

Terpenes, Insecticide, and a LaCroix Lawsuit

By Scott Krepich, Food and Environmental Application Scientist

Terpenes are a diverse class of organic compounds that can be found in many plants and often with a strong odor. There's been over 3,000 terpenes identified, and their diverse organoleptic properties have been used in products such as fragrances, essential oils, and beverages. Beverage companies that use craft brew formulations where diverse terpenes are found in hops contribute to unique and custom flavors.

One of the many plants that terpenes can be found in are cannabis flowers, where over a hundred different organic compounds have been identified in the plant. Combined with the various cannabinoids themselves, the diverse terpene profiles in the different strains may contribute to some therapeutic properties by the "entourage" effect. The entourage effect is a mechanism where compounds present in cannabis that are largely non-psychoactive by themselves, modulate the overall psychoactive effects of the plant.

This year, there was an interesting lawsuit brought against the popular sparkling water brand, LaCroix, for allegedly including components of insecticides. Among these components were terpenes, limonene, and linalool, which can be found in citrus peels and would contribute to floral aromas.

Law firm Beaumont Costales filed the suit on behalf of a customer, and claims testing revealed synthetic ingredients. LaCroix denies the allegations.

"LaCroix in fact contains ingredients that have been identified by the Food and Drug Administration as synthetic," the lawsuit obtained by CBS states. "These chemicals include limonene, which can cause kidney toxicity and tumors; linalool propionate, which is used to

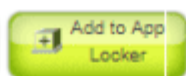
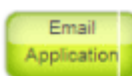
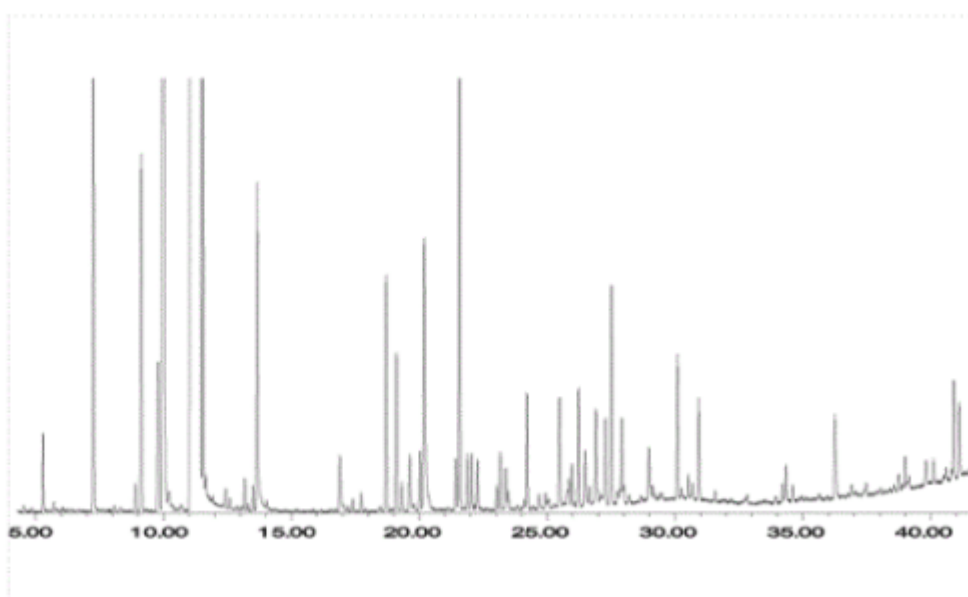
treat cancer; and linalool, which is used in cockroach insecticide.”

Without commenting on the lawsuit, I would say that plants have evolved into exceptionally sophisticated chemicals, that can be used to repel pests, which is perhaps one of the reasons why several different plant components are studied for natural pest repellents. It could also be why your grandmother’s advice to rub lemon peels on your skin to avoid mosquito bites might have been sound!

Interested in learning more about terpenes? Check out the following technical applications below:

Cold-Pressed Orange Oil GC-MS on ZB-WAX

Cold-Pressed Orange Oil on ZBWAX 60x0.25x0.25



Application Detail (App ID: 15570)

Column: Zebtron™ ZB-WAX, GC Cap. Column 60 m x 0.25 mm x 0.25 µm, Ea

Part No: 7KG-G007-11

Phase: Polyethylene Glycol (PEG)

Dimensions: 60 meters x 0.25 mm x 0.25 µm

Order Recommended
Products for this Application

Oven Profile: 75°C to for 4 min to 250°C at 4°C/min for 5 min

Carrier Gas: Constant Flow Helium, 0.8 mL/min

Injection: Split 75:1 0.2 µL @ 275°C

Detection: Mass Selective (MSD) (0°C)

Note: Injection of Pure Orange Oil

7 Primary Terpenes in Cannabis by LC-MS/MS

APPLICATIONS

7 Primary Terpenes in Cannabis by LC-MS/MS



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Overview

At least 200 terpenes have been identified in Cannabis sativa (cannabis), and many more can be found in other important plant species and products. Unique Cannabis strains and extracts can present varying terpene profiles. A method is shown that uses atmospheric pressure chemical ionization (APCI)-LC-MS/MS, focusing on seven terpenes typically found in cannabis.



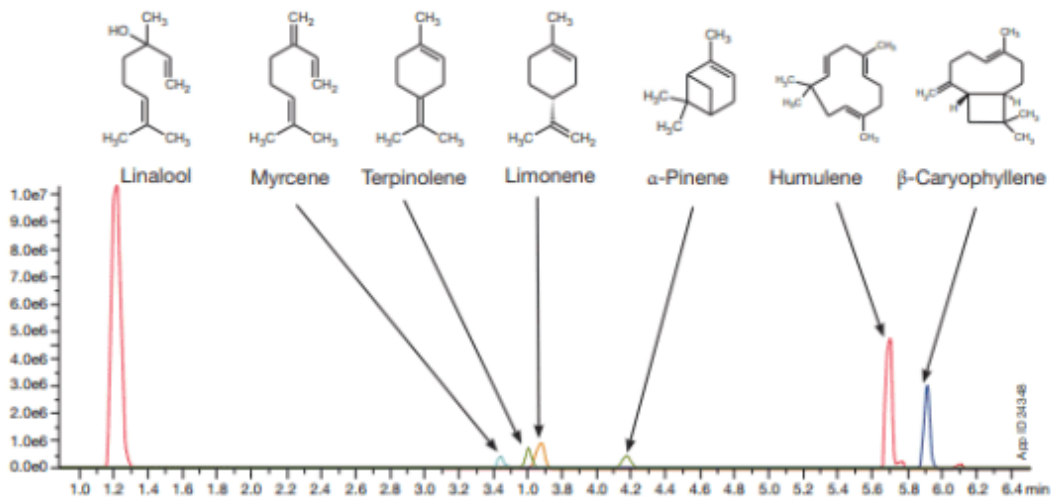
LC-MS/MS Conditions

Column: Kinetex® 2.6 µm Biphenyl
Dimension: 100 x 4.6mm
Part No.: 000-4622-EO
Mobile Phase: A: 2 mM Ammonium acetate + 0.1 % Formic acid in Water
 B: 2 mM Ammonium acetate + 0.1 % Formic acid in Methanol
Gradient:

Time (min)	B (%)
0	50
3	75
4	75
5	95
6	95
7	50
12	50

Flow Rate: 0.55 mL/min
Injection: 3 µL
Temperature: 40 °C
Detection: MS/MS
Instrument: SCIEX 3500 Triple Quad™ LC-MS
Analytes:

- Linalool
- Myrcene
- Terpinolene
- Limonene
- α-Pinene
- Humulene
- β-Caryophyllene



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

APPLICATIONS



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

Matthew Trass, Tim Anderson, and Scott Krepich
Phenomenex, Inc., 411 Madrid Ave., Torrance, CA 90501 USA

Overview

Terpenes are a diverse class of organic compounds found in many plants and generally have a strong odor. They are typically used in fragrances, essential oils, and for medicinal purposes. There are over 100 terpenes found in cannabis. Developed is a GC-FID method with excellent resolution and peak-shape for 33 primary and secondary terpenes found in cannabis. The selectivity and high temperature limits of the Zebtron™ ZB-5PLUS allows for great resolution of key terpenes and high bake out for the removal of low volatile matrix contaminants that may be present.

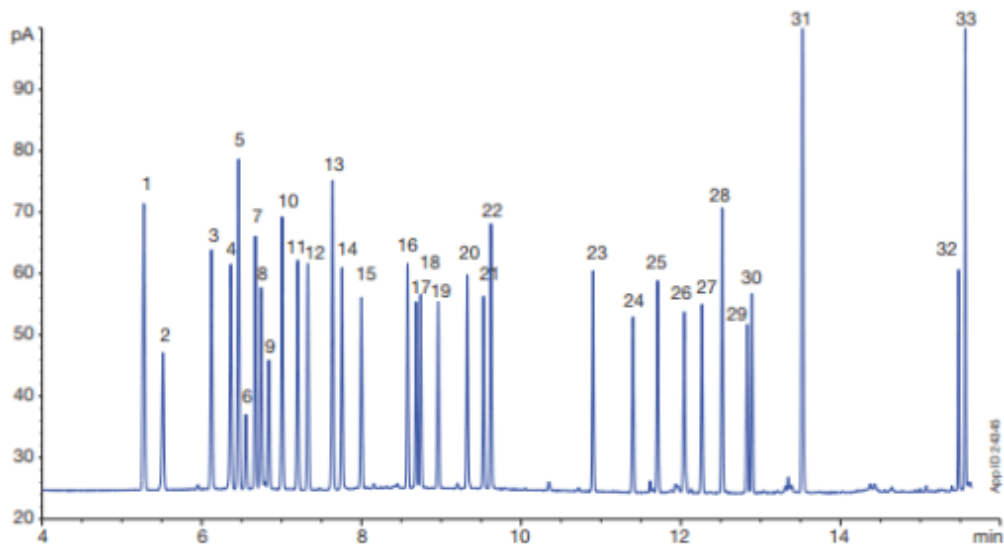


GC-FID Conditions

Column: ZB-5PLUS™
Dimension: 20m x 0.18mm x 0.36µm
Part No.: 7FD-G032-53
Guard: 5m Z-Guard™ (7AD-G000-00-GZD)
Injection: Split 20:1 @ 250 °C, 1 µL
Recommended Liner: Zebtron Plus Single Taper Z-Liner™
Liner Part No.: AG2-GA13-01
Carrier Gas: Helium @ 1.5mL/min
Oven Program: 35 °C to 100 °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-Phene | 12. Sabinine hydrate | 23. Geranyl acetate |
| 2. Camphene | 13. Terpinolene | 24. Trans-Caryophyllene |
| 3. Myrcene | 14. Linalol | 25. α-Humulene |
| 4. α-Phellandrene | 15. Fenchol | 26. Valencene |
| 5. β-Carene | 16. Isoborneol | 27. Nerolidol-1 |
| 6. α-Terpinene | 17. Borneol | 28. Nerolidol-2 |
| 7. p-Cymene | 18. Menthol | 29. Caryophyllene oxide |
| 8. Limonene | 19. α-Terpineol | 30. Guaiol |
| 9. Ocimene-1 | 20. Citronellol | 31. α-Bisabolol |
| 10. Ocimene-2 | 21. Pulgonol | 32. Phytol-1 |
| 11. γ-Terpinene | 22. Geraniol | 33. Phytol-2 |



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