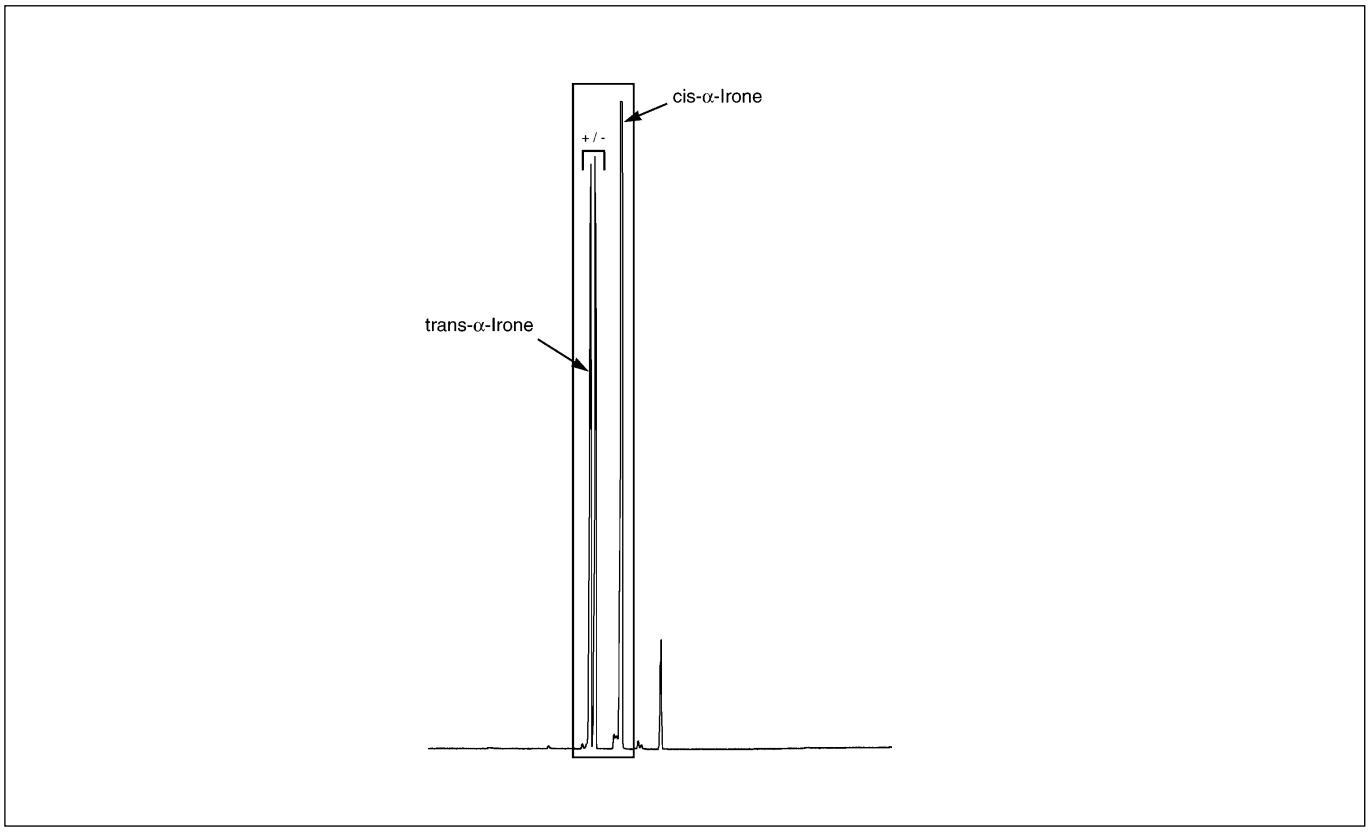
# ANALYSIS OF α-IRONE (STANDARD) ON CYDEX-B

## α-IRONE (STANDARD)

| | | | |
|---|---|---|---|
| **Column Part No.:** | **054900** | Rate: | 2 °C/min |
| Column: | Cydex-B, 0.25 µm | Final Temp.: | 220 °C |
| Phase: | 25 m x 0.22 mm I.D. | Carrier Gas: | Helium |
| Initial Temp.: | 100 °C, 1 min | Carrier Pressure: | 16 psi |
| | | Injection Mode: | Split 50:1 |

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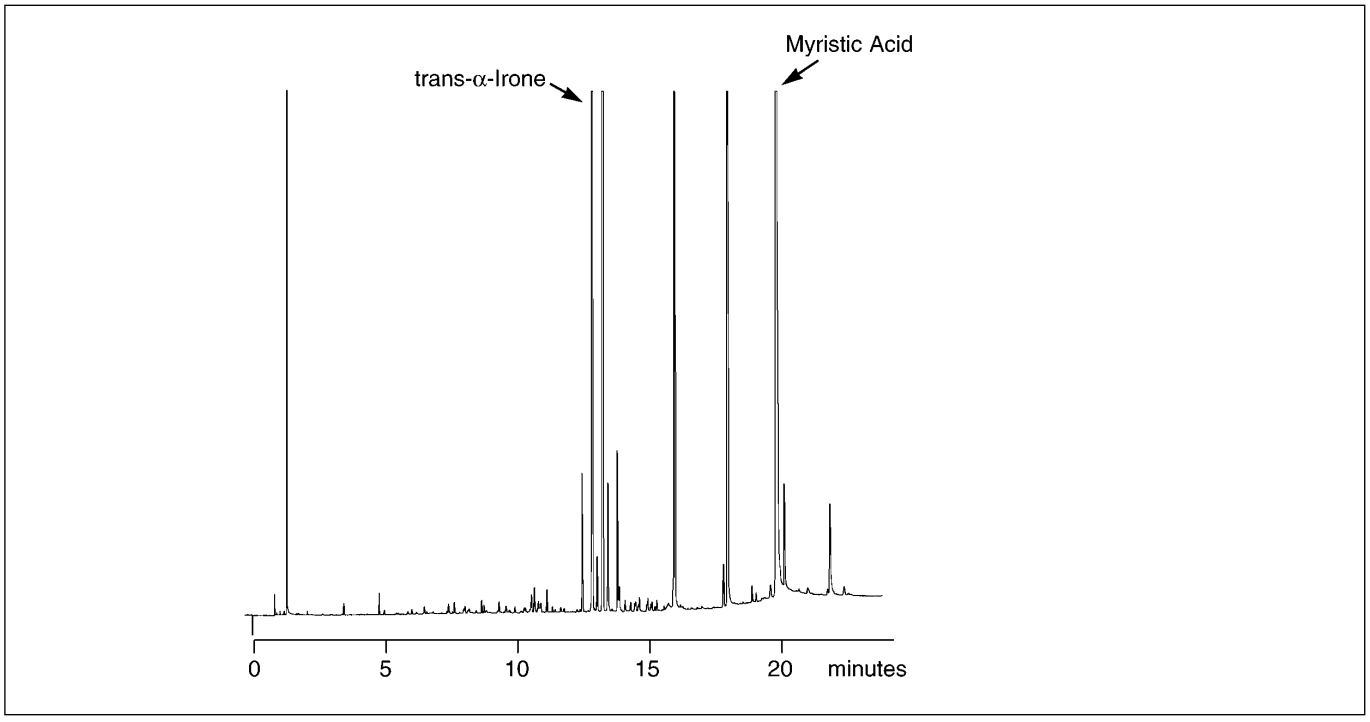
# ANALYSIS OF ORRIS CONCENTRATE ON BP20

## ORRIS CONCENTRATE

| | | | |
|---|---|---|---|
| **Column Part No.:** | **054436** | Rate: | 10 °C/min |
| Column: | BP20, 0.5 µm | Final Temp.: | 250 °C, 10 min |
| Phase: | 25 m x 0.32 mm I.D. | Carrier Gas: | Helium |
| Initial Temp.: | 70 °C, 1 min | Carrier Pressure: | 10 psi |
| | | Injection Mode: | Split 50:1 |

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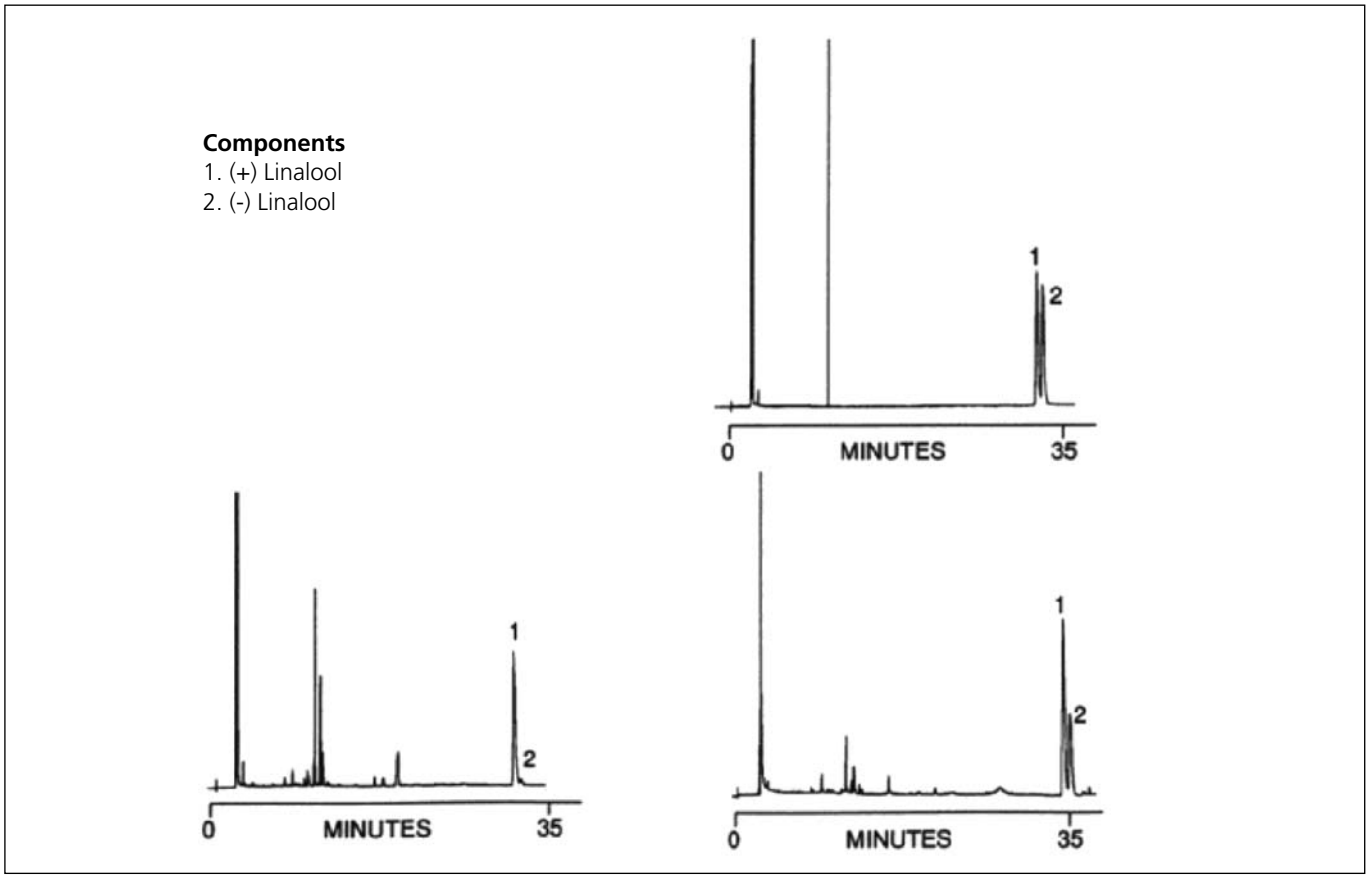
# ANALYSIS OF LAVENDER OIL ON CYBEX-B

## LAVENDER OIL

| | | | |
|---|---|---|---|
| **Column Part No.:** | **054901** | Detector: | FID |
| Phase: | Cydex-B 0.25 µm film | Sensitivity: | 32 x $10^{-12}$ AFS |
| Column: | 50 m x 0.22 mm ID | Injection Mode: | Split |
| Initial Temp.: | Isothermal at 90 °C | | |

*Notes: The Cydex - B column enables easy detection of adulteration of Lavender oils*

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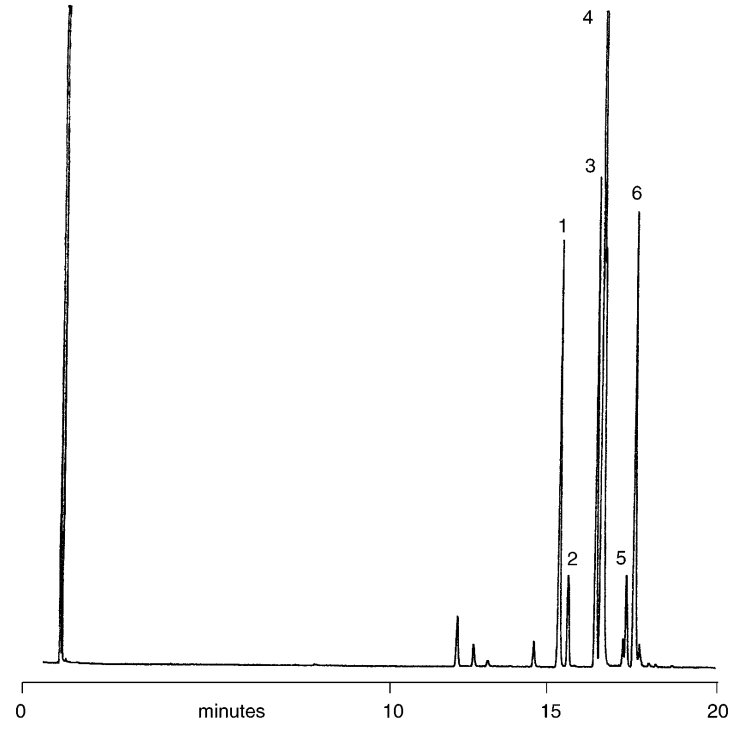
# ANALYSIS OF MENTHOL OIL ON CYDEX-B

## MENTHOL OIL

| | | | |
|---|---|---|---|
| **Column Part No.:** | **054901** | Final Temp.: | 130 °C |
| Phase: | Cydex-B, 0.25 µm film | Carrier Gas: | $H_2$ |
| Column: | 50 m x 0.22 mm I.D. | Detector: | F.I.D. |
| Initial Temp.: | 100 °C, 5 min | Sensitivity: | 32 x $10^{-12}$ AFS |
| Rate: | 2 °C/min | Injection Mode: | Split |

*Notes: Cydex - B column enables the separation of three different enantiomer pairs in Menthol Oil.*




**Components**
1. (+) Neomenthol
2. (-) Neomenthol
3. (+) Menthol
4. (-) Menthol
5. (+) a-Terpineol
6. (-) a-Terpineol

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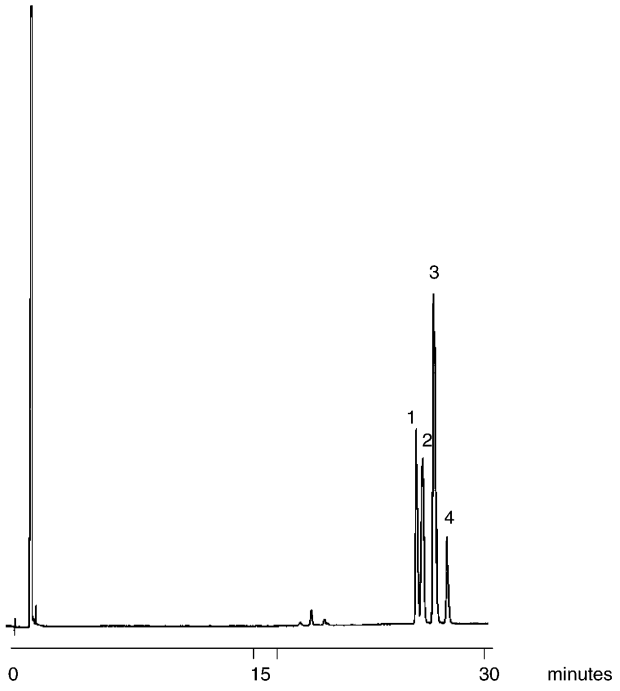
# ANALYSIS OF BORNEOLS ON CYDEX-B

## ANALYSIS OF BORNEOLS

| | | | |
|---|---|---|---|
| **Column Part No.:** | **054900** | Final Temp.: | 130 °C |
| Phase: | Cydex-B, 0.25 µm film | Carrier Gas: | $H_2$, 12 psi |
| Column: | 25 m x 0.22 mm I.D. | Detector: | F.I.D. |
| Initial Temp.: | 90 °C, 1 min | Sensitivity: | 32 x $10^{-12}$ AFS |
| Rate: | 2 °C/min | Injection Mode: | Split |




**Components**
1. (+) Iso-borneol
2. (-) Iso-borneol
3. (+) Borneol
4. (-) Borneol

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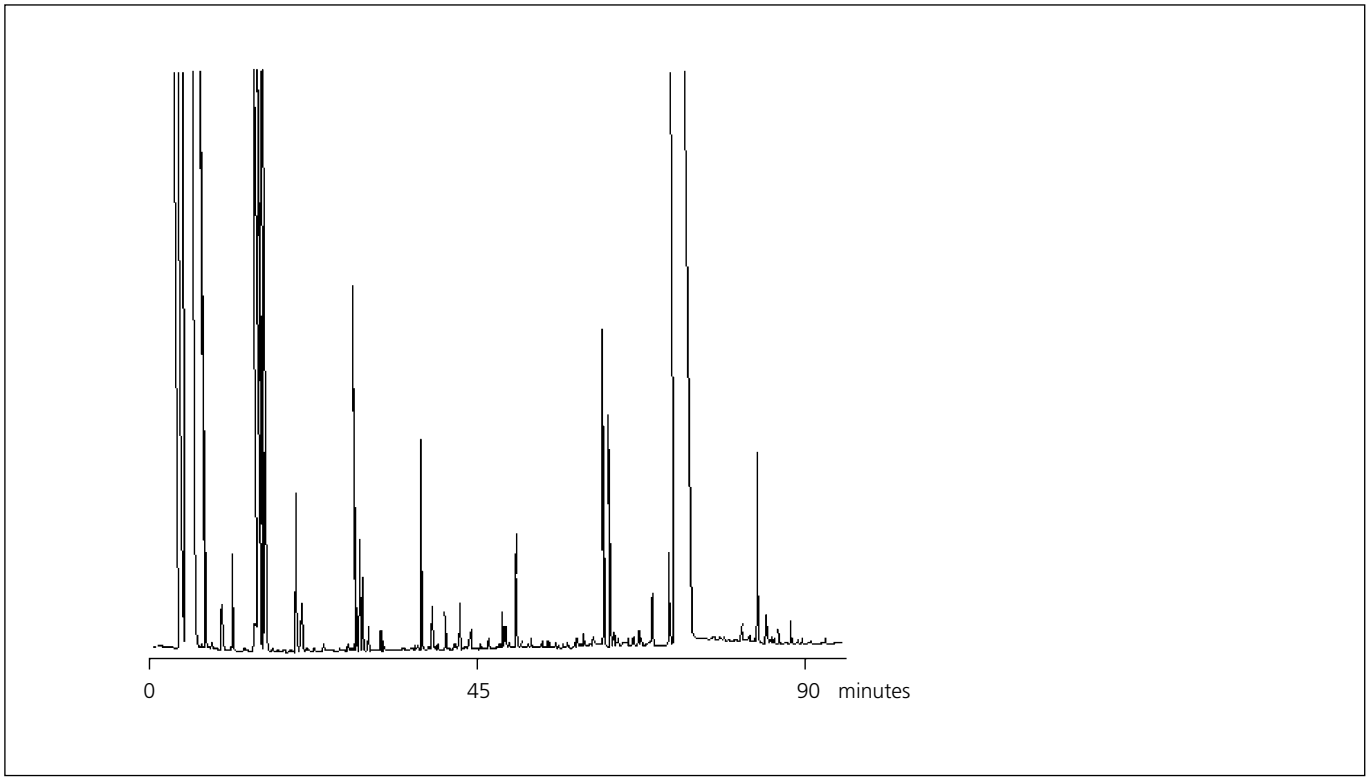
GC APPLICATION NOTE

# ANALYSIS OF RASPBERRY FLAVOURS ON BPX5

| | | | |
|---|---|---|---|
| **Column Part No.:** | **054114** | Final Temp: | 250 °C, 10 min |
| Phase: | BPX5, 0.25 µm film | Injector Temp.: | 240 °C |
| Column: | 50 m x 0.22 mm ID | Injector Mode: | Split |
| Initial Temp.: | 60 °C, 10 min | Detector: | FID 320 °C |
| Rate: | 2 °C/min | Carrier Gas: | Helium, 25 psi |

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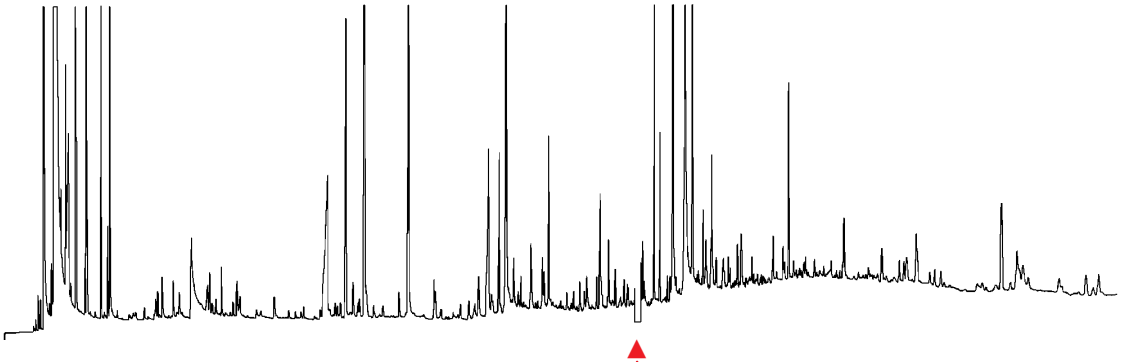
SGE Analytical Science

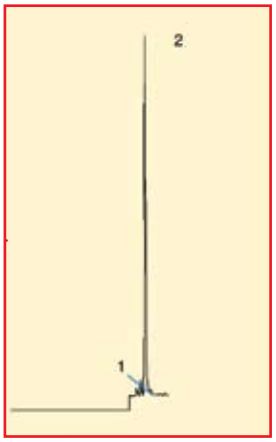
# RASPBERRY EXTRACT ON BP1

| | |
|---|---|
| **Column Part No.:** | **054066** |
| Phase: | BP1, 0.5 µm film |
| Column: | 50 m x 0.32 mm ID |
| Initial Temp.: | 40 °C |
| Rate 1: | 2 °C/min |
| Temp 2: | 130 °C |
| Rate 2: | 4 °C/min |
| Final Temp.: | 130 °C |
| Detector: | FID |
| Injection Mode: | Splitless (1 µL) |

RASPBERRY EXTRACT



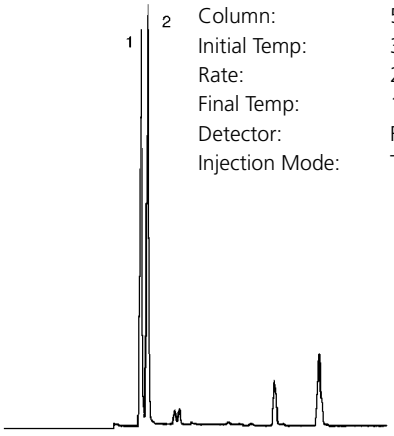
Heart Cut




α- *IONONE RASPBERRY (Heart Cut)*

**ANALYSIS OF α-IONONE**

| | |
|---|---|
| **Column Part No.:** | **054901** |
| Phase: | CYDEX-B, 0.25 µm |
| Column: | 50 m x 0.22 mm ID |
| Initial Temp: | 30 °C |
| Rate: | 20 °C/min |
| Final Temp: | 140 °C, 15 min |
| Detector: | FID |
| Injection Mode: | Thermal desorption (CHIS) |




**Components**

1. (S) α - Ionone
2. (R) α - Ionone

*Chromatogram courtesy of Bio-Industries, Grasse, France*

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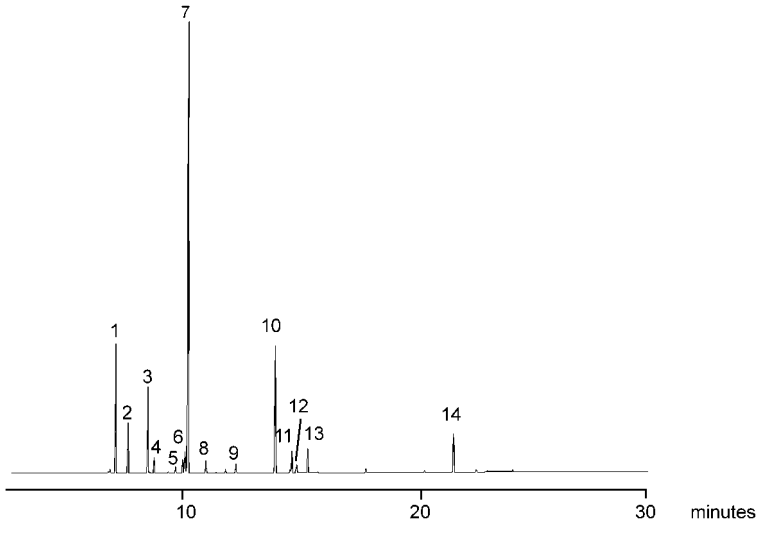
# ANALYSIS OF ROSEMARY ESSENTIAL OIL ON BPX5

| | | | |
|---|---|---|---|
| **Column Part No.:** | **054101** | Detector: | 5973 MSD |
| Phase: | BPX5, 0.25 µm film | Injector Mode: | Split (50:1) |
| Column: | 30 m x 0.25 mm ID | Injector Temp.: | 250 °C |
| Initial Temp.: | 45 °C | Carrier Gas: | He, 35 cm/sec at 45 °C |
| Initial Hold Time: | 1 min. | Injection Volume: | 1 µL |
| Rate 1: | 5 °C/min | Concentration (ng/mL) | 1:20 dilution in DCM |
| Temp 2: | 250 °C | GC model: | HP 6890 GC, 5973 MSD |
| Temp 1 Hold Time: | 15 min | Interface/Source/Quad: | 320 °C, 250 °C, 106 °C |




**Components**

1. alpha-Pinene
2. Camphene
3. beta-Pinene
4. beta-Myrcene
5. p-Cymene
6. Limonene
7. 1,8-Cineole
8. gamma-Terpinene
9. Linalool L
10. Camphor
11. 1-Borneol
12. Terpinene-4-ol
13. alpha-Terpineol
14. trans-Caryophyllene

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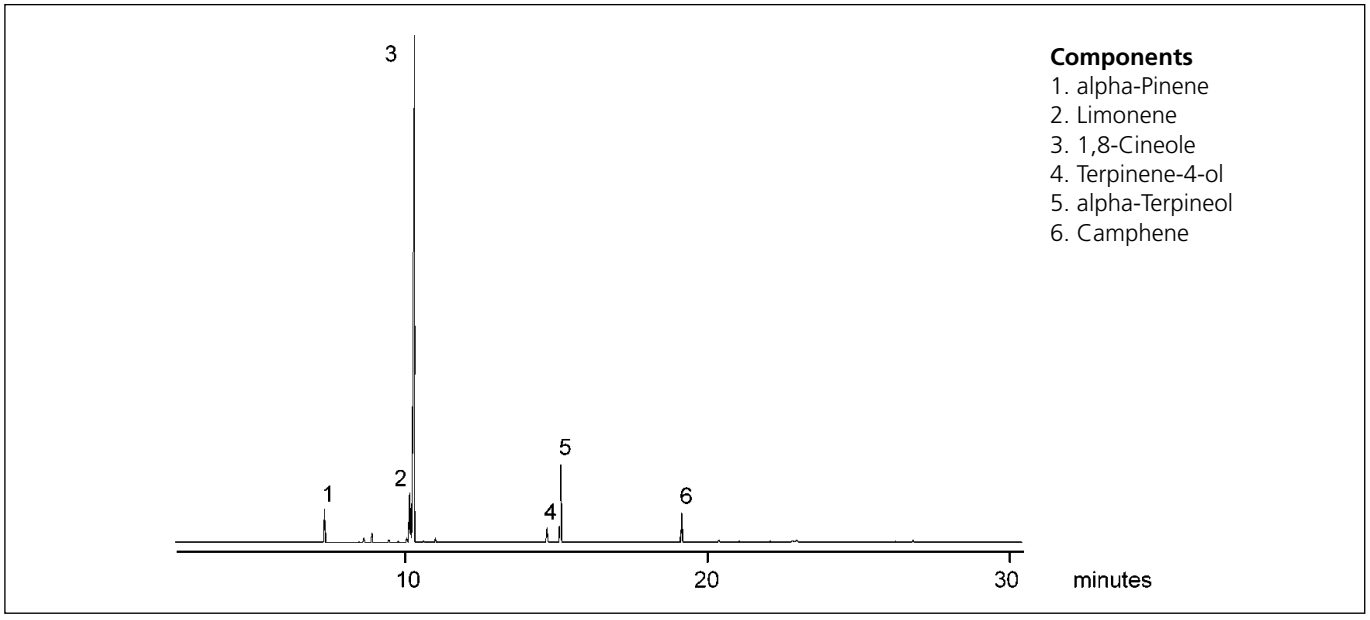
# ANALYSIS OF EUCALYPTUS ESSENTIAL OIL ON BPX5

| | | | |
|---|---|---|---|
| **Column Part No.:** | **054101** | Detector: | 5973 MSD |
| Phase: | BPX5, 0.25 µm film | Injector Mode: | Split (50:1) |
| Column: | 30 m x 0.25 mm ID | Injector Temp.: | 250 °C |
| Initial Temp.: | 45 °C | Carrier Gas: | He, 35 cm/sec at 45 °C |
| Initial Hold Time : | 1 min | Injection Volume : | 1mL |
| Rate 1: | 5 °C/min | Concentration (ng/mL) | 1:20 dilution in DCM |
| Temp 2: | 250 °C | GC model: | HP 6890 GC, 5973 MSD |
| Temp 1 Hold Time: | 15 min | Interface/Source/Quad: | 320 °C, 250 °C, 106 °C |

*Note: The non-polar nature of the phase will generally give separation based on boiling point and this is complimentary to the unique selectivity of the polyethylene glycol BP20 phase*

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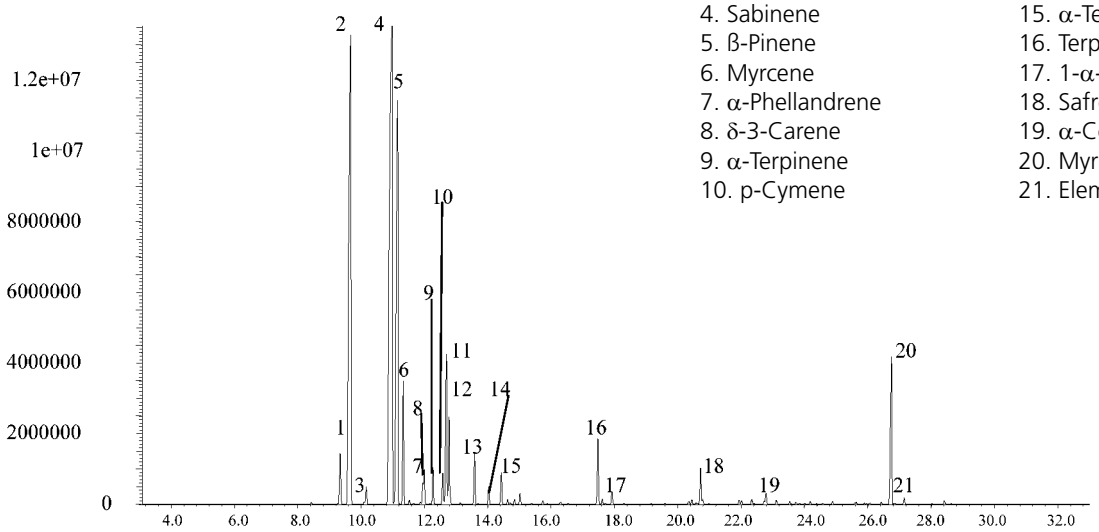
# ANALYSIS OF NUTMEG OIL ON BPX5

| | | | |
|---|---|---|---|
| **Column Part No.:** | **054101** | Average Linear Velocity: | 36 cm/sec at 40 °C |
| Phase: | BPX5, 0.25 µm film | Injection Mode: | Split |
| Column: | 30 m x 0.25 mm ID | Split Ratio: | 200:1 |
| Initial Temp.: | 40 °C, 1 min. | Purge on (Split) Vent Flow: | 200 mL/min. |
| Rate: | 5 °C/min to 260 °C, | Injection Volume: | 0.2 µL |
| Final Temp: | 260 °C | Injection Temp.: | 250 °C |
| Detector Type: | Mass Spectrometer | Liner Type: | 4 mm ID Double Taper Liner |
| Carrier Gas: | He, 7.0 psi | | |
| Carrier Gas Flow: | 1.0 mL/min. | Liner Part Number: | 092018 |
| Constant Flow: | On | | |




**Components**

1. α–Thujene
2. α-Pinene
3. Camphene
4. Sabinene
5. ß-Pinene
6. Myrcene
7. α-Phellandrene
8. δ-3-Carene
9. α-Terpinene
10. p-Cymene
11. Limonene
12. ß-Phellandrene
13. ϒ-Terpinene
14. trans-Sabinene hydrate
15. α-Terpinolene
16. Terpinen-4-ol
17. 1-α-Terpineol
18. Safrole
19. α-Copaene
20. Myristcin
21. Elemicin

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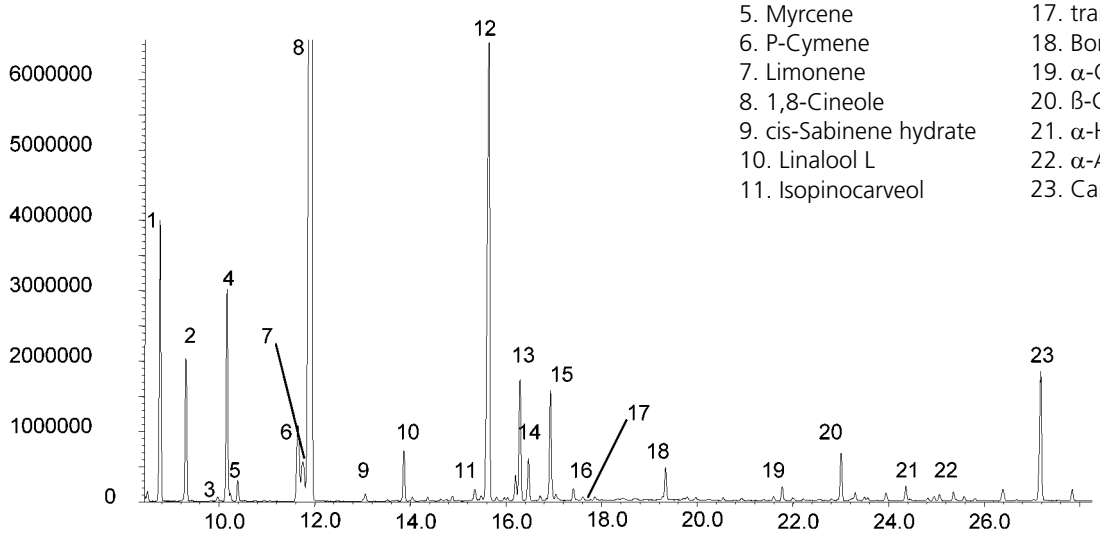
# ANALYSIS OF ROSEMARY OIL ON BPX5

| | |
|---|---|
| **Column Part No.:** | **054101** |
| Phase: | BPX5, 0.25 µm film |
| Column: | 30 m x 0.25 mm ID |
| Initial Temp.: | 40 °C, 1 min. |
| Rate 1: | 5 °C/min to 260 °C, |
| Final Temp: | 260 °C |
| Detector Type: | Mass Spectrometer |
| Carrier Gas: | He, 7.0 psi |
| Carrier Gas Flow: | 1.0 mL/min. |
| Constant Flow: | On |
| Average Linear Velocity: | 36 cm/sec at 40 °C |
| Injection Mode: | Split |
| Split Ratio: | 200:1 |
| Purge on (Split) | |
| Vent Flow: | 200 mL/min. |
| Injection Volume: | 0.2 µL |
| Injection Temp.: | 250 °C |
| Liner Type: | 4 mm ID Double Taper Liner |
| Liner Part Number: | 092018 |




**Components**

1. α-Pinene
2. Camphene
3. Sabinene
4. ß-Pinene
5. Myrcene
6. P-Cymene
7. Limonene
8. 1,8-Cineole
9. cis-Sabinene hydrate
10. Linalool L
11. Isopinocarveol
12. Camphor
13. Borneol L
14. Terpinen-4-ol
15. α-Terpineol
16. Verbenone
17. trans-(+)-Carveol
18. Bornyl acetate
19. α-Copaene
20. ß-Caryophyllene
21. α-Humulene
22. α-Amorphene
23. Caryophyllene oxide

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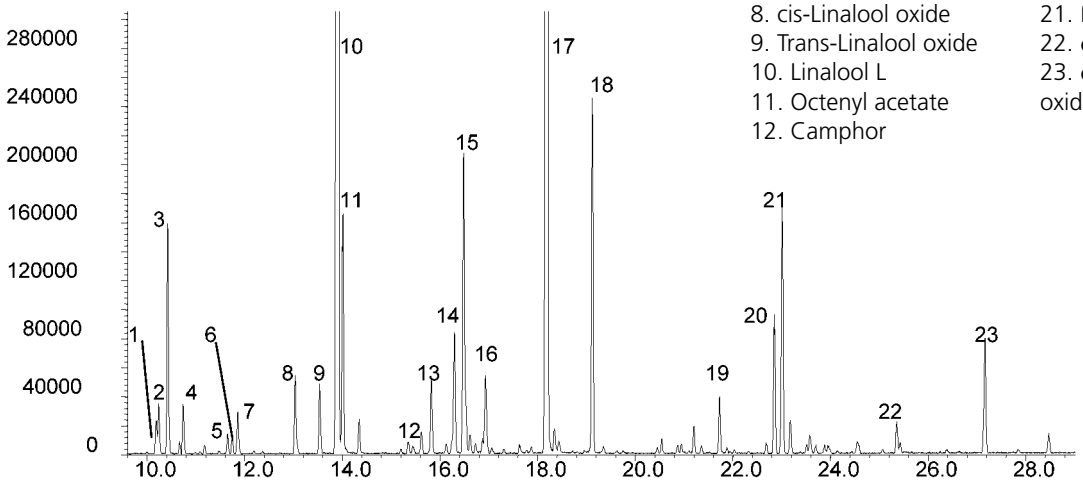
# ANALYSIS OF LAVENDER OIL ON BPX5

| | | | |
|---|---|---|---|
| **Column Part No.:** | **054101** | Average Linear Velocity: | 36 cm/sec at 40 °C |
| Phase: | BPX5, 0.2 5 µm film | Injection Mode: | Split |
| Column: | 30 m x 0.25 mm ID | Split Ratio: | 200:1 |
| Initial Temp.: | 40 °C, 1 min. | Purge on (Split) | |
| Rate 1: | 5 °C/min to 260 °C, | Vent Flow: | 200 mL/min. |
| Final Temp: | 260 °C | Injection Volume: | 0.2 µL |
| Detector Type: | Mass Spectrometer | Injection Temp.: | 250 °C |
| Carrier Gas: | He, 7.0 psi | Liner Type: | 4 mm ID Double Taper Liner |
| Carrier Gas Flow: | 1.0 mL/min. | | |
| Constant Flow: | On | Liner Part Number: | 092018 |




**Components**

1. ß-Pinene
2. 1-Octen-3-ol
3. 3-Octanone
4. 3-Octanol
5. p-Cymene
6. Limonene
7. cis-Ocimene
8. cis-Linalool oxide
9. Trans-Linalool oxide
10. Linalool L
11. Octenyl acetate
12. Camphor
13. Lavandulol
14. Borneol L
15. Terpinen-4-ol
16. α-Terpineol
17. Linalyl acetate
18. Lavundyl Acetate
19. Geranyl Acetate
20. α-Santalene
21. ß-Caryophyllene
22. α-Cadinene
23. α-Caryophyllene oxide

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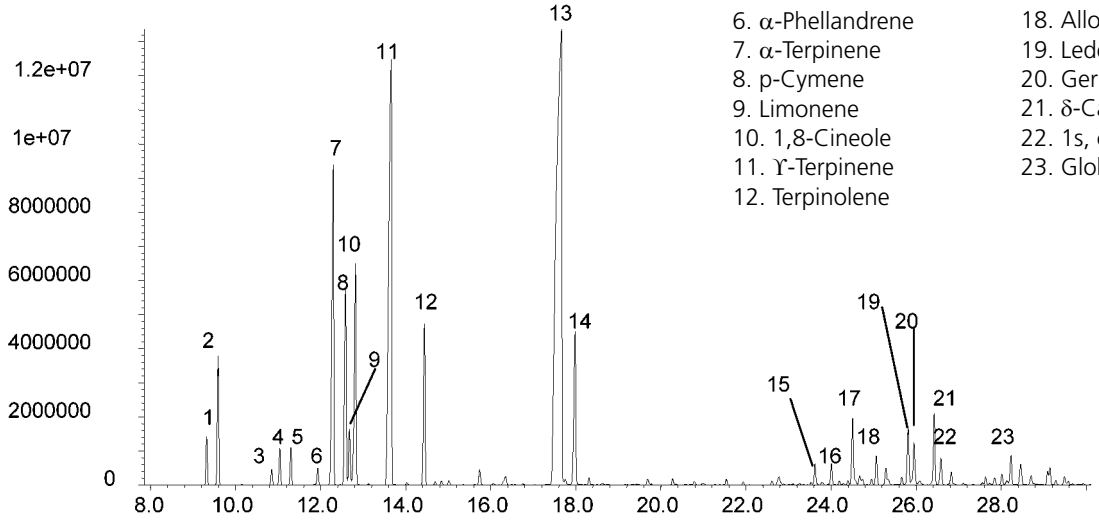
# ANALYSIS OF TEATREE OIL ON BPX5

| | | | |
|---|---|---|---|
| **Column Part No.:** | **054101** | Average Linear Velocity: | 36 cm/sec at 40 °C |
| Phase: | BPX5, 0.25 µm film | Injection Mode: | Split |
| Column: | 30 m x 0.25 mm ID | Split Ratio: | 200:1 |
| Initial Temp.: | 40 °C, 1 min. | Purge on (Split) | |
| Rate 1: | 5 °C/min to 200 °C, | Vent Flow: | 200 mL/min. |
| Final Temp: | 200 °C | Injection Volume: | 0.2 µL |
| Detector Type: | Mass Spectrometer | Injection Temp.: | 250 °C |
| Carrier Gas: | He, 7.0 psi | Liner Type: | 4 mm ID Double Taper Liner |
| Carrier Gas Flow: | 1.0 mL/min. | | |
| Constant Flow: | On | Liner Part Number: | 092018 |




**Components**

1. Thujene
2. α-Pinene
3. Sabinene
4. 3-Octanol
5. ß-Pinene
6. α-Phellandrene
7. α-Terpinene
8. p-Cymene
9. Limonene
10. 1,8-Cineole
11. ϒ-Terpinene
12. Terpinolene
13. Terpinen-4-ol
14. α-Terpineol
15. α-Gurjunene
16. (trans)-ß-Caryophyllene
17. Aromadendrene
18. Alloaromadendrene
19. Ledene
20. Germacrene B
21. δ-Cadinene
22. 1s, cis-Calamenene
23. Globulol

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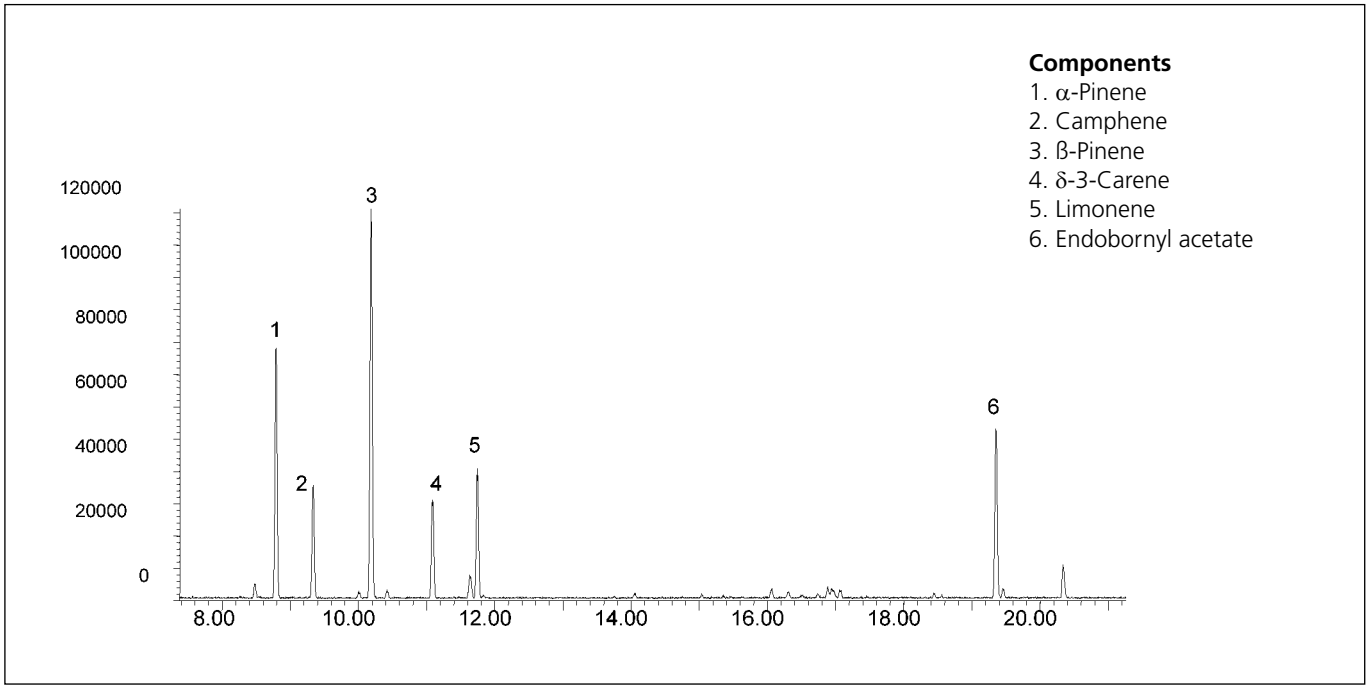
# ANALYSIS OF PINE OIL ON BPX5

| | | | |
|---|---|---|---|
| **Column Part No.:** | **054101** | Average Linear Velocity: | 36 cm/sec at 40 °C |
| Phase: | BPX5, 0.25 µm film | Injection Mode: | Split |
| Column: | 30 m x 0.25 mm ID | Split Ratio: | 200:1 |
| Initial Temp.: | 40 °C, 1 min. | Purge on (Split) | |
| Rate 1: | 5 °C/min to 260 °C, | Vent Flow: | 200 mL/min. |
| Final Temp: | 260 °C | Injection Volume: | 0.2 µL |
| Detector Type: | Mass Spectrometer | Injection Temp.: | 250 °C |
| Carrier Gas: | He, 7.0 psi | Liner Type: | 4 mm ID Double Taper Liner |
| Carrier Gas Flow: | 1.0 mL/min. | | |
| Constant Flow: | On | Liner Part Number: | 092018 |

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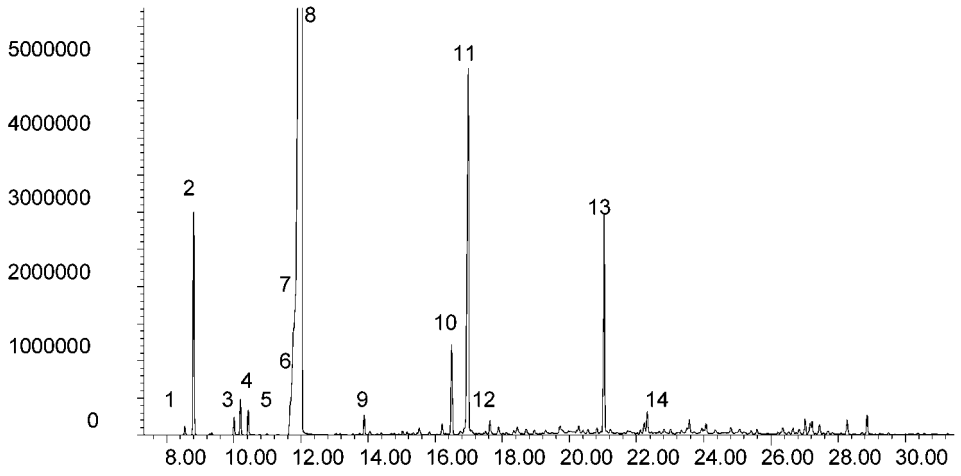
# ANALYSIS OF EUCALYPTUS OIL ON BPX5

| | | | |
|---|---|---|---|
| **Column Part No.:** | **054101** | Average Linear Velocity: | 36 cm/sec at 40 °C |
| Phase: | BPX5, 0.25 µm film | Injection Mode: | Split |
| Column: | 30 m x 0.25 mm ID | Split Ratio: | 200:1 |
| Initial Temp.: | 40 °C, 1 min. | Purge on (Split) | |
| Rate 1: | 5 °C/min to 200 °C, | Vent Flow: | 200 mL/min. |
| Final Temp: | 260 °C | Injection Volume: | 0.2 µL |
| Detector Type: | Mass Spectrometer | Injection Temp.: | 250 °C |
| Carrier Gas: | He, 7.0 psi | Liner Type: | 4 mm ID Double Taper Liner |
| Carrier Gas Flow: | 1.0 mL/min. | | |
| Constant Flow: | On | Liner Part Number: | 092018 |




**Components**
1. α-Phellandrene
2. α-Pinene
3. Sabinene
4. ß-Pinene
5. Myrcene
6. Cymene
7. Limonene
8. 1,8-Cineole
9. Linalool L
10. 1-Terpinen-4-ol
11. α-Terpineol
12. Citronellol
13. α-Terpinenyl acetate
14. Methyl cinnamate

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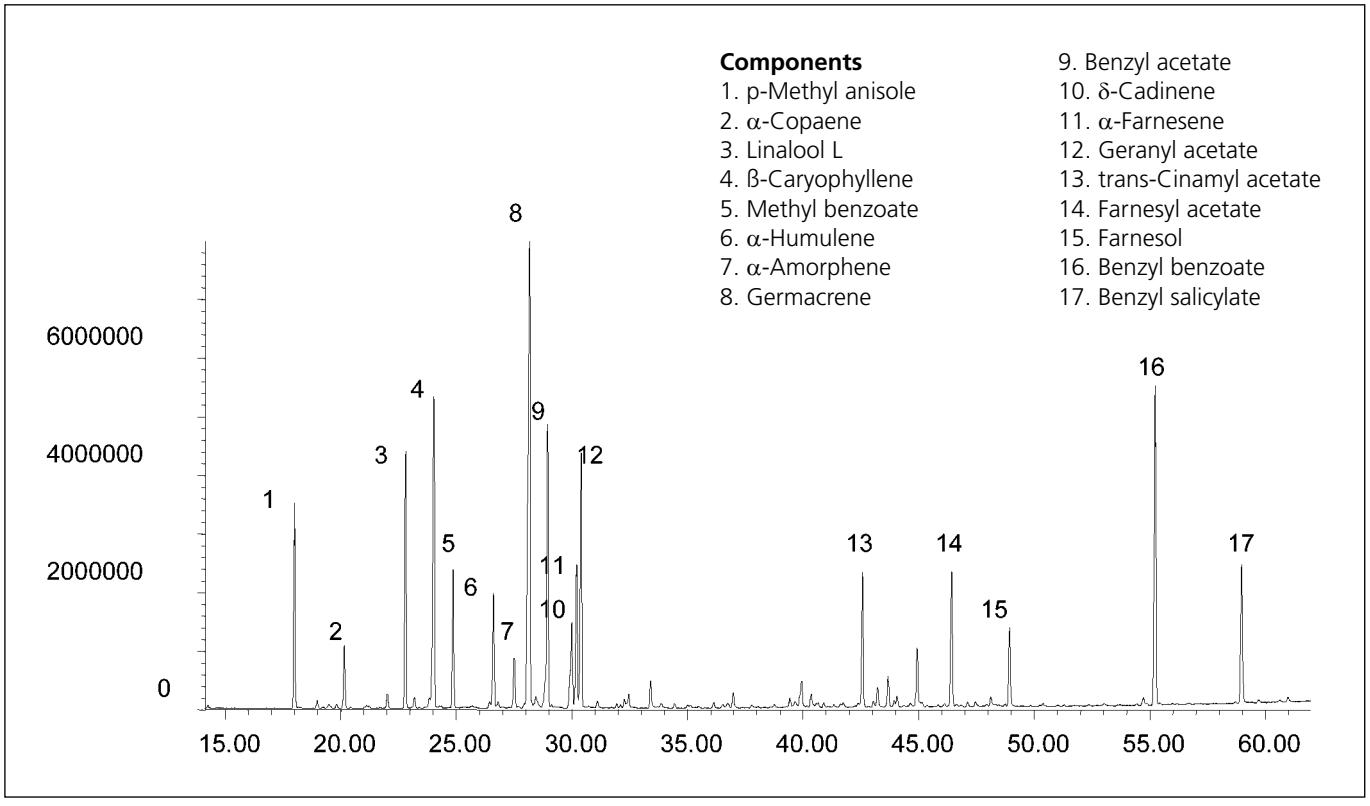
# ANALYSIS OF YLANG YLANG OIL ON SOLGEL-WAX™

| | | | |
|---|---|---|---|
| **Column Part No.:** | **054796** | Constant Flow: | On |
| Phase: | SolGel-Wax™, 0.25 µm | Average Linear Velocity: | 35 cm/sec at 40 °C |
| Sample: | Ylang Ylang oil neat. | Injection Mode: | Split |
| Column: | 30 m x 0.25 mm ID | Split Ratio: | 120:1 |
| Initial Temp.: | 40 °C, 2 min. | Injection Volume: | 0.1 µL |
| Rate 1: | 3 °C/min to 250 °C, | Injection Temp.: | 250 °C |
| Final Temp: | 250 °C, 10 min. | Autosampler: | No |
| Detector Type: | Mass Spectrometer | Liner Type: | 4 mm ID Double Taper Liner |
| Carrier Gas: | He, 25.7 psi | Liner Part Number: | 092018 |
| Carrier Gas Flow: | 1.8 mL/min. | Full Scan / SIM: | Full scan 45-450 |

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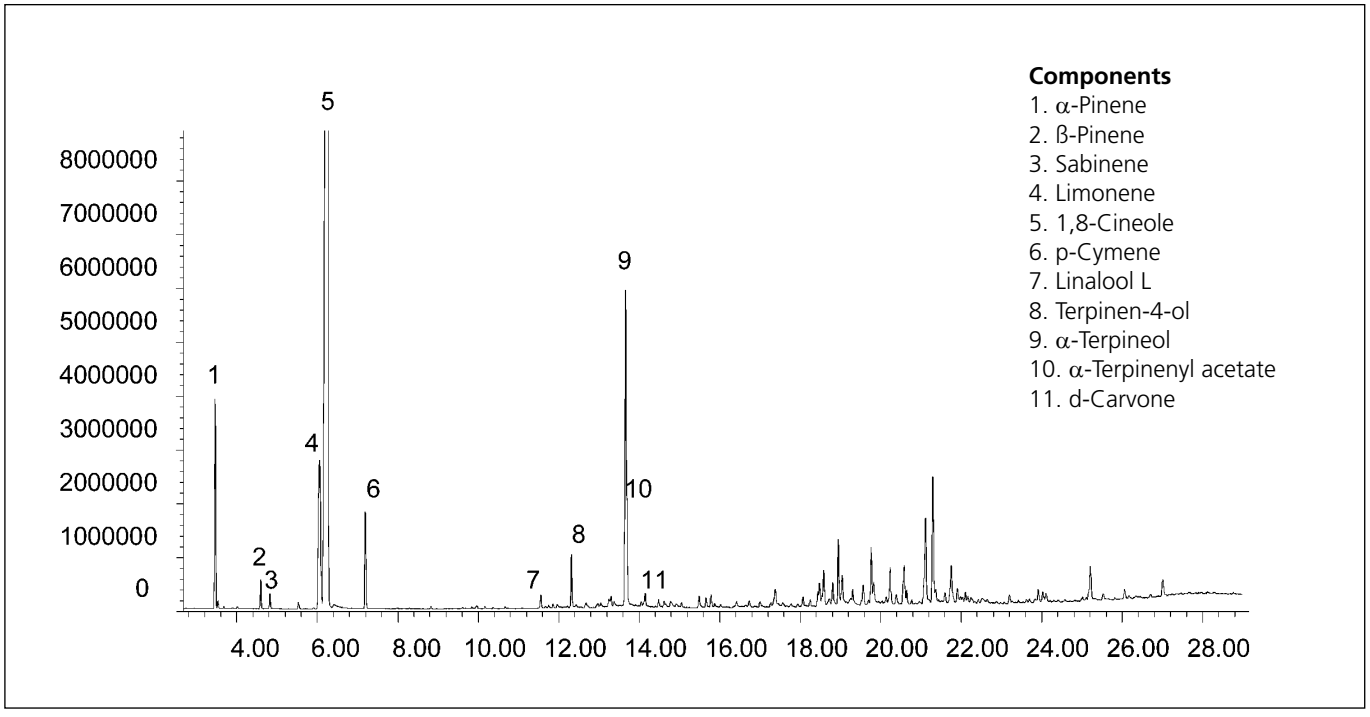
# ANALYSIS OF EUCALYPTUS OIL ON SOLGEL-WAX™

| | | | |
|---|---|---|---|
| **Column Part No.:** | **054796** | Constant Flow: | On |
| Phase: | SolGel-Wax™, 0.25 µm film | Average Linear Velocity: | 35 cm/sec at 40 °C |
| Sample: | neat | Injection Mode: | Split |
| Column: | 30 m x 0.25 mm ID | Split Ratio: | 100:1 |
| Initial Temp.: | 40 °C, 1 min. | Injection Volume: | 0.2 µL |
| Rate 1: | 8 °C/min to 220 °C, | Injection Temp.: | 250 °C |
| Final Temp: | 220 °C, 5 min. | Liner Type: | 4 mm ID Single Taper Liner |
| Detector Type: | Mass Spectrometer | Liner Part Number: | 092017 |
| Carrier Gas: | He, 25.7 psi | Full Scan / SIM: | Full scan 45-450 |
| Carrier Gas Flow: | 1.8 mL/min. | | |

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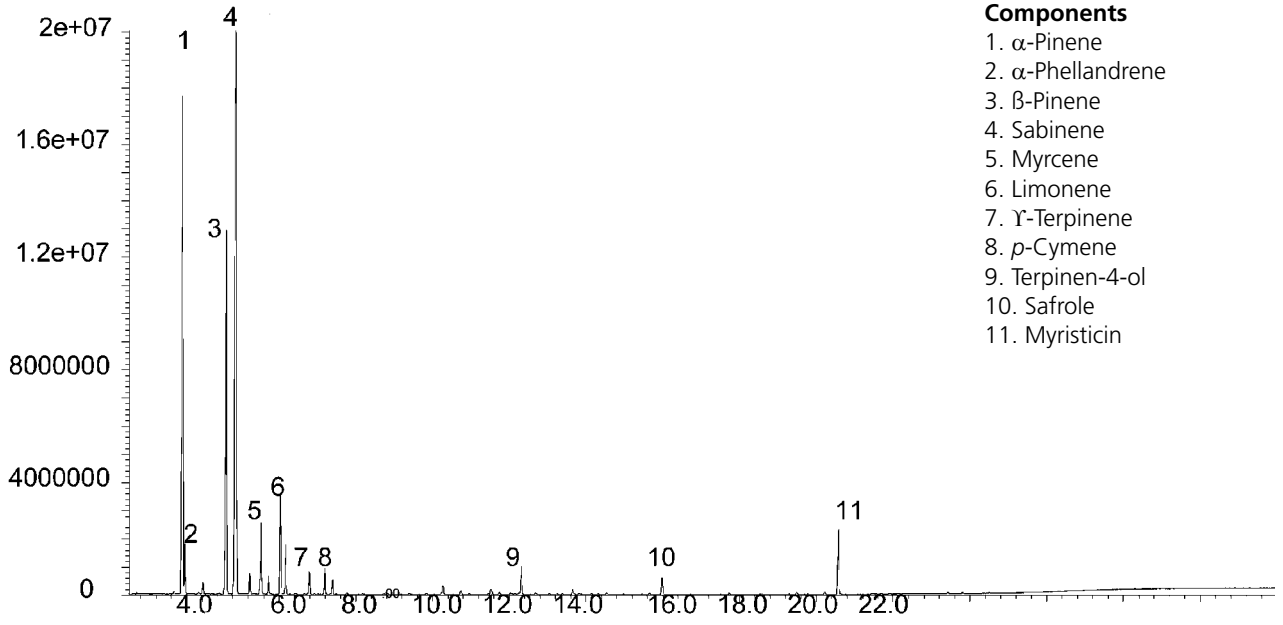
# ANALYSIS OF NUTMEG OIL ON SOLGEL-WAX™

| | | | |
|---|---|---|---|
| **Column Part No.:** | **054796** | Constant Flow: | On |
| Phase: | SolGel-Wax™, 0.25 µm | Average Linear Velocity: | 35 cm/sec at 40 °C |
| Sample: | 2000-3000 ppm in ethanol | Injection Mode: | Split |
| Column: | 30 m x 0.25 mm ID | Split Ratio: | 100:1 |
| Initial Temp.: | 40 °C, 1 min. | Injection Volume: | 0.2 µL |
| Rate 1: | 8 °C/min to 220 °C, | Injection Temp.: | 250 °C |
| Final Temp: | 220 °C, 5 min. | Liner Type: | 4 mm ID Single Taper Liner |
| Detector Type: | Mass Spectrometer | | |
| Carrier Gas: | He, 25.7 psi | Liner Part Number: | 092017 |
| Carrier Gas Flow: | 1.8 mL/min. | Full Scan / SIM: | Full scan 45-450 |




**Components**
1. α-Pinene
2. α-Phellandrene
3. ß-Pinene
4. Sabinene
5. Myrcene
6. Limonene
7. ϒ-Terpinene
8. *p*-Cymene
9. Terpinen-4-ol
10. Safrole
11. Myristicin

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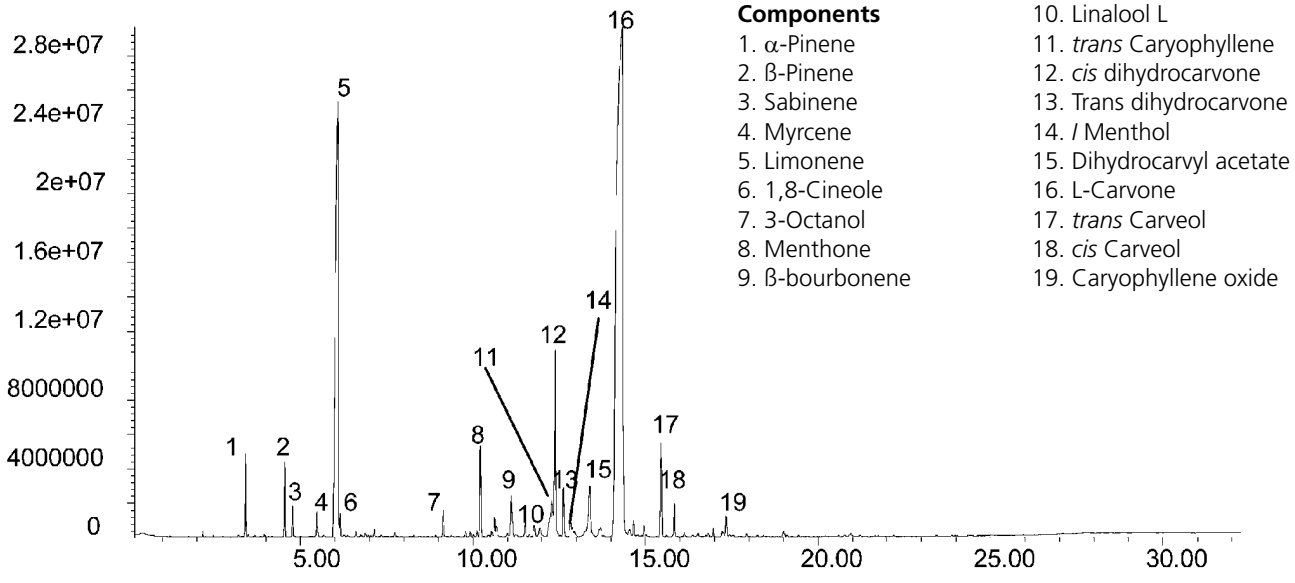
# ANALYSIS OF SPEARMINT OIL ON SOLGEL-WAX™

| | | | |
|---|---|---|---|
| **Column Part No.:** | **054796** | Constant Flow: | On |
| Phase: | SolGel-WAX™, 0.25 µm film | Average Linear Velocity: | 35 cm/sec at 40 °C |
| Sample: | neat | Injection Mode: | Split |
| Column: | 30 m x 0.25 mm ID | Split Ratio: | 100:1 |
| Initial Temp.: | 40 °C, 1 min. | Injection Volume: | 0.2 µL |
| Rate 1: | 8 °C/min to 220 °C, | Injection Temp.: | 250 °C |
| Final Temp: | 220 °C, 5 min. | Liner Type: | 4 mm ID Single Taper Liner |
| Detector Type: | Mass Spectrometer | Liner Part Number: | 092017 |
| Carrier Gas: | He, 25.7 psi | Full Scan / SIM: | Full scan 45-450 |
| Carrier Gas Flow: | 1.8 mL/min. | | |




**Components**

1. α-Pinene
2. ß-Pinene
3. Sabinene
4. Myrcene
5. Limonene
6. 1,8-Cineole
7. 3-Octanol
8. Menthone
9. ß-bourbonene
10. Linalool L
11. *trans* Caryophyllene
12. *cis* dihydrocarvone
13. Trans dihydrocarvone
14. *l* Menthol
15. Dihydrocarvyl acetate
16. L-Carvone
17. *trans* Carveol
18. *cis* Carveol
19. Caryophyllene oxide

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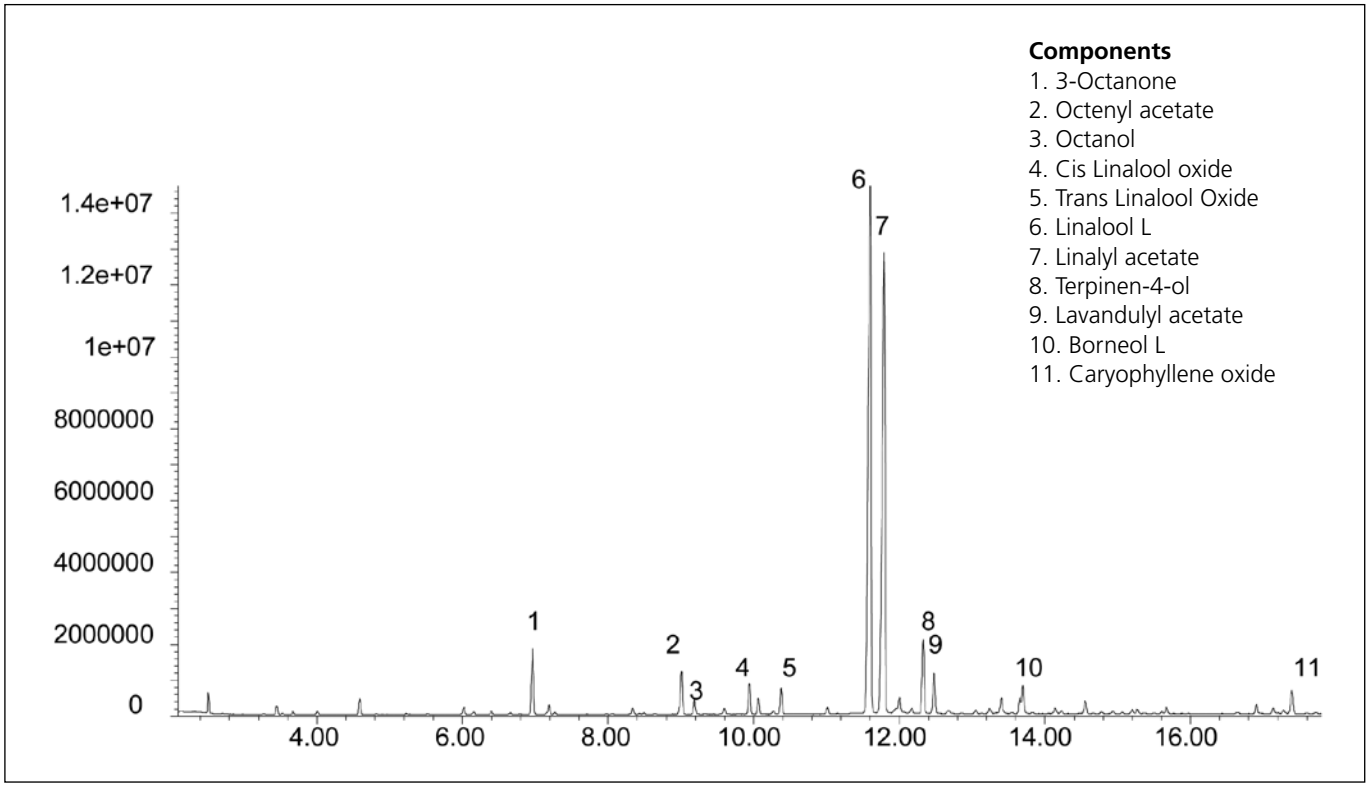
# ANALYSIS OF TASMANIAN LAVENDER OIL SOLGEL-WAX™

| | | | |
|---|---|---|---|
| **Column Part No.:** | **054796** | Constant Flow: | On |
| Phase: | SolGel-WAX™, 0.25 µm film | Average Linear Velocity: | 35 cm/sec at 40 °C |
| Sample: | neat | Injection Mode: | Split |
| Column: | 30 m x 0.25 mm ID | Split Ratio: | 100:1 |
| Initial Temp.: | 40 °C, 1 min. | Injection Volume: | 0.2 µL |
| Rate 1: | 8 °C/min to 220 °C, | Injection Temp.: | 250 °C |
| Final Temp: | 220 °C, 5 min. | Liner Type: | 4 mm ID Single Taper Liner |
| Detector Type: | Mass Spectrometer | Liner Part Number: | 092017 |
| Carrier Gas: | He, 25.7 psi | Full Scan / SIM: | Full scan 45-450 |
| Carrier Gas Flow: | 1.8 mL/min. | | |

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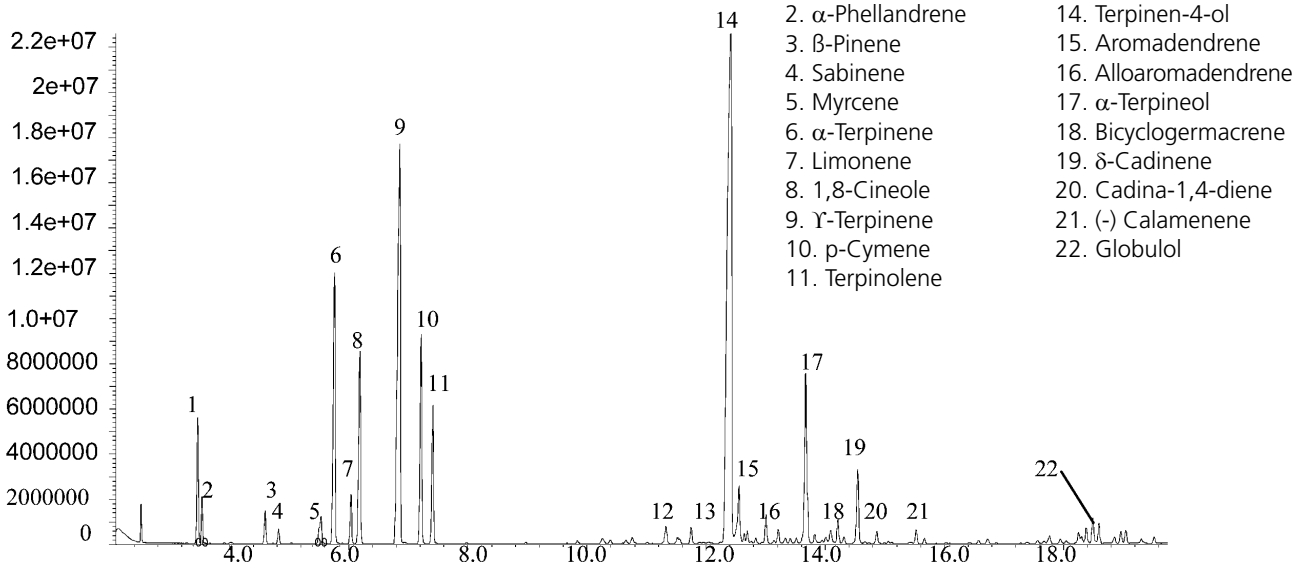
# ANALYSIS OF TEATREE OIL ON SOLGEL-WAX™

| | | | |
|---|---|---|---|
| **Column Part No.:** | **054796** | Constant Flow: | On |
| Phase: | SolGel-WAX, 0.25 µm film | Average Linear Velocity: | 35 cm/sec at 40 °C |
| Sample: | 10 ppm in methanol | Injection Mode: | Split |
| Column: | 30 m x 0.25 mm ID | Split Ratio: | 100:1 |
| Initial Temp.: | 40 °C, 1 min. | Injection Volume: | 0.2 µL |
| Rate 1: | 8 °C/min to 220 °C, | Injection Temp.: | 250 °C |
| Final Temp: | 220 °C, 5 min. | Liner Type: | 4 mm ID Single Taper Liner |
| Detector Type: | Mass Spectrometer | | |
| Carrier Gas: | He, 25.7 psi | Liner Part Number: | 092017 |
| Carrier Gas Flow: | 1.8 mL/min. | Full Scan / SIM: | Full scan 45-450 |




**Components**

1. α-Pinene
2. α-Phellandrene
3. ß-Pinene
4. Sabinene
5. Myrcene
6. α-Terpinene
7. Limonene
8. 1,8-Cineole
9. ϒ-Terpinene
10. p-Cymene
11. Terpinolene
12. α-Gurjunene
13. 1-Terpineol
14. Terpinen-4-ol
15. Aromadendrene
16. Alloaromadendrene
17. α-Terpineol
18. Bicyclogermacrene
19. δ-Cadinene
20. Cadina-1,4-diene
21. (-) Calamenene
22. Globulol

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APPLICATION NOTE

# Physicochemical Characterization of European Blackcurrants on SolGel-WAX™

## INTRODUCTION

The yield and relative distribution of flavor and fragrance components in foodstuffs, beverages and other agricultural produce varies with plant or animal species, agricultural conditions, geographic range, and climate. Production and processing techniques can also have a major effect. In the case of higher value products, especially those that are specific to a particular region, a premium price may be obtained based on the expectation that the product possesses certain gustatory or olfactory characteristics. Indeed in Europe today it is possible to gain legal protection similar to a trademark, for such regional "specialities". Consistency is everything to the manufacturers of such products, and traditionally they have often relied on a highly experienced "nose" to ensure it. Gas chromatography is also a valuable and widely used tool, capable of producing high quality data where required for commercial, or legal, reasons.

Complete separation of closely related flavour and fragrance compounds is not always possible using non-polar phases such as 100 % dimethylpolysiloxane and 5% phenyl 95 % dimethylpolysiloxane. Complementary separation based on a H-bond accepting phase is particularly useful for resolving alcohols and other polar components. Polyethylene glycol (or 'wax') phases provide the ideal polarity but are prone to oxidative phase loss, which gives poor retention time reproducibility over time, making comparisons between different samples difficult. SGE's SolGel-WAX™ columns are much more resistant to oxidative phase loss than conventional wax phases, having lower bleed and greater retention time reproducibility with use. The combination of low bleed and resistance to oxygen, make SGE's SolGel-WAX™ columns an excellent choice for the QC analysis of flavor and fragrance compounds.

This study, using GC-MS, demonstrates the characterisation of six samples of blackcurrants, from several regions across Europe.

## EXPERIMENTAL CONDITIONS

The six blackcurrant samples were analysed within 2 days of their receipt, and were refrigerated prior to extraction. Each sample was then sealed in a bottle using a stopper with a septum and warmed to 60 °C prior to extraction. SPME extraction was carried out with a Divinylbenzene/Carboxen/Poly-dimethylsiloxane StableFlex 50/30 µm fiber (Supelco p/n: 57328-U) for 15 minutes.

The desorption of the volatile components was carried out directly in the GC injector (250 °C) for 90 seconds.

SolGel-WAX™ 30 m x 0.25 mm ID x 1 µm (Part No. 054787).

## RESULTS

A typical chromatographic profile of one of the various batches of blackcurrants is presented in Figure 1.

The qualitative analysis shows the presence of 60 components in the six extracts of blackcurrant buds. The majority of these components have been previously quoted in the literature, except the 1-Hydroxy-2-methyl ethyl ketone and hydroxyphenylethyl alcohol, which are identified in the present study. Only one component, named X, could not be identified.

Of the 60 chemical components present in the six extracts, 16 components were selected to demonstrate the different characteristics of the extracts obtained. These specific components were chosen, either because they were indicative of the balance between woody aromas and the more desirable fruity ones, or because there were notable differences in their concentrations from one extract to another. Alpha-Terpinene, Benzaldehyde, Copaene, (E)-2-Caren-4-ol and Perillyl alcohol, were deleted from this list despite their specificity, because of their low-level concentrations. The 16 components selected are presented in Table 1.

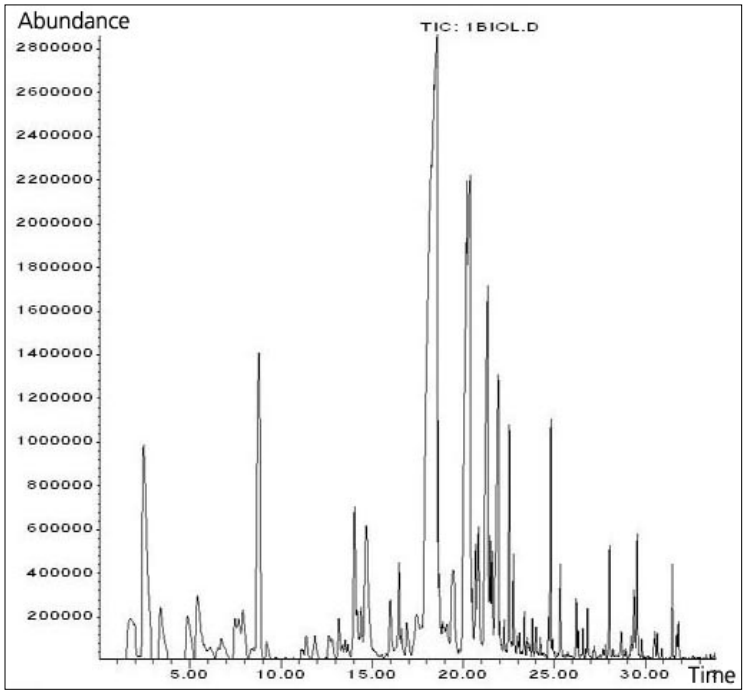


*Figure 1. Chromatographic profile of blackcurrant buds from Batch 1*



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| Chemical Compounds | Retention time (min) | % of total area Batch1 | Batch2 | Batch3 | Batch4 | Batch5 | Batch6 |
|---|---|---|---|---|---|---|---|
| 3-Carene | 5.4 | 1,63 | 2,26 | 2,04 | 1,00 | 2,78 | 2,48 |
| Limonene | 6.55 | 0,16 | 0,78 | 0,13 | 0,19 | 0,34 | 0,35 |
| β-Phellandrene | 6.73 | 0,49 | 2,58 | 2,73 | 0,74 | 1,39 | 1,28 |
| 4-Carene | 8.72 | 4,98 | 3,26 | 7,04 | 2,59 | 3,01 | 3,02 |
| X | 14.00 | 2,41 | 1,19 | 0,19 | 2,39 | 3,77 | 3,81 |
| Bornyl acetate | 17.59 | 1,10 | 7,31 | 23,72 | 1,27 | 0,99 | 1,16 |
| beta Caryophyllene | 18.44 | 26,72 | 21,14 | 14,43 | 18,16 | 19,02 | 18,59 |
| gamma Elemene | 19.34 | - | - | - | 5,59 | 8,9 | 9,01 |
| Allo-aromadendrene | 19.48 | 1,78 | 1,16 | 3,25 | 0,8 | - | - |
| alpha Caryophyllene | 20.26 | 13,54 | 10,33 | 4,04 | 8,97 | 8,16 | 8,02 |
| Germacrene D | 21.23 | 5,17 | 0,64 | 0,67 | 3,98 | 2,36 | 2,28 |
| delta-Cadinene | 22.51 | 1,51 | 0,63 | 0,66 | 1,82 | 1,27 | 1,29 |
| p-Cymen-8-ol | 24.68 | 1,27 | 1,61 | 0,63 | 0,45 | 0,45 | 0,45 |
| 2-Methoxyphenol | 24.82 | 0,12 | 0,29 | 0,11 | 1,88 | 1,74 | 1,78 |
| Caryophyllene oxide | 28.09 | 0,65 | 2,08 | 4,33 | 2,06 | 1,71 | 1,82 |
| Spathulenol | 31.51 | 0,48 | 1,27 | 2,74 | 3,62 | 2,47 | 2,53 |

*Table 1: List of components chosen to distinguish between blackcurrant batches*

## CONCLUSIONS

After extraction by SPME and analysis by GC-MS, using SGE's SolGel-WAX™ GC columns of the six batches, it was possible to identify 60 components, including 16 that differed from batch to batch sufficiently to allow determination of each sample's source and/or quality.

## REFERENCES

We thank M. Bernet and M. Didtsch of the ISIPCA Group, Research and Studies Centre for Fragrance, Cosmetics and Food Flavours, France, for developing this application, and also SOCOFRUIT, les COTEAUX BOURGUIGNONS, and Mr Krausz of the CEPPARM for providing the blackcurrants.

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APPLICATION NOTE

# Analysis of Serai Essential Oil by Fast GCMS

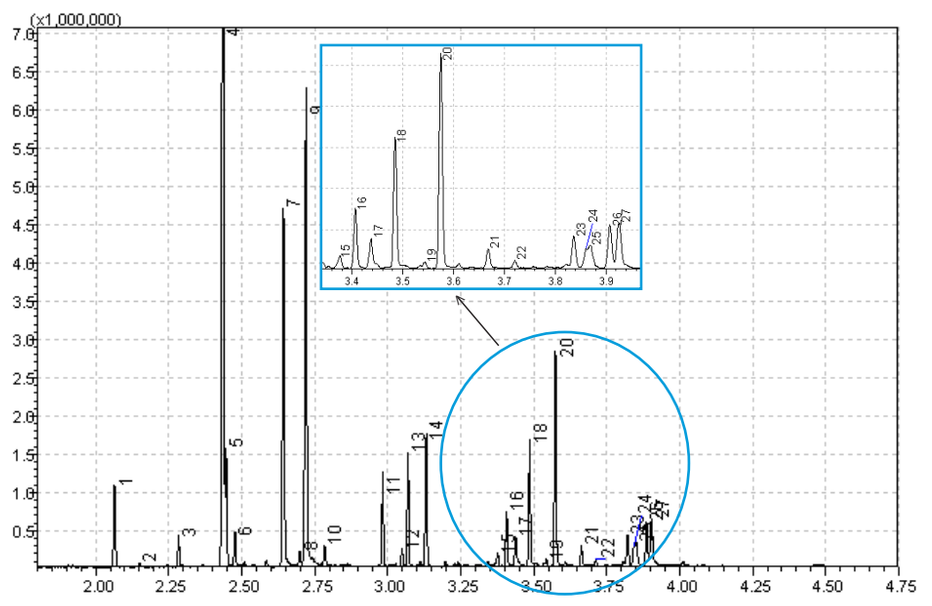
## INTRODUCTION

Analysis of essential oil by GCMS normally takes a long time due to its complex compositions. A basic analysis often takes between 60 minutes to 100 minutes for a complete identification of its compounds. The time can be shortened by carrying out the same analysis on a Fast GCMS. This application note demonstrates the analysis of west indian lemongrass, otherwise known as Serai oil, by Fast GCMS.

## Instrument Parameters (Fast GCMS):

| | |
|---|---|
| Instrument: | Shimadzu GCMS 2010 ULTRA |
| Column: | BPX5 10 m x 0.10 mm ID x 0.10 µm |
| Column Part Number : | 054099 |
| Injection Mode: | High Pressure injection (550 kPa, Time: 1.0 min) (Split 1:50) |
| Flow Control Mode: | Linear Velocity (50 cm/sec) |
| Injection Temperature: | 250 ˚C |
| Column Temperature: | Temperature Gradient [Initial 50 ˚C (hold 1 min), 75 ˚C/min until 150 ˚C (hold 0.30 min), 60 ˚C/min until 200 ˚C (hold 0.5 min), 750 ˚C/min until 300 ˚C]. |
| Interface Temperature: | 300 ˚C |
| Ion Source Temperature: | 200 ˚C |
| Mass Range: | 40 - 500.00 m/z. |
| Scan Speed: | 20,000 u/sec. |

## RESULTS




| Peak No. | Compound Name |
|---|---|
| 1 | Limonene |
| 2 | Bergamal |
| 3 | Linalool |
| 4 | Citronellal |
| 5 | Isopulegol |
| 6 | Isoisopulegol |
| 7 | Citronellol |
| 8 | Neral |
| 9 | Geraniol |
| 10 | Geranial |
| 11 | Citronellyl acetate |
| 12 | Eugenol |
| 13 | Geranyl acetate |
| 14 | Beta-Elemene |
| 15 | Gamma-Muurolene |
| 16 | Gamma-Amorphene |
| 17 | Alpha-Muurolene |
| 18 | Delta-Cadinene |
| 19 | Alpha-Cadinene |
| 20 | Alpha-Elemol |
| 21 | Gleenol |
| 22 | Unknown |
| 23 | Gamma-Eudesmol |
| 24 | Alpha-Muurolol |
| 25 | Unknown |
| 26 | Cadin-4-en-10-ol |
| 27 | Beta-Eudesmol |

*Figure 1. Total Ion Chromatogram of Fast GC-MS and its compound names.*

## REFERENCES


Analysis of Essential Oil by Fast GCMS by Fisher Scientific Malaysia, Ang May Yen, Chow Tan Wei, Hoh Lian Hoi, Hazni Hashim.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