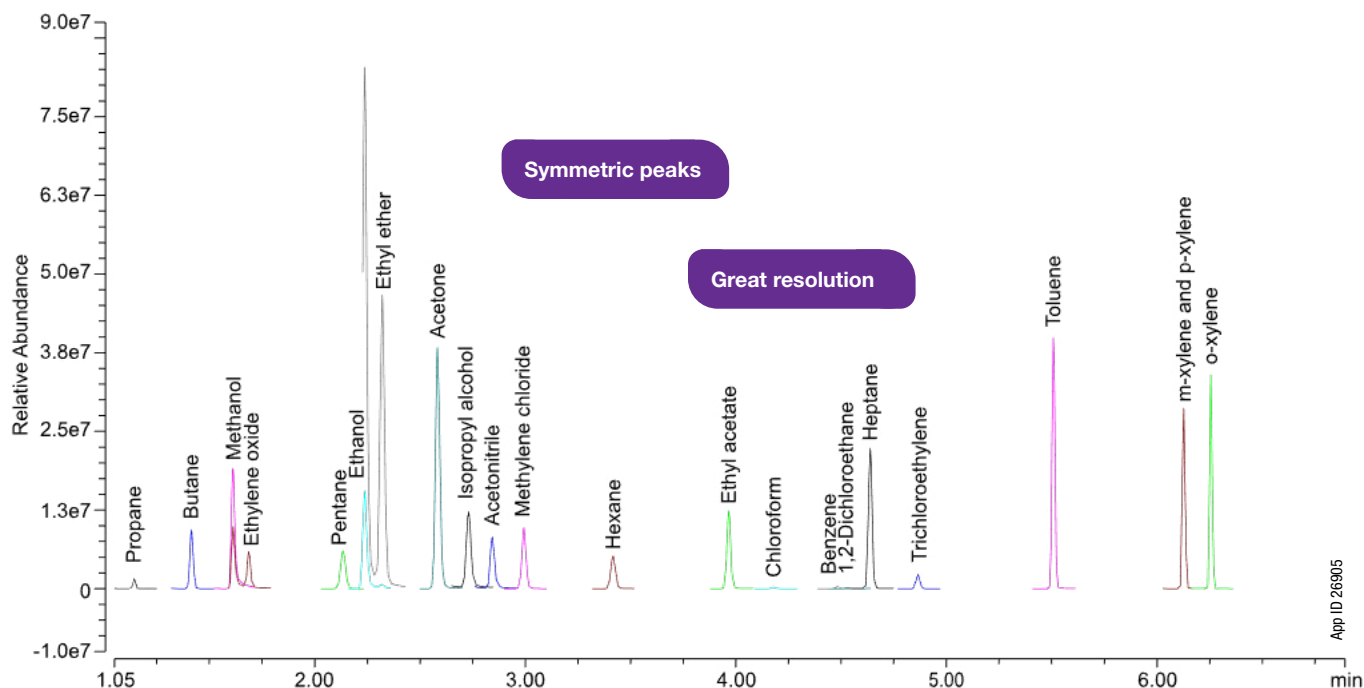
| Ramp (°C/min) | Temp (°C) | Time(min) |
|---------------|-----------|-----------|
| -             | 35        | 2.0       |
| 7.3           | 58        | 0.0       |
| 11.3          | 115       | 0.0       |
| 25.2          | 300       | 8.9       |

**Detector:** Thermo ISQ GC-MS  
**Detector Temperature:** 300 °C

### Headspace Autosampler Conditions

**Vial:** Zebtron ZB-624PLUS  
**Description:** 23 x 75 mm, 20 mL  
**Part No.:** [ARO-3260-13](#)  
**Vial Seal:** 20 mm, PTFE/Silicone, Magnetic  
**Vial Part No.:** [ARO-3260-13](#)  
**Instrument:** Thermo Scientific™ TriPlus™ 500  
**Vial Incubation Temperature:** 170 °C  
**Vial Incubation Time:** 8 min  
**Loop Temperature:** 180 °C  
**Loop Pressure:** 7.5 psi  
**Injection Mode:** Standard  
**Injection Time:** 0.10 min

Figure 1: Separation of 21 Residual Solvents with excellent resolution and peak symmetry on a ZB-624PLUS GC column



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# Residual Solvents

## Gas Chromatography

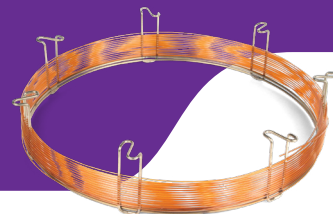
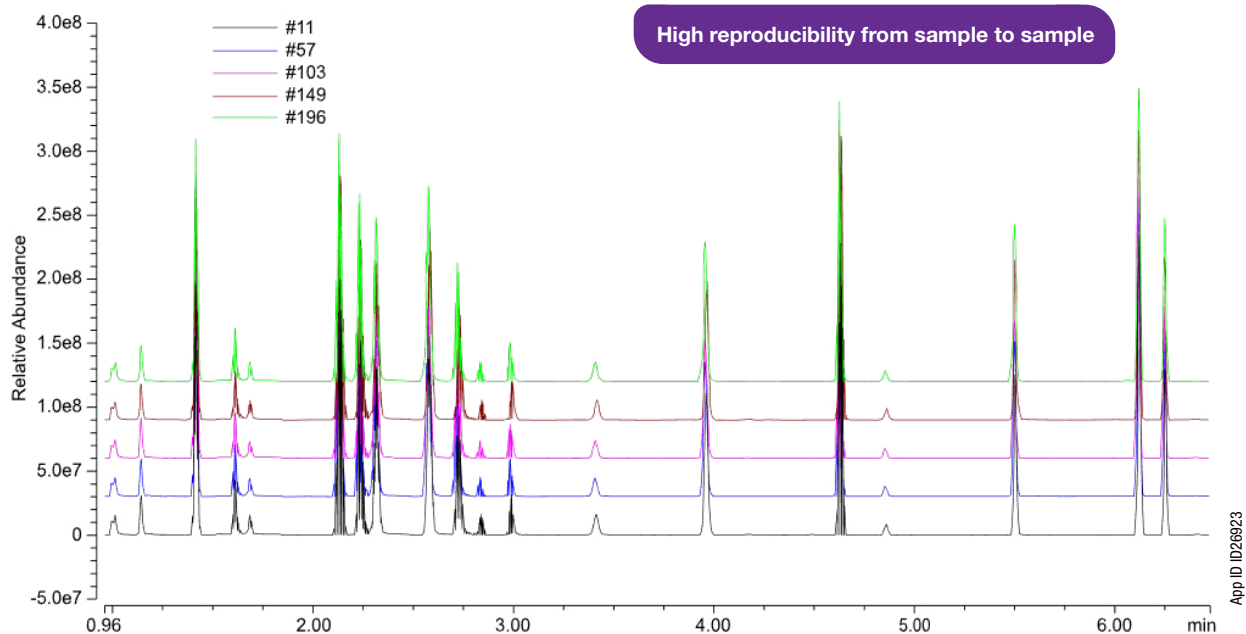


Figure 2: Reproducible peak shape and retention of residual solvents between 11 and 196 injections of residual solvents on a ZB-624PLUS GC column



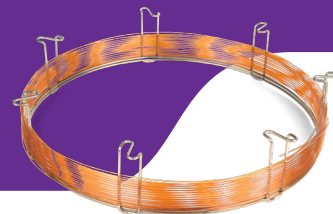
| Analyte               | Retention Time (min) | El Mass Fragments (m/z)                 | %RSD- Peak Area (n-6) |
|-----------------------|----------------------|-----------------------------------------|-----------------------|
| Propane               | 1.15                 | 29.2, 38.1, 39.1, 41.1, 42.1            | 5.79                  |
| Butane                | 1.42                 | 29.2, 39.1, 41.1, 42.1, 43.1, 58.1      | 3.04                  |
| Methanol              | 1.62                 | 29.2, 31.1, 32.1                        | 5.86                  |
| Ethylene oxide        | 1.69                 | 29.2, 42.1, 43.1, 44.1                  | 2.88                  |
| Pentane               | 2.13                 | 41.1, 42.1, 43.1, 57.1, 72.1            | 0.81                  |
| Ethanol               | 2.26                 | 31.1, 45.1, 46.1                        | 1.43                  |
| Ethyl ether           | 2.33                 | 29.2, 31.1, 45.1, 59.1, 74.1            | 1.36                  |
| Acetone               | 2.6                  | 42.1, 43.1, 58                          | 2.81                  |
| Isopropyl alcohol     | 2.75                 | 29.2, 43.1, 45.1, 59.1                  | 0.93                  |
| Acetonitrile          | 2.86                 | 38.1, 39.1, 40.1, 41.1, 42.1            | 4.18                  |
| Methylene chloride    | 3                    | 49, 51, 83.9, 86, 88                    | 3.69                  |
| n-Hexane              | 3.42                 | 41.1, 43.1, 56.1, 57.1, 86.1            | 3.81                  |
| Ethyl acetate         | 3.98                 | 43.1, 43.1, 45.1, 61.1, 70.1, 88        | 1.32                  |
| Chloroform            | 4.19                 | 47, 83, 84.9, 86.9, 116.9, 117.9, 118.9 | 1.21                  |
| Benzene               | 4.49                 | 74, 76, 77.1, 78.1, 79.1                | 2.01                  |
| 1,2-Dichloroethane    | 4.54                 | 62, 64, 98, 100                         | 0.78                  |
| Heptane               | 4.65                 | 41.1, 43.1, 56.1, 57.1, 70.1, 71.14.87  | 4.19                  |
| Trichloroethylene     | 4.87                 | 95, 97, 129.9, 131.9, 133.9             | 2.51                  |
| Toluene               | 5.52                 | 39.1, 65.1, 91, 92.1                    | 0.86                  |
| m-xylene and p-xylene | 6.14                 | 78.1, 91.1, 103.1, 105.1, 106.1, 107.1  | 4.06                  |
| o-xylene              | 6.27                 | 78.1, 91.1, 103.1, 105.1, 106.1, 107.1  | 4.02                  |

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# Residual Solvents

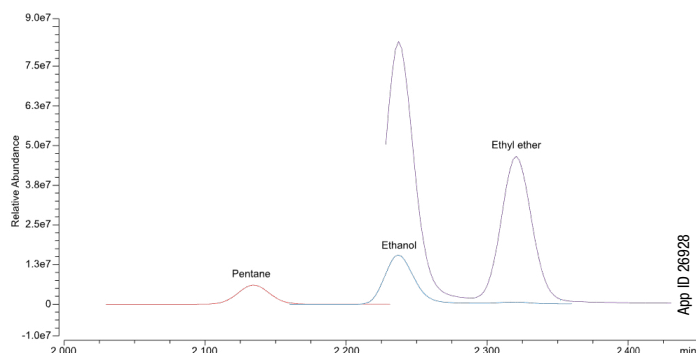
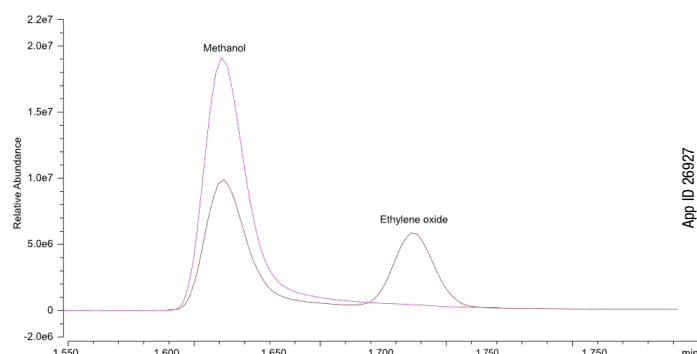
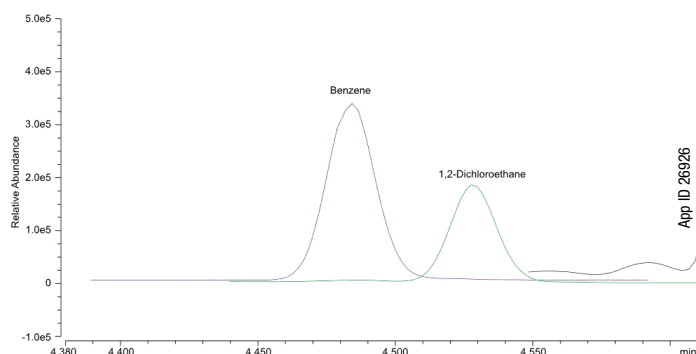
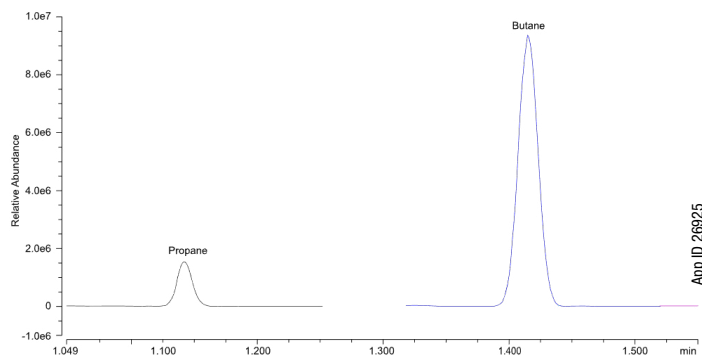
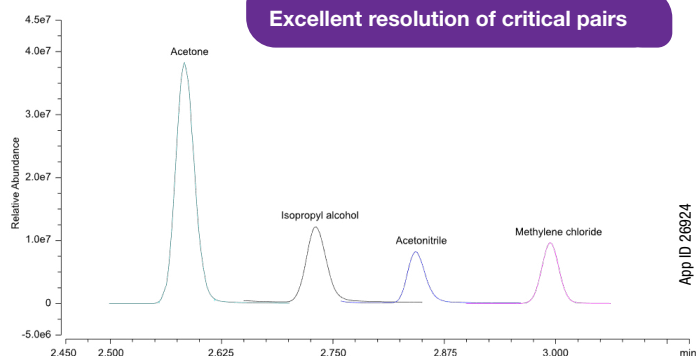
## Gas Chromatography



### Chromatograms showing resolution of critical pairs using a ZB-624PLUS GC Column

**Zebron™**  
GC Columns

Excellent resolution of critical pairs



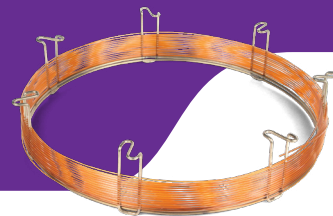
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# Residual Solvents

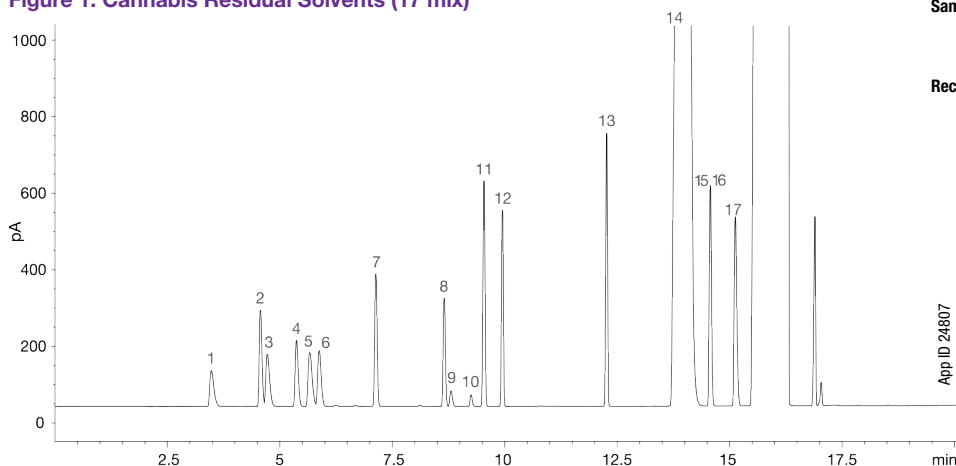
## Gas Chromatography



## Determination of Residual Solvents and Terpenes in Cannabis by GC-FID using Zebtron ZB-624<sub>PLUS</sub> GC Column



Figure 1. Cannabis Residual Solvents (17 mix)



### GC-FID Conditions

Same conditions for both separations

Column: Zebtron ZB-624<sub>PLUS</sub>

Dimensions: 30 meter x 0.25 mm x 1.40  $\mu$ m

Part No.: 7HG-G040-27

Recommended Z-Guard™: 7CG-G000-00-GHK

Injection: Split 10:1 @ 200 °C, 1  $\mu$ L

Recommended Liner: Zebtron PLUS Liner Z-Liner

Liner Part No.: AG2-0A03-05 (for Agilent® and Thermo Scientific™ systems)

Carrier Gas: Helium @ 1.0 mL/min (constant flow)

Oven Program: 35 °C for 4 min, 50 °C @ 20 °C/min for 1 min, 160 °C @ 10 °C/min for 4 min, 300 °C at 15 °C/min for 5 min

Detector: FID @ 240 °C

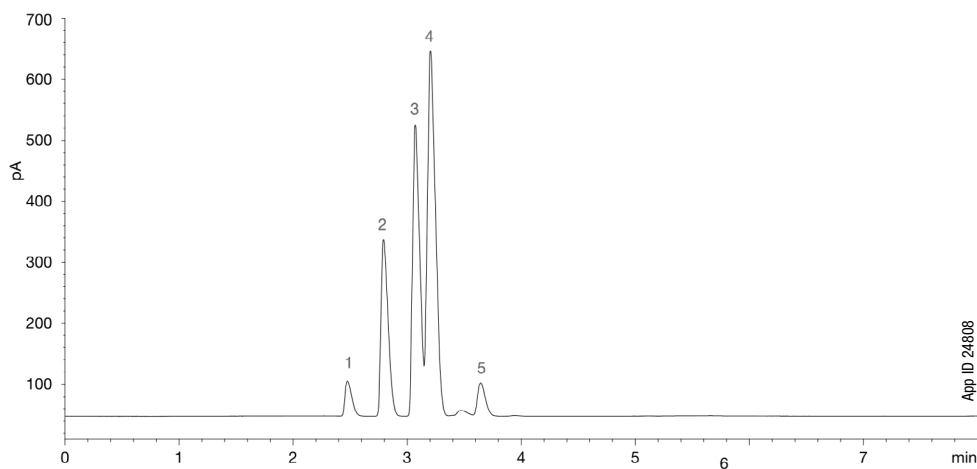
### Emerald Scientific Residual Solvent standards STRS01024 at 1000 $\mu$ g/mL

- |                 |                          |
|-----------------|--------------------------|
| 1. Methanol     | 10. Carbon Tetrachloride |
| 2. n-Pentane    | 11. n-Heptane            |
| 3. Ethanol      | 12. Benzene              |
| 4. 2-Propanol   | 13. Toluene              |
| 5. Acetone      | 14. Dimethylformamide    |
| 6. Acetonitrile | 15. m-Xylene             |
| 7. n-Hexane     | 16. p-Xylene             |
| 8. THF          | 17. o-Xylene             |
| 9. Chloroform   |                          |

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Figure 2. Low Boiling Cannabis Residual Solvents

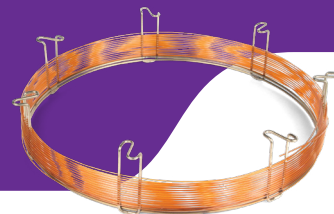


### Emerald Scientific Residual Solvent Standards STRS01075 at 500-5000 $\mu$ g/mL

1. Propane
2. 2-Methylpropane
3. n-Butane
4. Neopentane
5. Ethylene Oxide

# Residual Solvents

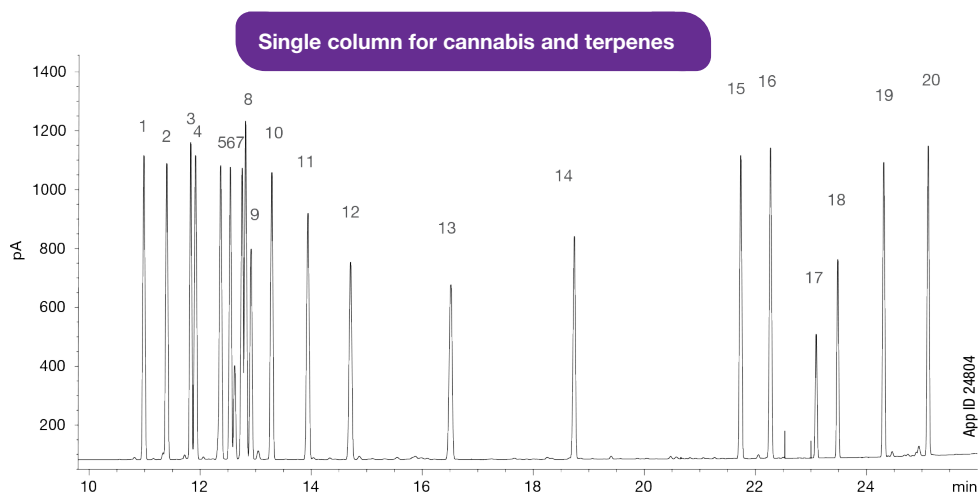
## Gas Chromatography



## Determination of Residual Solvents and Terpenes in Cannabis by GC-FID using Zebron ZB-624<sup>PLUS</sup>™ GC Column (*cont'd*)

**Zebron™**  
GC Columns

Figure 3. 20 Terpene Standards Chromatogram at 2500 µg/mL



### GC-FID Conditions

Same conditions for both separations

Column: Zebron ZB-624<sup>PLUS</sup>

Dimensions: 30 meter x 0.25 mm x 1.40 µm

Part No.: ZHG-G040-27

Recommended Z-Guard™: ZCG-G000-00-GHK

Injection: Split 20:1 @ 250 °C, 1 µL

Recommended Liner: Zebron PLUS Liner Z-Liner™

Liner Part No.: AG2-0A03-05 (for Agilent® and Thermo Scientific™ systems)

Carrier Gas: Helium @ 1.0 mL/min (constant flow)

Oven Program: 50 °C for 1 min, 160 °C @ 10 °C/min, hold for 4 min, to 280 °C @ 12 °C/min

Detector: FID @ 300 °C

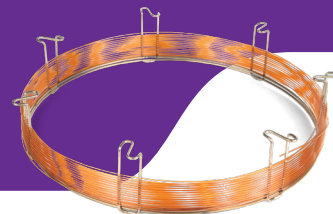
|         |                 |                     |
|---------|-----------------|---------------------|
| Sample: | 1. α-Pinene     | 11. Terpinolene     |
|         | 2. Camphene     | 12. Linalool        |
|         | 3. β-Myrcene    | 13. Isopulegol      |
|         | 4. (-)-β-Pinene | 14. Geraniol        |
|         | 5. Δ-3-Carene   | 15. β-Caryophyllene |
|         | 6. α-Terpinene  | 16. α-Humulene      |
|         | 7. d-Limonene   | 17. Nerolidol 1     |
|         | 8. Δ-Cymene     | 18. Nerolidol 1     |
|         | 9. Ocimene      | 19. Guaiol          |
|         | 10. γ-Terpinene | 20. α-Bisabolol     |

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# Terpenes

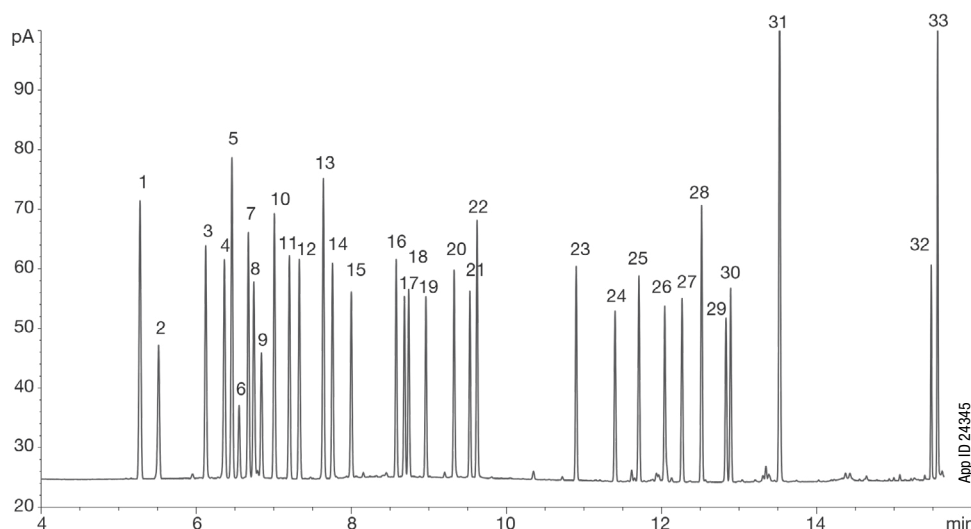
## Gas Chromatography



## Analysis of 33 Primary and Secondary Terpenes Found in Cannabis by GC-FID

**Zebbron™**  
GC Columns

Excellent resolution of 33 terpenes



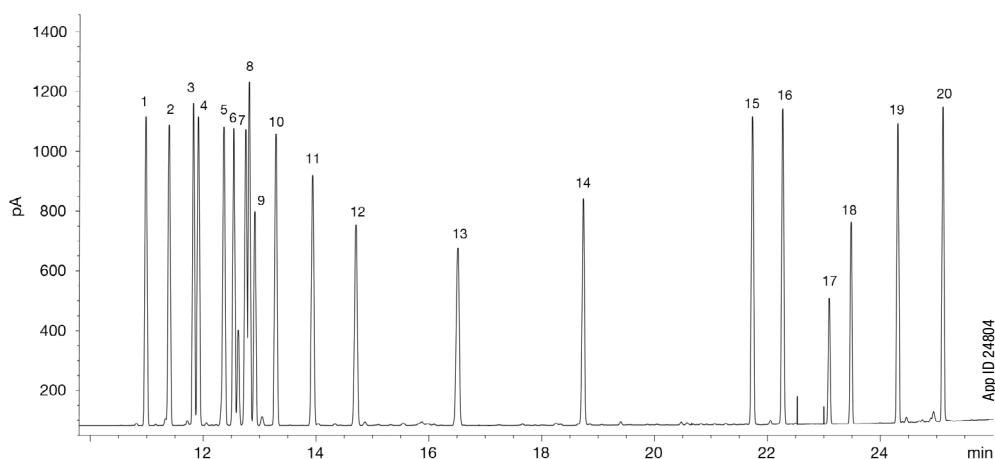
### GC-FID Conditions

**Column:** Zebbron ZB-5PLUS  
**Dimensions:** 20 m x 0.18 mm x 0.36 µm  
**Part No.:** 7FD-G032-53  
**Recommended Z-Guard™:** 5 m Z-Guard™ (7AD-G000-00-G70)  
**Injection:** Split 20:1 @ 250 °C, 1 µL  
**Recommended Liner:** Zebbron Plus Single Taper Z-Liner™  
**Liner Part No.:** AG2-0A13-01  
**Carrier Gas:** Helium @ 1.9 mL/min  
**Oven Program:** 35 °C to 105 °C @ 10 °C/min to 205 °C @ 15 °C/min to 360 °C @ 35 °C/min for 1.9 min  
**Detector:** FID @ 340 °C  
**Sample:** Terpenes are 50-100 ppm in Acetonitrile

|                      |                         |
|----------------------|-------------------------|
| 1. α-Pinene          | 18. Menthhol            |
| 2. Camphene          | 19. α-Terpineol         |
| 3. β-Myrcene         | 20. Citronellol         |
| 4. α-Phellandrene    | 21. Pulegone            |
| 5. 3-Carene          | 22. Geraniol            |
| 6. α-Terpinene       | 23. Geranyl acetate     |
| 7. p-Cymene          | 24. Trans-Caryophyllene |
| 8. Limonene          | 25. α-Humulene          |
| 9. Ocimene-1         | 26. Valencene           |
| 10. Ocimene-2        | 27. Nerolidol-1         |
| 11. γ-Terpinene      | 28. Nerolidol-2         |
| 12. Sabinine hydrate | 29. Caryophyllene oxide |
| 13. Terpineolene     | 30. Guaiol              |
| 14. Linalool         | 31. α-Bisabolol         |
| 15. Fenchol          | 32. Phytol-1            |
| 16. Isoborneol       | 33. hyltol-2            |
| 17. Borneol          |                         |

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### 20 Terpenes Using Zebbron ZB-624PLUS



### GC-FID Conditions

**Column:** Zebbron ZB-5PLUS  
**Dimensions:** 30 meter x 0.25 mm x 1.40 µm  
**Part No.:** 7HG-G040-27  
**Recommended Z-Guard™:** 7CG-G000-00-GHK  
**Injection:** Split 20:1 @ 250 °C, 1 µL  
**Recommended Liner:** Zebbron PLUS Straight Z-Liner™  
**Liner Part No.:** AG2-0A03-05 (for Agilent® and Thermo Scientific™ systems)  
**Carrier Gas:** Helium @ 1.0 mL/min (constant flow)  
**Oven Program:** 50 °C for 1 min, 160 °C @ 10 °C/min, hold for 4 min, to 280 °C @ 12 °C/min  
**Detector:** FID @ 300 °C  
**Sample:** Terpenes 20 mix

|                 |                     |
|-----------------|---------------------|
| 1. α-Pinene     | 11. Terpinolene     |
| 2. Camphene     | 12. Linalool        |
| 3. β-Myrcene    | 13. Isopulegol      |
| 4. (-)-β-Pinene | 14. Geraniol        |
| 5. d-3-Carene   | 15. β-Caryophyllene |
| 6. α-Terpinene  | 16. α-Humulene      |
| 7. d-Limonene   | 17. Nerolidol 1     |
| 8. p-Cymene     | 18. Nerolidol 1     |
| 9. Ocimene      | 19. Guaiol          |
| 10. γ-Terpinene | 20. α-Bisabolol     |

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# Residual Solvents and Terpenes

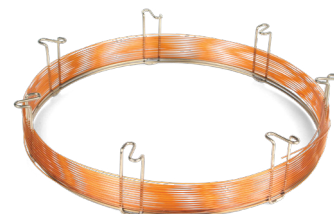
List of recommended part numbers

## GC Columns and Accessories

| Part No.                        | Product Description                                                       |
|---------------------------------|---------------------------------------------------------------------------|
| <a href="#">7HG-G040-27</a>     | Zebron ZB-624PLUS, GC Cap. Column 30m x 0.25mm x 1.4 µm                   |
| <a href="#">7FD-G032-53</a>     | Zebron ZB-5PLUS Capillary GC, Column 20m x 0.18mm x 0.36 µm               |
| <a href="#">7HG-G025-11</a>     | Zebron ZB-35HT, GC Cap. Column 30 m x 0.25 mm x 0.25 µm                   |
| <a href="#">AG2-0A11-05</a>     | Zebron PLUS Liner for Agilent & Thermo 4mm ID Single Taper Wool on Bottom |
| <a href="#">AG2-0A03-05</a>     | Zebron PLUS Liner for Agilent & Thermo, 4mm ID Straight Z-Liner™          |
| <a href="#">AG2-0A13-01</a>     | Zebron PLUS Liner for Agilent & Thermo, 4mm ID Single Taper Z-Liner       |
| <a href="#">7CG-G000-00-GHK</a> | Zebron Z-Guard™ Hi-Temp Guard Column Kit, GC Cap. Column 10 m x 0.25 mm   |
| <a href="#">7AD-G000-00-GZ0</a> | Zebron Z-Guard Guard Column, GC Cap. Column 5 m x 0.18 mm                 |

For a complete selection of GC columns and accessories, and ordering part numbers visit [www.phenomenex.com/Zebbron](http://www.phenomenex.com/Zebbron)

**Zebron™**  
GC Columns



## Verex Headspace Vials

### Screw- and Crimp-Top Headspace Vials

- 10 and 20mL screw- or crimp-top, with round or flat bottom
- Uniform glass thickness ensures even heating
- Lot traceable



**VEREX**  
Certified Filter Vials

#### Ordering Information

| Description                                                                             | 1000/pk                     |
|-----------------------------------------------------------------------------------------|-----------------------------|
| <b>Crimp-Top</b>                                                                        |                             |
| Headspace Vial, 23 x 75 mm, 20mL Beveled Edge, Flat Bottom, Clear, No Patch             | <a href="#">ARO-3260-13</a> |
| Headspace Vial, 23 x 75 mm, 20mL Beveled Edge, Flat Bottom., Clear, No Patch, Silanized | <a href="#">ARO-3263-13</a> |
| Headspace Vial, 23 x 75 mm, 20mL Square Rim, Flat Bottom, Clear, No Patch               | <a href="#">ARO-3290-13</a> |
| Headspace Vial, 23 x 75 mm, 20mL Beveled Edge, Round Bottom, Clear, No Patch            | <a href="#">ARO-3270-13</a> |
| <b>Screw-Top</b>                                                                        |                             |
| Headspace Vial, 23 x 75 mm, 20mL 18 mm Screw, Round Bottom, Clear, No Patch             | <a href="#">ARO-3280-13</a> |
| Headspace Vial, 23 x 75 mm, 20mL 18 mm Screw, Round Bottom, Amber, No Patch             | <a href="#">ARO-3281-13</a> |



#### Autosampler Compatibility

**Flat Bottom:** HP / Agilent, Carlo Erba, Shimadzu

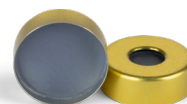
**Round Bottom:** PerkinElmer, Tekmar, LEAP Technologies, Varian

## Headspace Screw- and Crimp-Top Seals / Closures

- Variety of styles for any application
- Magnetic and pressure-release caps available

#### Ordering Information

| Description                                                                               | 1000/pk                     |
|-------------------------------------------------------------------------------------------|-----------------------------|
| <b>Crimp-Top</b>                                                                          |                             |
| Seal, 20 mm Diameter, PTFE/Gray Butyl Rubber, magnetic cap                                | <a href="#">ARO-52C5-13</a> |
| Seal, 20 mm Diameter, PTFE/Butyl Rubber Pharmafix Molded Septum, silver                   | <a href="#">ARO-52D0-13</a> |
| Seal, 20 mm Diameter, PTFE/Butyl Rubber Pressure Release, Pharmafix Molded Septum, silver | <a href="#">ARO-52B0-13</a> |
| Seal, 20 mm Diameter, PTFE/Silicone, magnetic cap                                         | <a href="#">ARO-5255-13</a> |
| Seal, 20 mm Diameter, PTFE/Silicone, silver                                               | <a href="#">ARO-5250-13</a> |
| Seal, 20 mm Diameter, PTFE/Silicone Pressure Release, silver                              | <a href="#">ARO-5220-13</a> |
| <b>Screw-Top</b>                                                                          |                             |
| Screw Cap, 18 mm, Magnetic, Silver, PTFE/Butyl Rubber septa (red/grey)                    | <a href="#">ARO-814M-13</a> |
| Screw Cap, 18 mm, Magnetic, Silver, PTFE/Silicone septa (red/white)                       | <a href="#">ARO-815M-13</a> |
| Screw Cap, 18 mm, Magnetic, Silver, PTFE/Silicone septa (blue/white)                      | <a href="#">ARO-81AM-13</a> |
| Screw Cap, 18 mm, Magnetic, Silver, PTFE/Silicone septa (white/translucent blue)          | <a href="#">ARO-81BM-13</a> |



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# Accessories

HPLC / UHPLC / GC

## HPLC / UHPLC Accessories

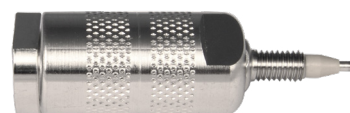
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Column Protection



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[SecurityGuard ULTRA UHPLC Column Protection](#)



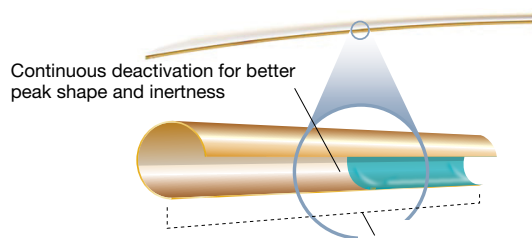
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[SecurityGuard Standard HPLC Column Protection](#)

## GC Accessories

**Zebtron™**  
GC Products



Continuous deactivation for better peak shape and inertness

Seamless guard transition, no connection hassles and no potential for leaks

[Guardian Integrated Guard Columns](#)

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[Gas Filters and Traps](#)

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## Ordering Information

[Sample Preparation / SPE](#)



[GC Columns & Accessories](#)



[HPLC / UHPLC Columns & Accessories](#)





# Cannabis Testing Guide

- Potency
- Pesticides
- Residual Solvents
- Terpenes
- Mycotoxins

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