



GC AND GC/MS

Your Essential Resource for Columns & Supplies



The Measure of Confidence



Agilent Technologies



GC Applications

Industry-specific applications from your partner in chromatography

With over 40 years of chromatography expertise, Agilent is a great resource for all types of applications. In fact, we're developing new ones every day.

Simply turn to the pages listed below for the most current applications based on your area of specialization.

Environmental – you'll learn how to perform critical analyses – such as measuring the levels of atmospheric halocarbons and identifying organochlorine pesticides in soil – while meeting your increasing demands for speed and accuracy. **Turn to page 429.**

Food, Flavors, and Fragrances – we'll discuss how to ensure quality, safety, and regulatory compliance for fragrances, perfumes, and essential oils. Applications focus on chiral compounds, menthol, and FAMES. **Turn to page 478.**

Industrial Chemicals – we'll help you maintain product quality – and production efficiency – by sharing the latest applications for alcohols, halogenated hydrocarbons, aromatic solvents, phenols, and inorganic gases. **Turn to page 501.**

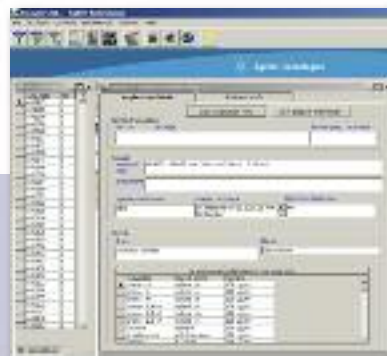
Life Sciences – we'll bring you fully up-to-date on the newest screening methods for controlled substances such as amphetamines, narcotics, and alcohol. We'll also review the latest techniques for monitoring residual solvents. **Turn to page 535.**

Energy and Fuels – here you'll find applications – such as the analysis of sulfur compounds in propylene – that you can use right away to meet regulatory requirements, improve efficiency, and maintain good environmental stewardship. **Turn to page 552.**

TIPS & TOOLS



Search the ScanView database to find almost 2000 GC applications and standard methods of all types, old and new. Get your free copy of ScanView at www.agilent.com/chem/scanview



Environmental Applications, Hydrocarbons

Methyl Tert-Butyl Ether (MTBE) FID, Extended 8020 Analysis

Column: DB-MTBE
124-0034
30 m x 0.45 mm, 2.55 μ m

Carrier: Helium at 10 mL/min

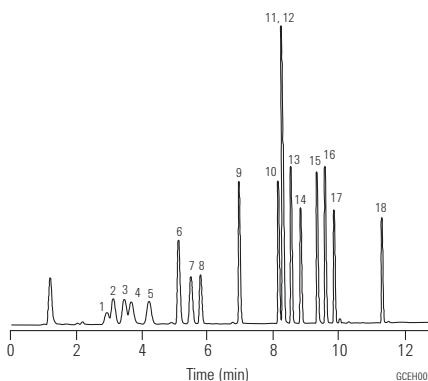
Oven: 35 °C for 4 min
35-200 °C at 20 °C/min
200 °C for 5 min

Sampler: Purge and Trap (O.I.A. 4560)
Trap: Tenax only
Preheat: 175 °C
Desorb: 180 °C for 3 min

Injection: LVI (Low Volume Injector), 150 °C

Detector: FID (O.I.A. 4410), 200 °C

Sample: 40 ppb per component in 5 mL water



1. Methyl-tert-butyl-ether (MTBE)
2. 2-Methylpentane
3. 3-Methylpentane
4. Diisopropyl ether (DIPE)
5. Ethyl-tert-butyl ether (ETBE)
6. Benzene
7. tert-Amyl methyl ether (TAME)
8. α, α, α -Trifluorotoluene
9. Toluene
10. Ethylbenzene
11. m-Xylene
12. p-Xylene
13. o-Xylene
14. Cumene
15. 1,3,5-Trimethylbenzene
16. 1,2,4-Trimethylbenzene
17. 1,2,3-Trimethylbenzene
18. Naphthalene

Unleaded Gasoline

Column: DB-VRX
124-1534
30 m x 0.45 mm, 2.55 μ m

Carrier: Helium at 109 cm/sec (10.4 mL/min), measured at 40 °C

Oven: 40 °C for 2 min
40-200 °C at 12 °C/min
200 °C for 5 min

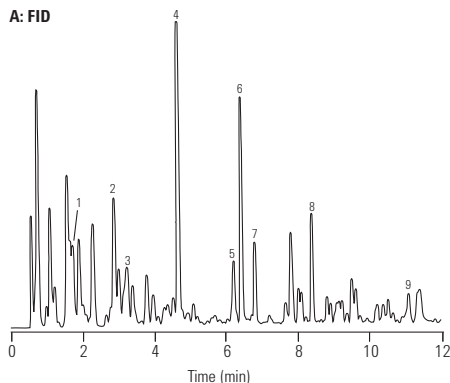
Sampler: Purge and Trap (O.I.A. 4560)
Trap: BTEX (Supelco) at 50 °C during purge
Preheat: 270 °C for 1 min

Injection: LVI (Low Volume Injector)

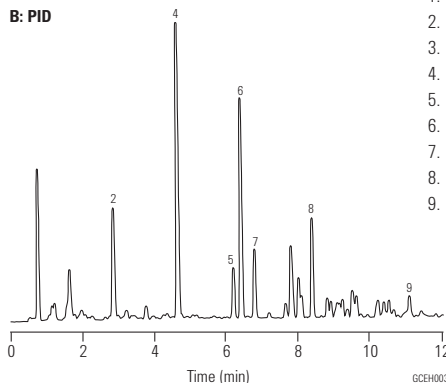
Detector: A: FID, 250 °C
B: PID (O.I.A. 4430), 200 °C

Sample: 115 ppb gasoline in 5 mL water

A: FID



B: PID



1. 3-Methylpentane
2. Benzene
3. iso-Octane
4. Toluene
5. Ethylbenzene
6. m, p-Xylene
7. o-Xylene
8. 1,2,4-Trimethylbenzene
9. Naphthalene

Determination of Chlorophenols in Water and Soil

Column: VF-5ms
CP8961
60 m x 0.32 mm, 0.25 µm

Oven: 60 °C, 30 °C/min to 300 °C

Carrier: He 80 kPa, 0.8 bar, 5.7 psi

Injection: Splitless, initial time: 1 min; Splitflow: 50 mL/min
250 °C
2 µL

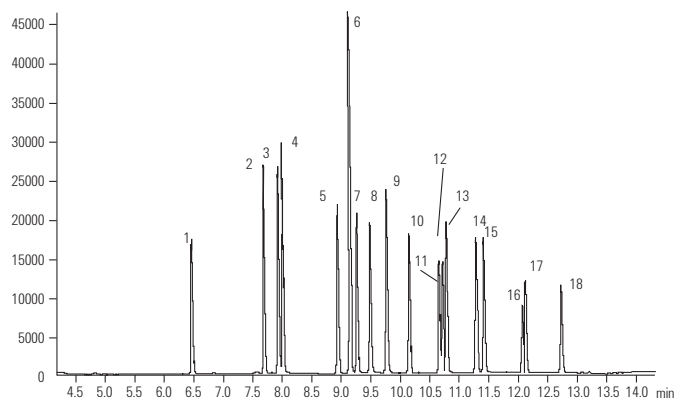
Detector: MS
280 °C

Sample: Isohexane

Sample Conc: Standard, 1 µg/mL, derivatization with acetic acid anhydride

Dr. Weßling, Laboratorien GmbH

- | | |
|---------------------------|-------------------------------|
| 1. Phenol | 10. 2,4,6-trichlorophenol |
| 2. 2-chlorophenol | 11. 2,3,6-trichlorophenol |
| 3. 3-chlorophenol | 12. 2,3,5-trichlorophenol |
| 4. 4-chlorophenol | 13. 2,4,5-trichlorophenol |
| 5. 2,6-dichlorophenol | 14. 2,3,4-trichlorophenol |
| 6. 2,4+2,5-dichlorophenol | 15. 3,4,5-trichlorophenol |
| 7. 3,5-dichlorophenol | 16. 2,3,5,6-tetrachlorophenol |
| 8. 2,3-dichlorophenol | 17. 2,3,4,6-tetrachlorophenol |
| 9. 3,4-dichlorophenol | 18. 2,3,4,5-tetrachlorophenol |

**PBDEs by ECD**

Column: DB-XLB
15 m x 0.18 mm, 0.07 µm
Agilent Technologies custom column

Carrier: Hydrogen at 72 cm/sec at 100 °C (4.0 mL/min), constant flow mode

Oven: 100 °C for 0.5 min
100 °C to 300 °C at 30 °C/min
300 °C for 5 min

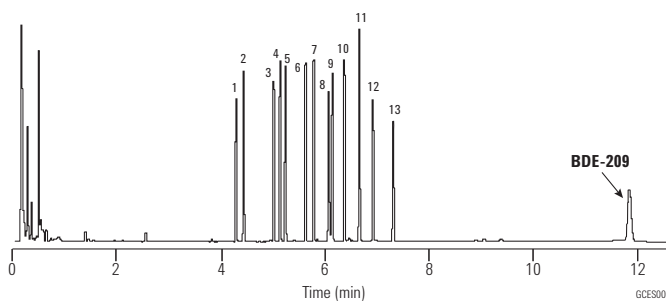
Injection: Split, 250 °C
Split ratio 20:1

Detector: ECD, 300 °C
Peak, Congener (2.5 mg/mL)

Sample: 1 µL

Special thanks to AccuStandard, Inc. of New Haven, CT, for PBDE standards.

- | | |
|-----------------------------------|---|
| 1. 2,2',4-TriBDE (BDE-17) | 8. 2,2',3,4,4'-PentaBDE (BDE-85) |
| 2. 2,4,4'-TriBDE (BDE-28) | 9. 2,2',4,4',5,6'-HexaBDE (BDE-154) |
| 3. 2,3',4',6-Tetra-BDE (BDE-71) | 10. 2,2',4,4',5,5'-HexaBDE (BDE-153) |
| 4. 2,2',4,4'-Tetra-BDE (BDE-47) | 11. 2,2',3,4,4',5'-HexaBDE (BDE-138) |
| 5. 2,3',4,4'-TetraBDE (BDE-66) | 12. 2,2',3,4,4',5',6-HeptaBDE (BDE-183) |
| 6. 2,2',4,4',6-PentaBDE (BDE-100) | 13. 2,3,3',4,4',5,6-HeptaBDE (BDE-190) |
| 7. 2,2',4,4',5-PentaBDE (BDE-99) | 14. DecaBDE (BDE-209) (12.5 mg/mL) |



Diesel Fuel

Column: DB-5ms
125-5532
30 m x 0.53 mm, 1.50 µm

Carrier: Helium at 48.5 cm/sec, measured at 60 °C

Oven: 60 °C for 2 min
60-300 °C at 12 °C/min
300 °C for 10 min

Injection: Direct, 280 °C

Detector: FID, 250 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL injection in hexane
A - Standard, 50 ng/component
B - Sample, 0.6 mg/mL

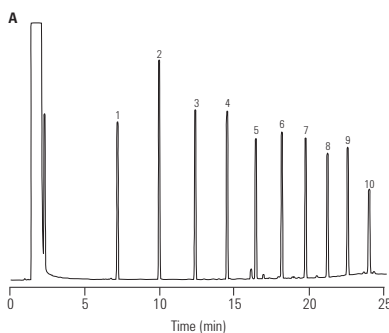
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

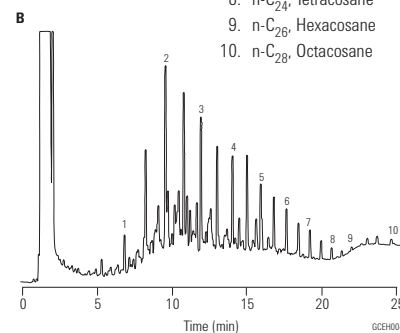
Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

**Diesel Fuel Standard
50 ng/component**



**Diesel Fuel
0.6 mg/mL**



1. n-C₁₀, Decane
2. n-C₁₂, Dodecane
3. n-C₁₄, Tetradecane
4. n-C₁₆, Hexadecane
5. n-C₁₈, Octadecane
6. n-C₂₀, Eicosane
7. n-C₂₂, Docosane
8. n-C₂₄, Tetracosane
9. n-C₂₆, Hexacosane
10. n-C₂₈, Octacosane

Analysis of Polycyclic Aromatic Hydrocarbons

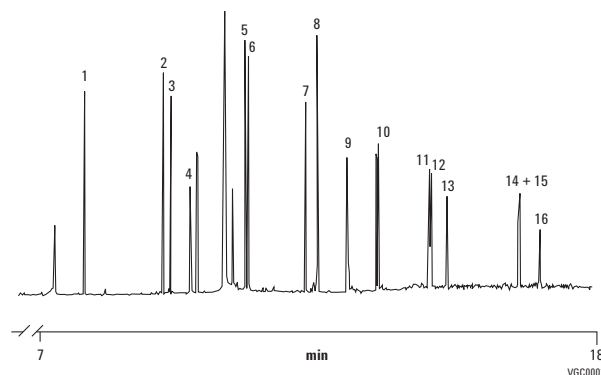
Column: VF-Xms
CP8805
30 m x 0.25 mm, 0.10 µm

Sample: 1 µL ca. 3 ng per component on-column

Carrier: Helium, 60 kPa

Injection: Split, T=275 °C

Detector: Ion Trap MS



1. Naphthalene
2. Acenaphthylene
3. Acenaphthene
4. Fluorene
5. Phenanthrene
6. Anthracene
7. Fluoranthene
8. Pyrene
9. Chrysene
10. Benzo(a)anthracene
11. Benzo(k)fluoranthene
12. Benzo(b)fluoranthene
13. Benzo(a)pyrene
14. Indeno(1,2,3-cd)pyrene
15. Dibenzo(a,h)anthracene
16. Benzo(g,h,i)perylene

Dioxins and Dibenzofurans

Column: CP-Sil 88
CP6173
50 m x 0.25 mm, 0.20 µm

Sample: 1.0 µL Toluene

Sample Conc: 100 – 400 pg/µl

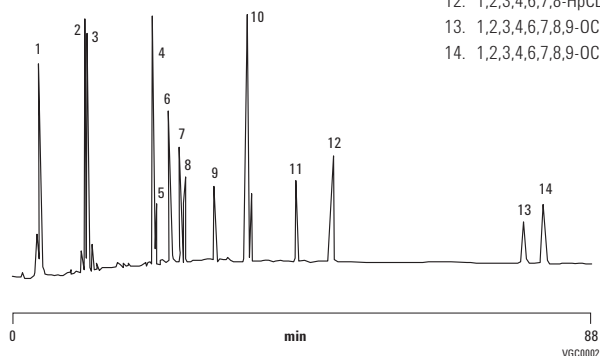
Carrier: Helium, 170 kPa (1.7 bar, 24 psi)

Oven: 100 °C to 180 °C to 230 °C, 3 °C/min

Injection: Splitless

Detector: MSD

1. 2,3,7-8-TCDD
2. 2,3,7,8-TCDF
3. 1,2,3,7,8-PeCDF
4. 1,2,3,4,7,8-HxCDF
5. 1,2,3,6,7,8-HxCDF
6. 2,3,4,7,8-PeCDF
7. 1,2,3,4,7,8-HxCDD + 1,2,3,7,8-PeCDD
8. 1,2,3,6,7,8-HxCDD
9. 1,2,3,7,8,9-HxCDD
10. 1,2,3,4,6,7,8-HxCDF
11. 2,3,4,6,7,8-HpCDD
12. 1,2,3,4,6,7,8-HpCDD
13. 1,2,3,4,6,7,8,9-OCDF
14. 1,2,3,4,6,7,8,9-OCDD


**Large Mix 5 ng Column AccuStandard 8720 Mixes
1, 2, 3, 4a, 4b, 5 & 6 (93 compounds)**

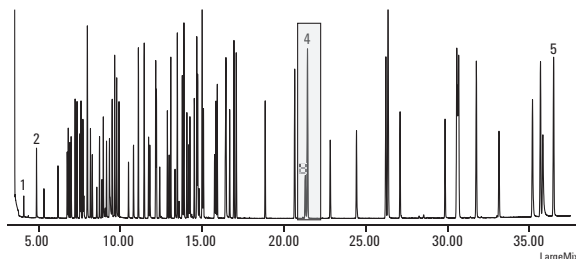
Column: DB-5ms Ultra Inert
122-5532UI
30 m x 0.25 mm, 0.25 µm

Oven: 40 °C (1 min) to 100 °C (15 °C/min),
10 °C/min to 210 °C (1 min),
5 °C/min to 310 °C (8 min)

Injection: Splitless @ 260 °C, purge flow 50 °C mL/min
at 0.5 min, gas saver 80 mL/min on at 1 min

Detector: MSD; Transfer line 290 °C,
Source 300 °C, Quad 180 °C

1. n-Nitrosodimethylamine
2. 2-methyl pyridine
3. Benzidene
4. Fluoranthene
5. Benzo (g,h,i) perylene



Polybrominated Diphenyl Ethers (PBDEs)

Column: DB-5ms Ultra Inert
122-5512UI
15 m x 0.25 mm, 0.25 µm

Instrument: Agilent 6890N/5973B MSD

Sampler: Agilent 7683B, 5.0 µL syringe (P/N 5188-5246),
1.0 µL splitless injection,
5 ng each component on-column

Carrier: Helium 72 cm/s, constant flow

Inlet: Pulsed splitless; 325 °C,
20 psi until 1.5 min,
purge flow 50 mL/min at 2.0 min

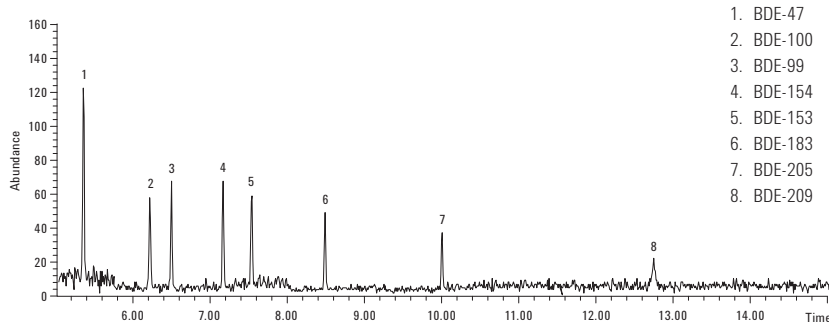
Oven: 150 to 325 °C (17 °C/min), hold 5 min

Detector: MSD source at 300 °C,
quadropole at 150 °C,
transfer line at 300 °C,
scan range 200-1000 amu

Suggested Supplies

Liner: Direct connect, dual taper, deactivated, 4 mm id, G1544-80700

Syringe: Autosampler syringe, 0.5 µL, 23 g, cone, 5188-5246



1. BDE-47
2. BDE-100
3. BDE-99
4. BDE-154
5. BDE-153
6. BDE-183
7. BDE-205
8. BDE-209

15+1 EU Priority PAHs**Resolution of Critical Pairs on an Agilent J&W DB-EUPAH Column**

Column: DB-EUPAH
121-9627
20 m x 0.18 mm, 0.14 µm

Instrument: Agilent 6890N/5975B MSD

Sampler: Agilent 7683B, 5.0 µL syringe,
0.5 µL splitless injection, injection speed 75 µL/min

Carrier: Helium, ramped flow 1.0 mL/min (0.2 min),
5 mL/min² to 1.7 mL/min

Inlet: 325 °C splitless, purge flow 60 mL/min at 0.8 min

Oven: 45 °C (0.8 min) to 200 °C (45 °C/min),
2.5 °C/min to 225 °C, 3 °C/min to 266 °C,
5 °C/min to 300 °C, 10 °C/min to 320 °C (4.5 min)

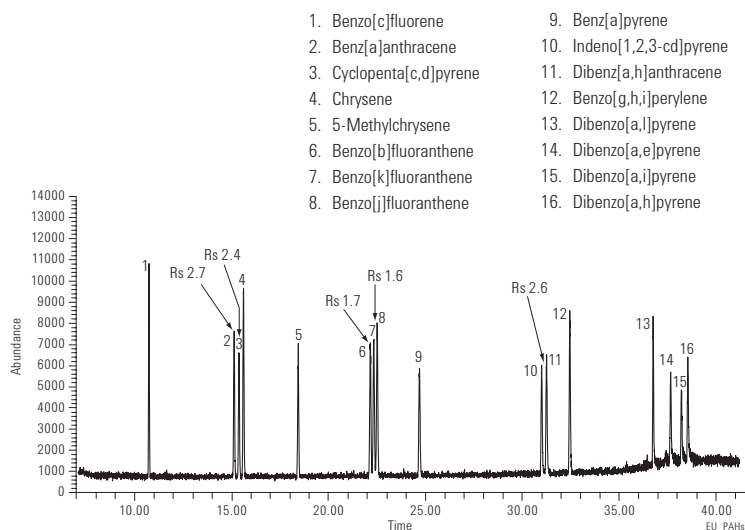
Detector: MSD source at 300 °C, quadrupole at 180 °C,
transfer line at 330 °C, scan range 50-550 AMU

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, dual taper, deactivated, 4 mm id, G1544-80700

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



- | | |
|--------------------------|----------------------------|
| 1. Benzo[c]fluorene | 9. Benzo[a]pyrene |
| 2. Benzo[a]anthracene | 10. Indeno[1,2,3-cd]pyrene |
| 3. Cyclopenta[c,d]pyrene | 11. Dibenz[a,h]anthracene |
| 4. Chrysene | 12. Benzo[g,h,i]perylene |
| 5. 5-Methylchrysene | 13. Dibenzo[a,i]pyrene |
| 6. Benzo[b]fluoranthene | 14. Dibenzo[a,e]pyrene |
| 7. Benzo[k]fluoranthene | 15. Dibenzo[a,j]pyrene |
| 8. Benzo[j]fluoranthene | 16. Dibenzo[a,h]pyrene |

All 15+1 EU regulated priority PAHs are well resolved with the DB-EUPAH column. Challenging benzo[b,k,j]fluoranthene isomers are baseline resolved, allowing for accurate quantitation of each isomer. In addition, baseline resolution is achieved for critical pairs benzo[a]anthracene and cyclopenta[c,d]pyrene, cyclopenta[c,d]pyrene and chrysene, and indeno[1,2,3-cd]pyrene and dibenz[a,h]anthracene. This application demonstrates that the DB-EUPAH column can provide excellent sensitivity and selectivity for the analysis of EU regulated PAHs.

Environmental Applications, Pesticides and Herbicides

Fast CLP Pesticides

Column: DB-CLP1
123-8232
30 m x 0.32 mm, 0.25 µm

Column: DB-CLP2
123-8336
30 m x 0.32 mm, 0.5 µm

Instrument: Agilent 7890 GC with dual µECD

Carrier: Helium, constant flow 3.5 mL/min

Oven: 150 °C (hold 0.2 min),
45 °C/min to 250 °C,
18 °C/min to 300 °C,
30 °C/min to 330 °C, hold 2.5 min

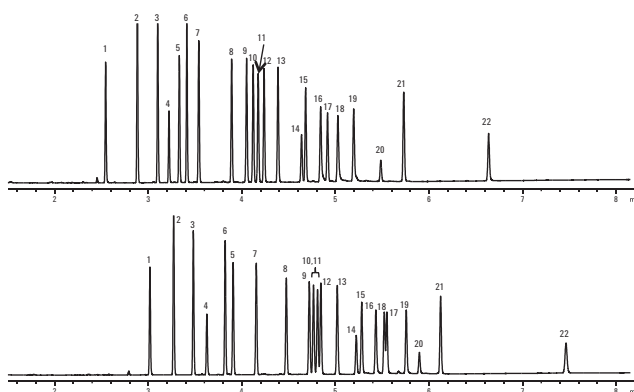
Sampler: Agilent 7693

Injection: 1 µL splitless

Detector: µECD @ 340 °C

Sample: 50 ng/mL CLP Pesticides

- | | |
|-------------------------|------------------------|
| 1. Tetrachloro-m-xylene | 12. 4,4'-DDE |
| 2. α-BHC | 13. Dieldrin |
| 3. γ-BHC | 14. Endrin |
| 4. β-BHC | 15. 4,4'-DDD |
| 5. Heptachlor | 16. Endosulfan II |
| 6. δ-BHC | 17. 4,4'-DDT |
| 7. Aldrin | 18. Endrin aldehyde |
| 8. Heptachlor epoxide | 19. Endosulfan sulfate |
| 9. γ-Chlordane | 20. Methoxychlor |
| 10. α-Chlordane | 21. Endrin ketone |
| 11. Endosulfan I | 22. Decachlorobiphenyl |



Organochlorine Pesticides, EPA Method 8081B

Column: DB-CLP1
123-8232
30 m x 0.32 mm, 0.25 µm

Column: DB-CLP2
123-8336
30 m x 0.32 mm, 0.25 µm

Instrument: Agilent 7890 GC with dual µECD

Carrier: Helium at 43.5 cm/sec (constant flow)

Oven: 80 °C (hold 0.5 min) to 150 °C at 20 °C/min,
5 °C/min to 235 °C, 15 °C/min to 300 °C, hold 5 min

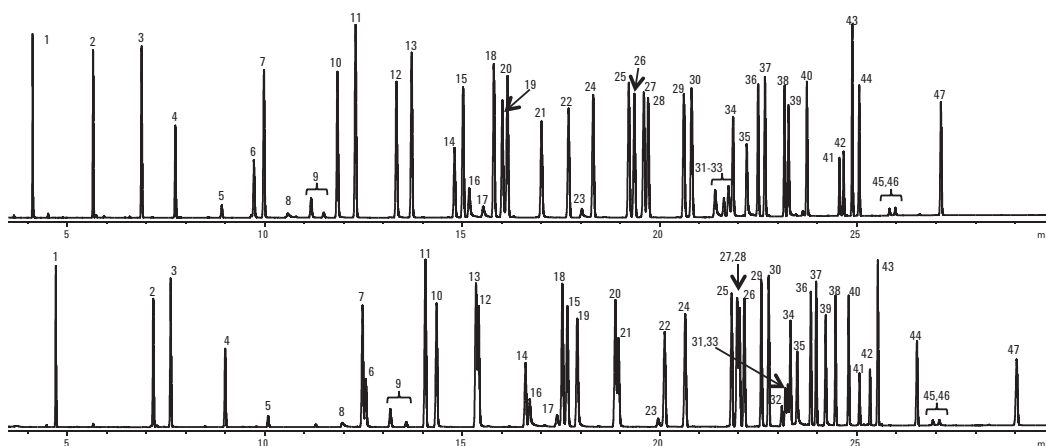
Sampler: Agilent 7693

Injection: 2 µL splitless

Detector: µECD @ 325 °C

Sample: 50 ng/mL 8081B analytes

- | | |
|--------------------------------|--------------------------------|
| 1. 1,2-Dibromo-3-chloropropane | 16. Dichlone |
| 2. Hexachlorocyclopentadiene | 17. Alachlor |
| 3. 1-Bromo-2-nitrobenzene | 18. δ-BHC |
| 4. Etriazole | 19. Chlorothalonil |
| 5. Chloroneb | 20. Aldrin |
| 6. Trifluralin | 21. DCPA |
| 7. TCMX | 22. Isodrin |
| 8. Propachlor | 23. Kelthane |
| 9. Diallate isomers (250ng/mL) | 24. Heptachlor epoxide |
| 10. Hexachlorobenzene | 25. γ-Chlordane |
| 11. α-BHC | 26. trans-Nonachlor |
| 12. Pentachloronitrobenzene | 27. α-Chlordane |
| 13. γ-BHC | 28. Endosulfan I |
| 14. β-BHC | 29. 4,4'-DDE |
| 15. Heptachlor | 30. Dieldrin |
| | 31. Chlorobenzilate (250ng/mL) |
| | 32. Perthane (250ng/mL) |
| | 33. Chloropropylate (250ng/mL) |
| | 34. Endrin |
| | 35. Nitrofen |
| | 36. 4,4'-DDD |
| | 37. Endosulfan II |
| | 38. 4,4'-DDT |
| | 39. Endrin aldehyde |
| | 40. Endosulfan sulfate |
| | 41. Captafol |
| | 42. Methoxychlor |
| | 43. Endrin ketone |
| | 44. Mirex |
| | 45. cis-Permethrin |
| | 46. trans-Permethrin |
| | 47. ΩΩΩDecachlorobiphenyl |

**DB-624UI Organic Acid Performance**

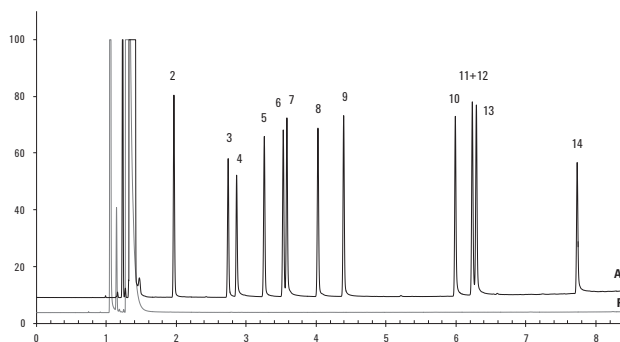
Column: DB-Select 624 Ultra Inert
122-0334UI
30 m x 0.25 mm, 1.4 µm

Carrier: Hydrogen 42 cm/s

Oven: 70 °C isothermal

Inlet: Split, 116:1 at 250 °C

Detector: FID at 260 °C



- | |
|-----------------------------|
| 1. Formic acid |
| 2. Acetic acid |
| 3. Propionic acid |
| 4. Acrylic acid |
| 5. Isobutyric acid |
| 6. n-Butyric acid |
| 7. Methacrylic acid |
| 8. Isopentanoic acid |
| 9. n-Pentanoic acid |
| 10. n-Heptanoic acid |
| 11. Levulinic acid |
| 12. 2-Propyl pentanoic acid |
| 13. 2-Ethyl hexanoic acid |
| 14. Citronellic acid |

US EPA Method 551.1

Column A: HP-1ms Ultra Inert
19091S-733UI
30 m x 0.25 mm, 1.00 μ m

Column B: DB-1301
122-1333
30 m x 0.25 mm, 1.00 μ m

Instrument: Agilent 7890A GC

Sampler: Agilent 7683B, 5.0 μ L syringe
(Agilent p/n 5181-1273) 0.5 μ L splitless injection

Carrier: Helium 25 cm/s, constant flow

Inlet: Splitless; 200 °C, purge flow 20 mL/min at 0.25 min

Retention Gap: 1 m, 0.32 mm id deactivated fused silica
high-temperature tubing (Agilent p/n 160-2855-5)

Oven: 33 °C (14 min) to 60 °C (5 °C/min), hold 5 min,
15 °C/min to 275 °C, hold 20 min

Detector: Dual G2397A μ ECD; 300 °C,
const col + makeup (N_2) = 30 mL/min

This application successfully demonstrates the use of the HP-1ms Ultra Inert column for primary analysis of EPA 551.1 chlorinated solvents, trihalomethanes and disinfection by-products. The excellent peak shape of the chloral hydrate and resolution between bromodichloromethane and trichloroethylene emphasize the high column inertness of the HP-1ms Ultra Inert column, making it an excellent choice for EPA Method 551.1 analysis.

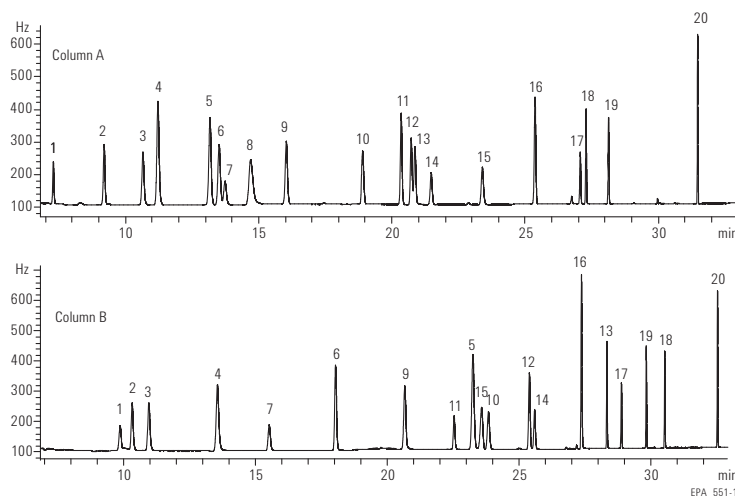
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

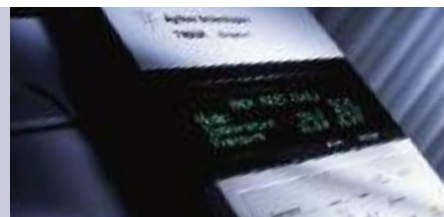
Liner: Direct connect, dual taper, deactivated, 4 mm id, G1544-80700

Syringe: 5 μ L tapered, FN 23-26s/42/HP, 5181-1273

- | | |
|-----------------------------|---------------------------------|
| 1. Chloroform | 11. Chloropicrin |
| 2. 1,1,1-Trichloroethane | 12. Dibromochloromethane |
| 3. Carbon tetrachloride | 13. Bromochloroacetonitrile |
| 4. Trichloroacetonitrile | 14. 1,2-Dibromoethane |
| 5. Dichloroacetonitrile | 15. Tetrachloroethylene |
| 6. Bromodichloromethane | 16. 1,1,1-Trichloro-2-propanone |
| 7. Trichloroethylene | 17. Bromoform |
| 8. Chloral hydrate | 18. Dibromoacetonitrile |
| 9. 1,1-Dichloro-2-propanone | 19. 1,2,3-Trichloropropane |
| 10. 1,1,2-Trichloroethane | 20. 1,2-Dibromo-3-chloropropane |

**TIPS & TOOLS**

Learn more about the Agilent 7890A GC System at www.agilent.com/chem/7890A



Analysis of Semivolatiles

Column A: DB-5.625
122-5632
30 m x 0.25 mm, 0.50 μ m

Column B: DB-5.625
121-5622
20 m x 0.18 mm, 0.36 μ m

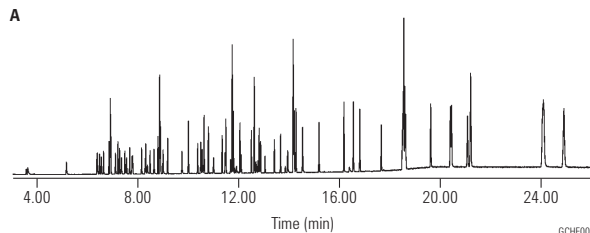
Carrier: He constant-flow mode, 1.1 mL/min

Oven: 40 °C (1 min), 25 °C/min to 320 °C
4.80 min hold

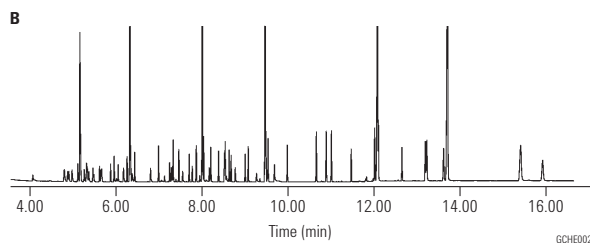
Injection: Splitless 0.5 μ L injected at 300 °C, QuickSwap pressure
5.0 psi during acquisition, 80.0 psi during backflush
with inlet set to 1.0 psi during backflush

Detector: Agilent 5975C Performance Turbo MSD equipped with
6 mm large-aperture drawout lens, P/N G2589-20045

Translating 0.25 mm id column method to 0.18 mm id format results in
32% reduction in analysis time. Resolution of 77 peaks of interest is also
maintained for the faster 0.18 mm id separation.



U.S. EPA Method 8270, 5 ng/mL System Performance Check Compounds
Chromatogram using a DB-5.625, 30 m x 0.25 mm, 0.5 μ m



U.S. EPA Method 8270, 5 ng/mL System Performance Check Compounds
Chromatogram using a DB-5.625, 20 m x 0.18 mm, 0.36 μ m

Pesticides, EPA 508.1

Column: DB-35ms
123-3832
30 m x 0.32 mm, 0.25 µm

Column: DB-XLB
123-1236
30 m x 0.32 mm, 0.50 µm

Carrier: Helium at 45 cm/sec (EPC in constant flow mode)

Oven: 75 °C for 0.5 min
75-300 °C at 10 °C/min
300 °C for 2 min

Injection: Splitless, 250 °C
30 sec purge activation time

Detector: µECD, 350 °C
Nitrogen makeup gas
(column + makeup flow = 30 mL/min constant flow)

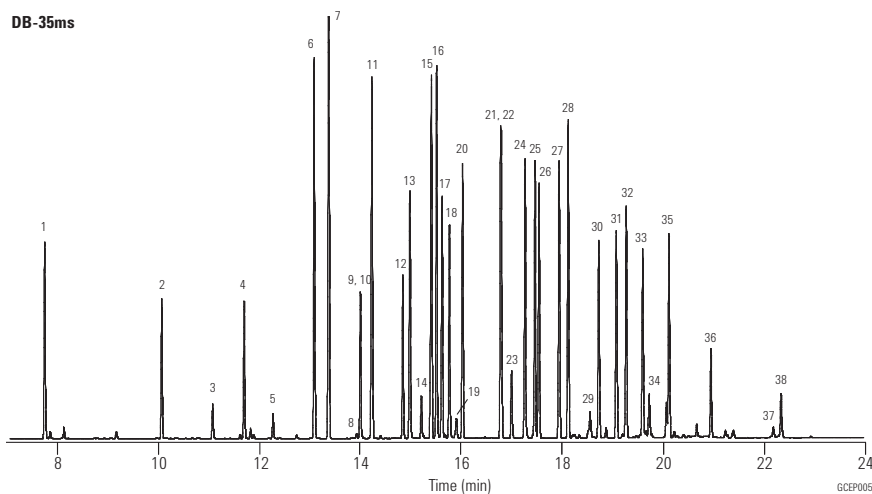
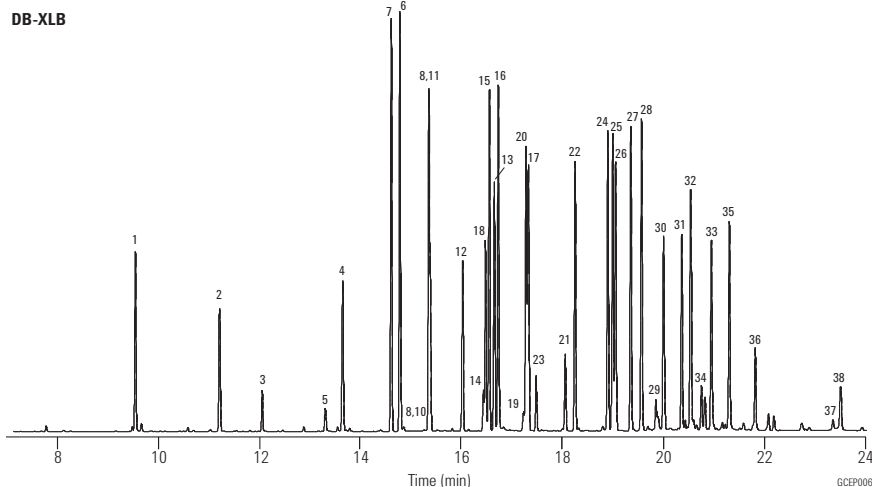
Sample: 50 pg per component

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

DB-35ms**DB-XLB**

1. Hexachlorocyclopentadiene
2. Etridiazole
3. Chloroneb
4. Trifluralin
5. Propachlor
6. Hexachlorobenzene
7. α-BHC
8. Atrazine
9. Pentachloronitrobenzene
10. Simazine
11. γ-BHC
12. β-BHC
13. Heptachlor
14. Alachlor
15. δ-BHC
16. Chlorothalonil
17. Aldrin
18. Metribuzin
19. Metolachlor
20. DCPA
21. 4,4'-Dibromobiphenyl
22. Heptachlor epoxide
23. Cyanazine
24. γ-Chlordane
25. α-Chlordane
26. Endosulfan I
27. 4,4'-DDE
28. Dieldrin
29. Chlorobenzilate
30. Endrin
31. 4,4'-DDD
32. Endosulfan II
33. 4,4'-DDT
34. Endrin aldehyde
35. Endosulfan sulfate
36. Methoxychlor
37. cis-Permethrin
38. trans-Permethrin

Phenoxy Acid Herbicides – Methyl Derivatives, EPA 8151A

Column: DB-35ms
123-3832
30 m x 0.32 mm, 0.25 µm

Carrier: Helium at 45 cm/sec (EPC in constant flow mode)

Oven: 50 °C for 0.5 min
50-100 °C at 25 °C/min
100-320 °C at 12 °C/min
320 °C for 2 min

Injection: Splitless, 250 °C
30 sec purge activation time

Detector: µECD, 350 °C
Nitrogen makeup gas
(column + makeup flow = 30 mL/min constant flow)

Sample: 50 pg per component

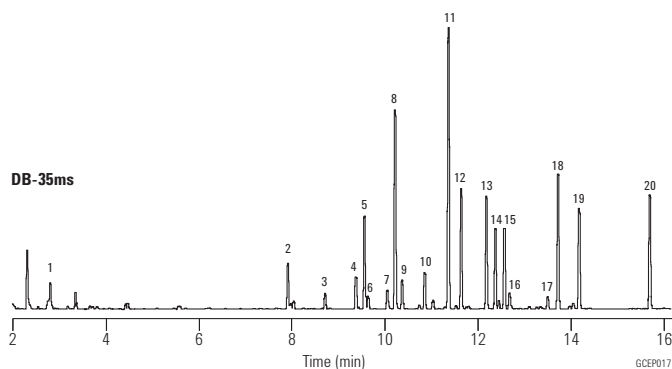
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

- | | |
|--|-----------------------|
| 1. Dalapon | 11. Pentachlorophenol |
| 2. 3,5-Dichlorobenzoic acid | 12. 2,4,5-T,P |
| 3. 4-Nitrophenol | 13. 2,4,5-T |
| 4. Methyl-2,4-dichlorophenylacetate (SS) | 14. Chloramben |
| 5. Dicamba | 15. Dinoseb |
| 6. MCPP | 16. 2,4-DB |
| 7. MCPA | 17. Bentazone |
| 8. 4,4'-Dibromooctafluorobiphenyl (IS) | 18. DCPA |
| 9. Dichloroprop | 19. Picloram |
| 10. 2,4-D | 20. Acifluorfen |



Direct Comparison for Rapid CLP (Contract Laboratory Program) Pesticide Analysis

Column: DB-17ms
121-4722
20 m x 0.18 mm, 0.18 μ m

Column: DB-XLB
121-1222
20 m x 0.18 mm, 0.18 μ m

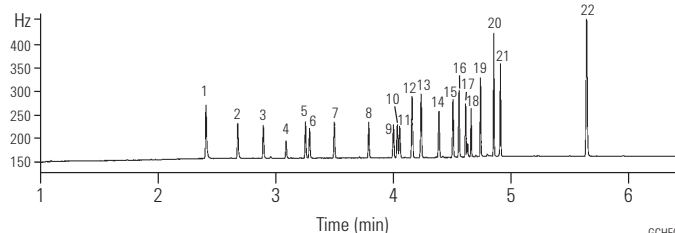
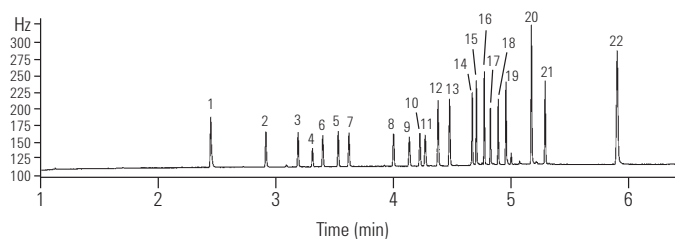
Carrier: Hydrogen (69 cm/sec at 120 °C,
ramped at 99 mL/min to
106 cm/sec at 4.4 minutes)

Oven: 120 °C (0.32 min);
120 °C/min to 160 °C;
30 °C/min to 258 °C (0.18 min);
38.81 °C/min to 300 °C (1.5 min)

Injection: Split/splitless; 220 °C,
pulsed splitless
(35 psi for 0.5 min,
purge flow of 40 mL/min
on at 1 minute, gas saver flow
20 mL/min on 3 minutes)

Detector: μ ECD 320 °C;
nitrogen makeup;
constant column + makeup flow
60 mL/min

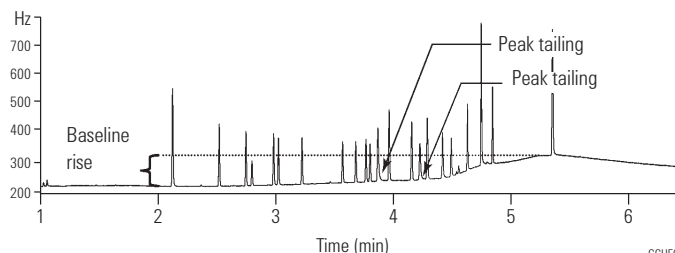
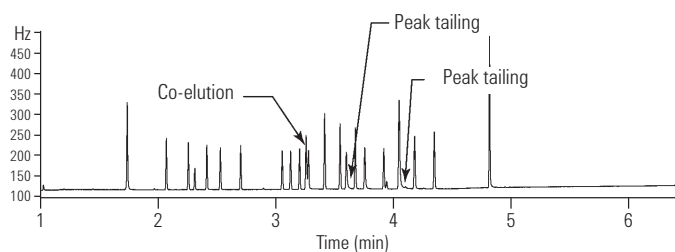
**DB-17ms primary column
DB-XLB confirmatory column**



GCHE004

1. Tetrachloro-m-xylene
2. α -BHC
3. γ -BHC
4. β -BHC
5. δ -BHC
6. Heptachlor
7. Aldrin
8. Heptachlor Epoxide
9. γ -Chlordane
10. α -Chlordane
11. Endosulfan I
12. 4,4' DDE
13. Dieldrin
14. Endrin
15. 4,4' DDD
16. Endosulfan II
17. 4,4' DDT
18. Endrin Aldehyde
19. Endosulfan Sulfate
20. Methoxychlor
21. Endrin Ketone
22. Decachlorobiphenyl

**Vendor R primary column, 20 m x 0.18 mm, 0.18 μ m
Vendor R confirmatory column, 20 m x 0.18 mm, 0.14 μ m**



GCHE005

Agilent's DB-17ms primary column and DB-XLB confirmatory column sufficiently resolved all the peaks of interest in less than 6 minutes with sharp, symmetrical peaks and minimal baseline drift. In contrast, vendor R's primary analysis column resolved only 20 of 22 peaks with visible peak tailing. Vendor R's confirmatory column resolved all 22 peaks of interest but with peak tailing and an unacceptable level of temperature dependent baseline drift.

Aroclors 1016-1268 (without 1221)

Column: DB-XLB
121-1232
30 m x 0.18 mm, 0.18 µm

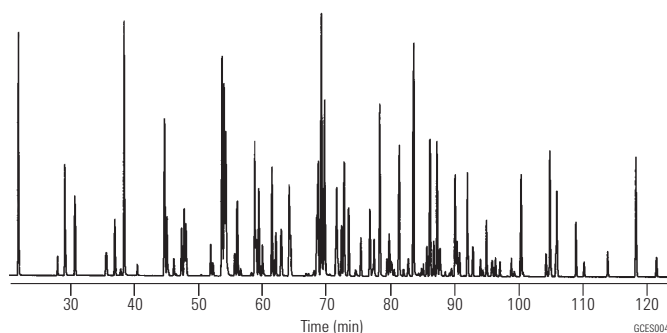
Carrier: Helium at 37 cm/sec, measured at 150 °C

Oven: 100 °C for 1 min
100-265 °C at 1.2 °C/min

Injection: Hot on-column, 250 °C

Detector: MSD, 340 °C transfer line, SIM

Sample: 1 µL in isooctane, 12.5 ppm

**Suggested Supplies**

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

CLP Pesticides

Column: DB-35ms
123-3832
30 m x 0.32 mm, 0.25 µm

Column: DB-XLB
123-1236
30 m x 0.32 mm, 0.50 µm

Carrier: Helium at 45 cm/sec
(EPC in constant flow mode)

Oven: 110 °C for 0.5 min
110-320 °C at 15 °C/min
320 °C for 2 min

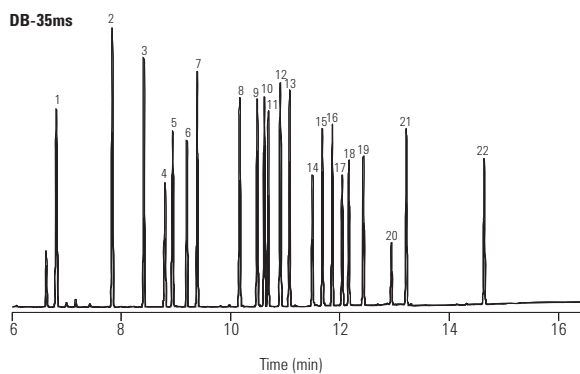
Injection: Splitless, 250 °C
30 sec purge activation time

Detector: µECD, 350 °C
Nitrogen makeup gas
(column + makeup flow = 30 mL/min
constant flow)

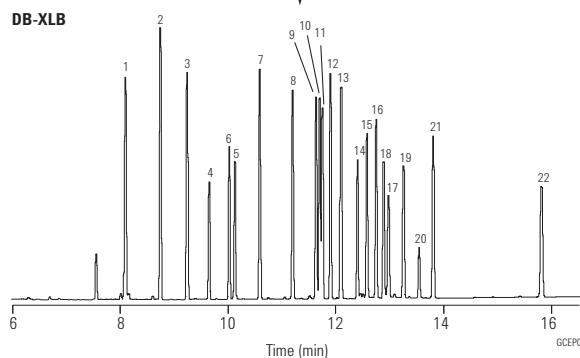
Sample: 50 pg per component

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



**Complete resolution and confirmation
of 22 CLP Pesticides in under 16 minutes!**



1. Tetrachloro m-xylene (SS)
2. α-BHC
3. γ-BHC
4. β-BHC
5. Heptachlor
6. δ-BHC
7. Aldrin
8. Heptachlor epoxide
9. γ-Chlordane
10. α-Chlordane
11. Endosulfan I
12. 4,4'-DDE
13. Dieldrin
14. Endrin
15. 4,4'-DDD
16. Endosulfan II
17. 4,4'-DDT
18. Endrin aldehyde
19. Endosulfan sulfate
20. Methoxychlor
21. Endrin ketone
22. Decachlorobiphenyl (SS)

SS - Surrogate Standard

High Speed VOC, EPA Method 8260

Column: DB-VRX
121-1524
20 m x 0.18 mm, 1.00 µm

Carrier: Helium at 55 cm/sec (1.5 mL/min)

Oven: 45 °C for 3.0 min
45-190 °C at 36 °C/min
190-225 °C at 20 °C/min
225 °C for 0.5 min

Sampler: Purge and trap (Tekmar 3100)
Purge: 11 min
Trap: Vocarb 3000
Preheat: 245 °C
Desorb: 250 °C for 1 min
Bake: 260 °C for 10 min
Line & valve: 100 °C

Injection: Split, 150 °C
Split ratio 60:1

Detector: Agilent 5975 MSD

Scan range: 35-260 amu
Scan rate: 3.25 scans/sec
Quad temperature: 150 °C
Source temperature: 200 °C
Transfer line temp: 200 °C

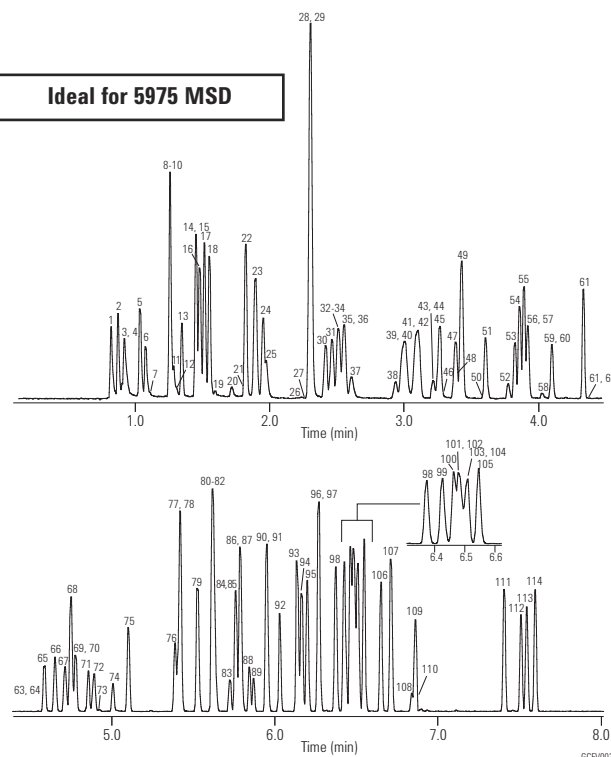
Sample: 5 mL

- Halogenated and aromatic analytes at 40 ppb
- Internal standards at 20 ppb
- Polar analytes (i.e., ethers, alcohols and ketones at 100-800 ppb)

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct, 1.5 mm id, 18740-80200
Seal: Gold plated seal, 18740-20885

- | | |
|-------------------------------|-------------------------------|
| 1. Dichlorodifluoromethane | 43. Crotonaldehyde |
| 2. Chloromethane | 44. 2-Chloroethanol |
| 3. Hydroxypropionitrile | 45. 1,1-Dichloropropene |
| 4. Vinyl chloride | 46. 1-Butanol |
| 5. Bromomethane | 47. Carbon tetrachloride |
| 6. Chloroethane | 48. Chloroacetonitrile |
| 7. Ethanol | 49. Benzene |
| 8. Acetonitrile | 50. tert-Amylmethyl ether |
| 9. Acrolein | 51. Fluorobenzene (IS) |
| 10. Trichlorofluoromethane | 52. 2-Pentanone |
| 11. Isopropyl alcohol | 53. Dibromomethane |
| 12. Acetone | 54. 1,2-Dichloropropane |
| 13. Ethyl ether | 55. Trichloroethene |
| 14. 1,1-Dichloroethene | 56. Bromodichloromethane |
| 15. tert-Butyl alcohol | 57. 2-Nitropropane |
| 16. Acrylonitrile | 58. 1,4-Dioxane |
| 17. Methylene chloride | 59. Epichlorohydrin |
| 18. Allyl chloride | 60. Methyl methacrylate |
| 19. Allyl alcohol | 61. cis-1,3-Dichloropropene |
| 20. 1-Propanol | 62. Propiolactone |
| 21. Propargyl alcohol | 63. Bromoacetone |
| 22. trans-1,2-Dichloroethene | 64. Pyridine |
| 23. MTBE | 65. trans-1,3-Dichloropropene |
| 24. 1,1-Dichloroethane | 66. 1,1,2-Trichloroethane |
| 25. Propionitrile | 67. Toluene-d8 (IS) |
| 26. 2-Butanone | 68. Toluene |
| 27. Diisopropyl ether | 69. 1,3-Dichloropropane |
| 28. cis-1,2-Dichloroethene | 70. Paraldehyde |
| 29. Methacrylonitrile | 71. Ethyl methacrylate |
| 30. Bromochloromethane | 72. Dibromochloromethane |
| 31. Chloroform | 73. 3-Chloropropionitrile |
| 32. 2,2-Dichloropropane | 74. 1,2-Dibromoethane |
| 33. Ethyl acetate | 75. Tetrachloroethene |
| 34. Ethyl-tert-butyl ether | 76. 1,1,1,2-Tetrachloroethane |
| 35. Methyl acrylate | 77. 1-Chlorohexane |
| 36. Dibromofluoromethane (IS) | 78. Chlorobenzene |
| 37. Isobutanol | 79. Ethylbenzene |
| 38. Dichloroethane-d4 (IS) | 80. Bromoform |
| 39. Pentafluorobenzene | 81. m-Xylene |
| 40. 1,2-Dichloroethane | 82. p-Xylene |
| 41. 1,1,1-Trichloroethane | 83. trans-Dichlorobutene |
| 42. 1-Chlorobutane | 84. 1,3-Dichloro-2-propanol |

Ideal for 5975 MSD

- | | |
|-------------------------------|----------------------------------|
| 85. Styrene | 100. sec-Butylbenzene |
| 86. 1,1,2,2-Tetrachloroethane | 101. 1,3-Dichlorobenzene |
| 87. o-Xylene | 102. Benzylchloride |
| 88. 1,2,3-Trichloropropane | 103. 1,4-Dichlorobenzene-d4 (IS) |
| 89. cis-Dichlorobutene | 104. 1,4-Dichlorobenzene |
| 90. 4-Bromofluorobenzene (IS) | 105. Isopropyltoluene |
| 91. Isopropylbenzene | 106. 1,2-Dichlorobenzene |
| 92. Bromobenzene | 107. Butylbenzene |
| 93. Propylbenzene | 108. 1,2-Dibromo-3-chloropropane |
| 94. 2-Chlorotoluene | 109. Hexachloroethane |
| 95. 4-Chlorotoluene | 110. Nitrobenzene |
| 96. 1,3,5-Trimethylbenzene | 111. 1,2,4-Trichlorobenzene |
| 97. Pentachloroethane | 112. Naphthalene |
| 98. tert-Butylbenzene | 113. Hexachlorobutadiene |
| 99. 1,2,4-Trimethylbenzene | 114. 1,2,3-Trichlorobenzene |

PBDEs

Column: DB-XLB
122-1231
30 m x 0.25 mm, 0.10 µm

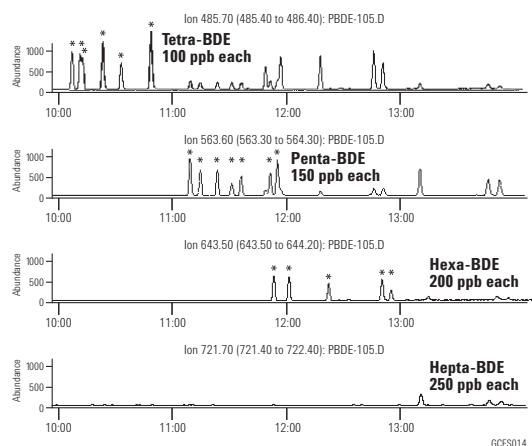
Carrier: Helium at 38 cm/sec at 100 °C (1.2 mL/min), constant flow mode

Oven: 100 °C for 1 min; 100 °C to 340 °C at 20 °C/min, 340 °C for 12 min

Injection: Cool on-column, oven-track mode

Detector: Agilent 5973 MSD, 325 °C transfer line, EI SIM
(ions monitored: 231.8, 248.0, 327.9, 398.6, 400.5,
405.8, 845.7, 563.6, 643.5, 721.4, 799.3)

Sample: 0.5 µL



For a complete Application Note, visit www.agilent.com/chem, select "Online Literature" from the Literature Library and type 5989-0094EN into the "Keyword" field.

EPA Volatiles by GC/MS (Split Injector)

Column: DB-VRX
122-1564
60 m x 0.25 mm, 1.40 µm

Carrier: Helium at 30 cm/sec, measured at 45 °C

Oven: 45 °C for 10 min
45-190 °C at 12 °C/min
190 °C for 2 min
190-225 °C at 6 °C/min
225 °C for 1 min

Sampler: Purge and trap (O.I.A. 4560)
Purge: Helium for 11 min at 40 mL/min
Trap: Tenax/Silica Gel/Carbosieve
Preheat: 175 °C
Desorb: 220 °C for 0.6 min

Injection: Split, 110 °C
Split flow 30 mL/min

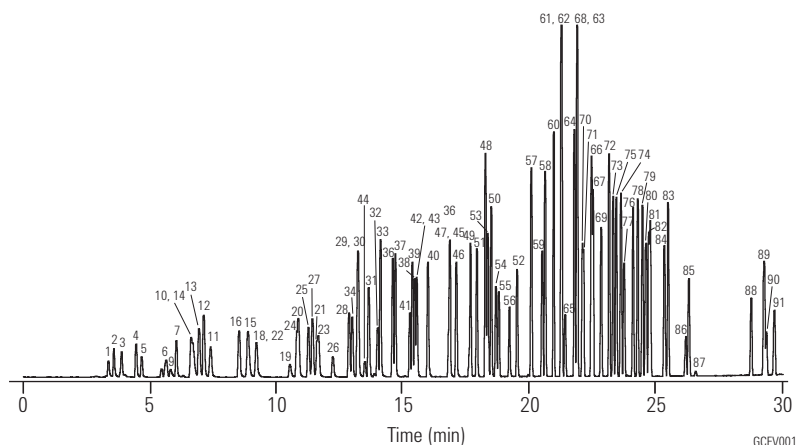
Detector: MSD, 235 °C transfer line
Full scan 35-260 amu (m/z 44 subtracted)

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal kit, 5188-5367



GCEV001

- | | | |
|------------------------------|-----------------------------------|---------------------------------|
| 1. Dichlorodifluoromethane | 32. Carbon tetrachloride | 63. o-Xylene |
| 2. Chloromethane | 33. Benzene | 64. Styrene |
| 3. Vinyl chloride | 34. 1,2-Dichloroethane | 65. Bromoform |
| 4. Bromomethane | 35. 2,2-Dimethylhexane | 66. Isopropylbenzene |
| 5. Chloroethane | 36. Fluorobenzene (IS) | 67. 4-Bromofluorobenzene (SS) |
| 6. Trichlorofluoromethane | 37. 1,4-Difluorobenzene (IS) | 68. 1,1,2,2-Tetrachloroethane |
| 7. Diethyl ether | 38. Trichloroethene | 69. Bromobenzene |
| 8. 1,1-Dichloroethene | 39. 1,2-Dichloropropane | 70. 1,2,3-Trichloropropane |
| 9. Acetone | 40. Methyl methacrylate | 71. trans-1,4-Dichloro-2-butene |
| 10. Iodomethane | 41. Dibromomethane | 72. n-Propylbenzene |
| 11. Carbon disulfide | 42. Bromodichloromethane | 73. 2-Chlorotoluene |
| 12. Allyl chloride | 43. 2-Nitropropane | 74. 1,3,5-Trimethylbenzene |
| 13. Methylene chloride | 44. Chloroacetonitrile | 75. 4-Chlorotoluene |
| 14. Acrylonitrile | 45. cis-1,3-Dichloropropene | 76. tert-Butylbenzene |
| 15. Methyl-tert-butyl ether | 46. 4-Methyl-2-pentanone | 77. Pentachloroethane |
| 16. trans-1,2-Dichloroethene | 47. 1,1-Dichloro-2-propanone | 78. 1,2,4-Trimethylbenzene |
| 17. Hexane | 48. Toluene | 79. sec-Butylbenzene |
| 18. 1,1-Dichloroethane | 49. trans-1,3-Dichloropropene | 80. 1,3-Dichlorobenzene |
| 19. 2-Butanone | 50. Ethyl methacrylate | 81. p-Isopropyltoluene |
| 20. cis-1,2-Dichloroethene | 51. 1,1,2-Trichloroethane | 82. 1,4-Dichlorobenzene |
| 21. 2,2-Dichloropropane | 52. Tetrachloroethene | 83. n-Butylbenzene |
| 22. Propionitrile | 53. 1,3-Dichloropropane | 84. 1,2-Dichlorobenzene |
| 23. Methyl acrylate | 54. 2-Hexanone | 85. Hexachloroethane |
| 24. Methacrylonitrile | 55. Dibromochloromethane | 86. 1,2-Dibromo-3-chloropropane |
| 25. Bromochloromethane | 56. 1,2-Dibromoethane | 87. Nitrobenzene |
| 26. Tetrahydrofuran | 57. 1-Chloro-3-fluorobenzene (IS) | 88. 1,2,4-Trichlorobenzene |
| 27. Chloroform | 58. Chlorobenzene | 89. Hexachlorobutadiene |
| 28. Pentafluorobenzene (IS) | 59. 1,1,1,2-Tetrachloroethane | 90. Naphthalene |
| 29. 1,1,1-Trichloroethane | 60. Ethylbenzene | 91. 1,2,3-Trichlorobenzene |
| 30. 1-Chlorobutane | 61. m-Xylene | |
| 31. 1,1-Dichloropropene | 62. p-Xylene | |

EPA Method 525.2

Column: DB-5ms
122-5532
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 32 cm/sec, measured at 45 °C, constant flow mode

Oven: 45 °C for 1 min
45-130 °C at 30 °C/min
130 °C for 3 min
130-180 °C at 12 °C/min
180-240 °C at 7 °C/min
240-325 °C at 12 °C/min
325 °C for 5 min

Injection: Splitless, 300 °C
1.0 min purge activation time
Focus liner

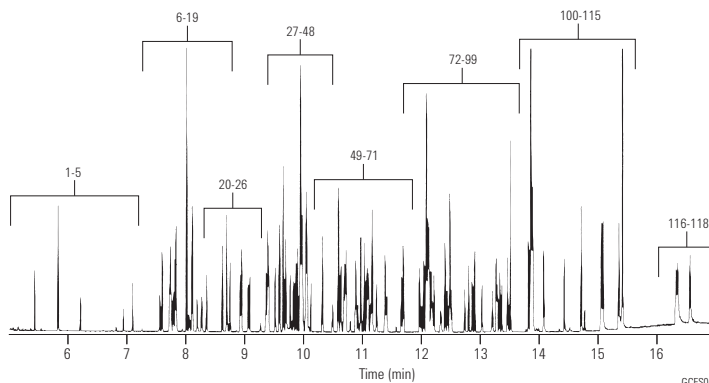
Detector: MSD, 325 °C transfer line
Full scan m/z 45-450

Sample: Composite mixture of AccuStandard
Method 525.2 standards (M-525.2-SV-ASL,
M-525.2-FS-ASL, M-525.2-CP-ASL,
M-525.2-NP1-ASL, M-525.2-NP2-ASL):
target compounds at 2 ng/µL, IS/SS at 5 ng/µL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Compound	RT	m/z	Compound	RT	m/z	Compound	RT	m/z
1. Isophorone	5.85	82	51. Alachlor	16.14	160	85. 2,2',4,4',5,6'-Hexachlorobiphenyl	19.90	360
2. 1,3-Dimethyl-2-nitrobenzene (SS)	6.65	134	52. Simetryn	16.23	213	86. Dieldrin	19.92	79
3. Dichlorvos	7.41	109	53. Ametryn	16.33	227/170	87. Carboxin	19.97	143
4. Hexachlorocyclo-pentadiene	8.87	237	54. Heptachlor	16.36	100	88. Endrin	20.43	67/81
5. EPTC	9.17	128	55. Prometryne	16.40	241/184	89. Chlorobenzilate	20.56	139
6. Mevinphos	10.09	127	56. Prebane (Terbutryne)	16.72	226/185	90. Endosulfan II	20.68	195
7. Butylate	10.18	57/146	57. Bromacil	16.79	205	91. p,p'-DDD	20.77	235/165
8. Vernolate	10.42	128	58. Di-n-butyl phthalate	16.90	149	92. Endrin aldehyde	21.01	67
9. Dimethyl phthalate	10.45	163	59. 2,2',4,4'-Tetrachlorobiphenyl	17.02	292	93. Norflurazon	21.36	145
10. Terrazole (Etridazole)	10.47	211/183	60. Metolachlor	17.11	162	94. Benzyl butyl phthalate	21.49	149
11. 2,6-Dinitrotoluene	10.56	165	61. Dursban (Chlorpyrifos)	17.15	197/97	95. Endosulfan sulfate	21.53	272
12. Tillam (Pebulate)	10.61	128	62. Cyanazine	17.23	225/68	96. p,p'-DDT	21.61	235/165
13. Acenaphthylene	10.65	152	63. Dacthal (DCPA methyl ester)	17.27	301	97. Hexazinone	21.68	171
14. Acenaphthene-d10 (IS)	11	164	64. Aldrin	17.29	66	98. Bis[2-ethylhexyl] adipate	21.87	129
15. Chloroneb	11.17	191	65. Triadimefon	17.43	57	99. Triphenylphosphate (SS)	21.98	326/325
16. 2-Chlorobiphenyl	11.19	188	66. Diphenamid	17.73	72/167	100. Endrin ketone (breakdown product)	22.52	67/317
17. Tebuthiuron	11.37	156	67. MGK-264 (Isomer A)	17.78	164/66	101. 2,2',3,3',4,4',6-Heptachlorobiphenyl	22.59	394/396
18. 2,4-Dinitrotoluene	11.51	165	68. MGK-264 (Isomer B)	18.11	164	102. Benz[a]anthracene	22.66	228
19. Molinate	11.68	126	69. Heptachlor epoxide	18.28	81	103. Chrysene-d12 (IS)	22.68	240
20. Diethyl phthalate	12.21	149	70. 2,2',3',4,6-Pentachlorobiphenyl	18.34	326	104. 2,2',3,3',4,5',6,6'-Octachlorobiphenyl	22.70	430/428
21. Fluorene	12.35	166	71. Merphos	18.36	209/153	105. Methoxychlor	22.73	227
22. Propachlor	12.46	120	72. γ-Chlordane	18.88	373	106. Chrysene	22.74	228
23. Ethoprop	12.82	158	73. Tetrachlorvinphos (Stirifos)	18.95	109	107. Bis[2-ethylhexyl] phthalate	23.10	149
24. Cycloate	12.86	83/154	74. Butachlor	19.03	176/160	108. Fenarimol	23.80	139
25. Chlorpropham	13.08	127	75. Pyrene-d10 (SS)	19.13	212	109. cis-Permethrin	24.38	183
26. Trifluralin	13.14	306	76. Pyrene	19.18	202	110. trans-Permethrin	24.50	183
27. α-BHC	13.69	181	77. α-Chlordane	19.21	375/373	111. Benzo[b]fluoranthene	25.06	252
28. 2,3-Dichlorobiphenyl	13.74	222/152	78. Endosulfan I	19.22	195	112. Benzo[k]fluoranthene	25.12	252
29. Hexachlorobenzene	13.77	284	79. trans-Nonachlor	19.28	409	113. Fluridone	25.66	328
30. Gesatamine (Atraton)	13.99	196/169	80. Fenamiphos	19.33	303/154	114. Benzo[a]pyrene	25.67	252
31. Prometon	14.14	225/168	81. Napropamide	19.39	72	115. Perylene-d12 (SS)	25.78	264
32. Atrazine	14.26	200/215	82. Tricyclazole	19.61	189	116. Indeno[1,2,3-c,d]pyrene	27.63	276
33. Simazine	14.27	201/186	83. p,p'-DDE	19.76	246	117. Dibenzo[a,h]anthracene	27.69	278
34. β-BHC	14.28	181	84. DEF	19.84	57/169	118. Benzo[g,h,i]perylene	28.11	276
35. Pentachlorophenol	14.35	266						
36. Propazine	14.35	214/172						
37. γ-BHC	14.52	181						
38. Terbufos	14.62	57						
39. Pronamide	14.69	173						
40. Diazinon	14.76	137/179						
41. Phenanthrene-d10 (IS)	14.85	188						
42. Chlorothalonil	14.89	266						
43. Phenanthrene	14.92	178						
44. Terbacil	15.02	161						
45. Methyl paraoxon	15.04	109						
46. Disulfoton	15.05	88						
47. Anthracene	15.06	178						
48. δ-BHC	15.20	181						
49. 2,4,5-Trichlorobiphenyl	15.59	256						
50. Metribuzin	15.95	198						



Pesticides and Fire Retardants (US EPA 527)

Column: DB-5ms Ultra Inert
122-5532UI
30 m x 0.25 mm, 0.25 µm

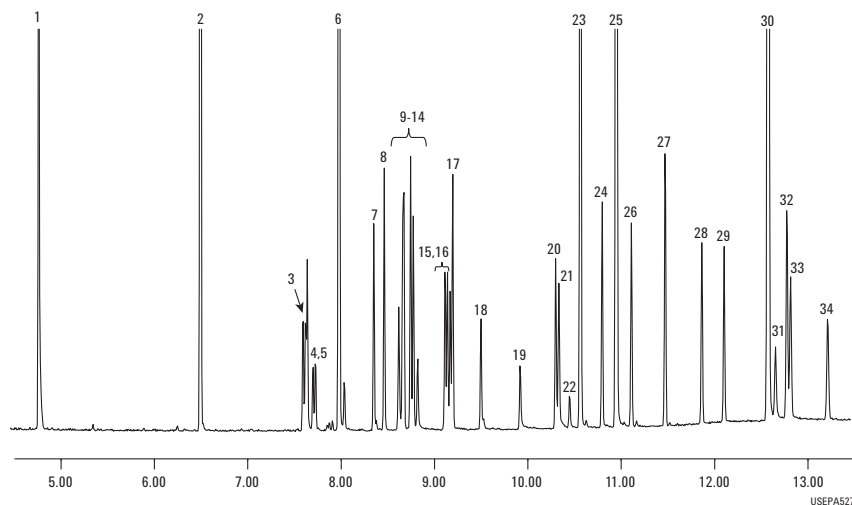
Carrier: Helium, 52 cm/sec, constant flow

Oven: 60 °C (1 min) to 210 °C (25 °C/min), 20 °C/min to 310 °C (3 min)

Injection: Splitless, 250 °C, purge flow 50 mL/min @ 1 in, gas saver 80 mL/min on @ 3 min

Detector: Transfer line 290 °C, source 300 °C, quad 180 °C

Sample: Pesticide/PBDE standards, 1 ng with 5 ng IS/SS on-column



1. 1,2-Dimethyl-2-nitrobenzene
2. Acenaphthalene-D10
3. Dimethoate
4. Atrazine
5. Propazine
6. Anthracene-D10
7. Vinclozoline
8. Prometryne
9. Bromacil
10. Malathion
11. Thiazopyr
12. Dursban
13. Benthocarb
14. Parathion
15. Terbus sulfone
16. Bioallethrin
17. Oxychlorane
18. Fenamiphos
19. Nitrophen
20. Norflurazone
21. Kepone
22. Hexazinone
23. Triphenyl phosphate
24. Bifenthrin
25. Chrysene-D12
26. BDE-47
27. Mirex
28. BDE-100
29. BDE-99
30. Perylene-D12
31. Fenvalerate
32. Esfenvalerate
33. Hexabromobiphenyl
34. BDE-153

Organochlorine Pesticides I EPA Method 8081A

Column: DB-35ms
122-3832
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 35 cm/sec, measured at 50 °C

Oven: 50 °C for 1 min
50-100 °C at 25 °C/min
100-300 °C at 5 °C/min
300 °C for 5 min

Injection: Splitless, 250 °C
30 sec purge activation time

Detector: MSD, 300 °C transfer line
Full scan at m/z 50-500

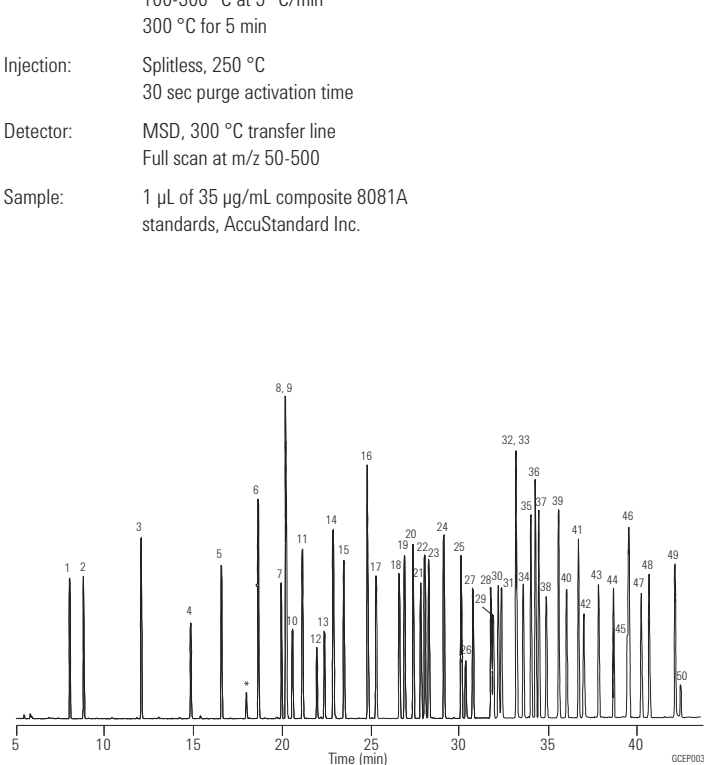
Sample: 1 µL of 35 µg/mL composite 8081A standards, AccuStandard Inc.

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



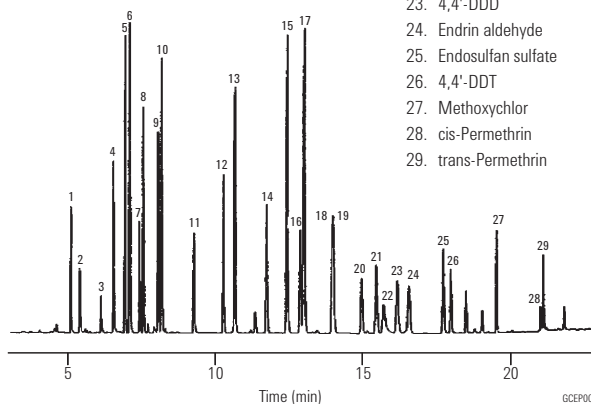
- | | |
|--|----------------------------|
| 1. 1,2-Dibromo-3-chloropropane | 28. γ-Chlordane |
| 2. 4-Chloro-3-nitrobenzotrifluoride (SS) | 29. trans-Nonachlor |
| 3. Hexachloropentadiene | 30. α-Chlordane |
| 4. 1-Bromo-2-nitrobenzene (IS) | 31. Endosulfan I |
| 5. Terrazole | 32. Captan |
| 6. Chloroneb | 33. p,p'-DDE |
| 7. Trifluralin | 34. Dieldrin |
| 8. 2-Bromobiphenyl (SS) | 35. Chlorobenzilate |
| 9. Tetrachloro m-xylene (SS) | 36. Perthane |
| 10. α, α-Dibromo-m-xylene | 37. Chloropropylate |
| 11. Propachlor | 38. Endrin |
| 12. Di-allate A | 39. p,p'-DDD |
| 13. Di-allate B | 40. Endosulfan II |
| 14. Hexachlorobenzene | 41. p,p'-DDT |
| 15. α-BHC | 42. Endrin aldehyde |
| 16. Pentachloronitrobenzene (IS) | 43. Endosulfan sulfate |
| 17. γ-BHC | 44. Dibutylchloredate (SS) |
| 18. β-BHC | 45. Captafol |
| 19. Heptachlor | 46. Methoxychlor |
| 20. Alachlor | 47. Endrin ketone |
| 21. δ-BHC | 48. Mirex |
| 22. Chlorothalonil | 49. cis-Permethrin |
| 23. Aldrin | 50. trans-Permethrin |
| 24. Dacthal | |
| 25. Isodrin | |
| 26. Kelthane | |
| 27. Heptachlor epoxide | |

* Breakdown Products
SS - Surrogate Standard
IS - Internal Standard

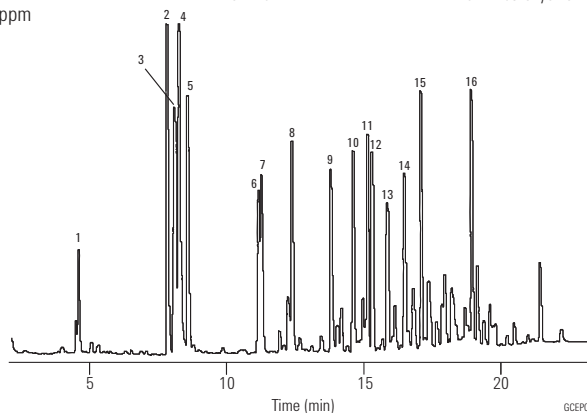
Standards used were a composite of individual solutions supplied courtesy of AccuStandard Inc., 25 Science Park, New Haven, CT 06511, 800-442-5290.

Chlorinated Pesticides, EPA Method 508**Column:** HP-5ms
19091S-433**30 m x 0.25 mm, 0.25 µm****Carrier:** Helium, 24 psi, 45 cm/sec (80 °C) constant flow**Oven:** 80 °C for 1 min
80-180 °C at 30 °C/min
180-205 °C at 3 °C/min
205 °C for 4 min
205-290 °C at 2 °C/min
290 °C for 2 min**Injection:** Splitless
1 min purge delay**Detector:** ECD, 320 °C
Makeup gas Nitrogen, 60 mL/min
Anode purge 3 mL/min**Sample:** 1 µL

- | | |
|----------------------|------------------------|
| 1. Etridiazole | 12. Aldrin |
| 2. Chloroneb | 13. DCPA |
| 3. Propachlor | 14. Heptachlor epoxide |
| 4. Trifluralin | 15. γ-Chlordane |
| 5. α-BHC | 16. Endosulfan I |
| 6. Hexachlorobenzene | 17. α-Chlordane |
| 7. β-BHC | 18. Dieldrin |
| 8. δ-BHC | 19. 4,4'-DDE |
| 9. γ-BHC | 20. Endrin |
| 10. Chlorothalonil | 21. Endosulfan II |
| 11. Heptachlor | 22. Chlorobenzilate |
| | 23. 4,4'-DDD |
| | 24. Endrin aldehyde |
| | 25. Endosulfan sulfate |
| | 26. 4,4'-DDT |
| | 27. Methoxychlor |
| | 28. cis-Permethrin |
| | 29. trans-Permethrin |

**Suggested Supplies****Septum:** 11 mm Advanced Green septa, 5183-4759**Liner:** Direct connect, single taper, deactivated, 4 mm id, G1544-80730**Syringe:** 10 µL tapered, FN 23-26s/42/HP, 5181-1267**Organohalide Pesticides in Water, EPA Method 505****Column:** HP-5ms
19091S-433**30 m x 0.25 mm, 0.25 µm****Carrier:** Helium at 2.0 mL/min,
constant flow,
42 cm/sec (22.4 psi at 80 °C)**Detector:** ECD, 300 °C
Makeup gas: N₂, 60 mL/min
Anode purge 6 mL/min**Oven:** 80 °C for 1 min
80-175 °C at 30 °C/min
175 °C for 4 min
175-215 °C at 6 °C/min
215 °C for 2 min
215-290 °C at 15 °C/min
290 °C for 5 min**Sample:** 1 µL injection volume
16 components EPA-505 targeted pesticides
and 14 ppb Aroclor 1260 in hexane.
Concentration of pesticides:
50 ppb each except 1.25 ppm
for atrazine and simazine.**Injection:** Splitless, 250 °C
1 min purge delay

- | | |
|------------------------------|-----------------------|
| 1. Hexachlorocyclopentadiene | 9. Heptachlor epoxide |
| 2. Hexachlorobenzene | 10. δ-Chlordane |
| 3. Simazine | 11. α-Chlordane |
| 4. Atrazine | 12. trans-Nonachlor |
| 5. Lindane | 13. Dieldrin |
| 6. Heptachlor | 14. Endrin |
| 7. Alachlor | 15. cis-Nonachlor |
| 8. Adrin | 16. Methoxychlor |

**Suggested Supplies****Septum:** 11 mm Advanced Green septa, 5183-4759**Liner:** Direct connect, single taper, deactivated, 4 mm id, G1544-80730**Syringe:** 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Organochlorine Pesticides I

Column: DB-5
125-5037
30 m x 0.53 mm, 0.50 µm

Carrier: Helium at 30 cm/sec (4.0 mL/min)

Oven: 150-275 °C at 4 °C/min
275 °C for 30 min

Injection: Splitless, 250 °C

Detector: ECD, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 0.7 µL of 100 pg/µL standard in isoctane

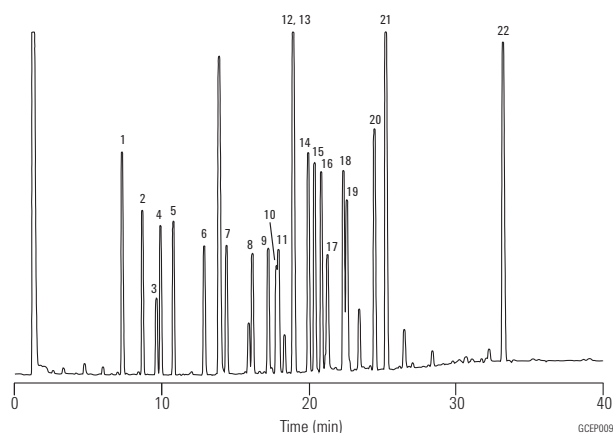
Suggested Supplies

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Septum: 11 mm Advanced Green septa, 5183-4759

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

- | | |
|--------------------------------------|-----------------------------|
| 1. 2,4,5,6-Tetrachloro-m-xylene (IS) | 12. Dieldrin |
| 2. α-BHC | 13. p,p'-DDE |
| 3. β-BHC | 14. Endrin |
| 4. γ-BHC | 15. Endosulfan II |
| 5. δ-BHC | 16. p,p'-DDD |
| 6. Heptachlor | 17. Endrin aldehyde |
| 7. Aldrin | 18. Endosulfan sulfate |
| 8. Heptachlor epoxide | 19. p,p'-DDT |
| 9. γ-Chlordane | 20. Endrin ketone |
| 10. Endosulfan I | 21. Methoxychlor |
| 11. α-Chlordane | 22. Decachlorobiphenyl (IS) |



GCEP009

Organochlorine Pesticides II

Column: DB-608
125-6837
30 m x 0.53 mm, 0.50 µm

Carrier: Helium at 30 cm/sec (4.0 mL/min)

Oven: 150-275 °C at 4 °C/min
275 °C for 30 min

Injection: Splitless, 250 °C

Detector: ECD, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 0.7 µL of 100 pg/µL standard in isoctane

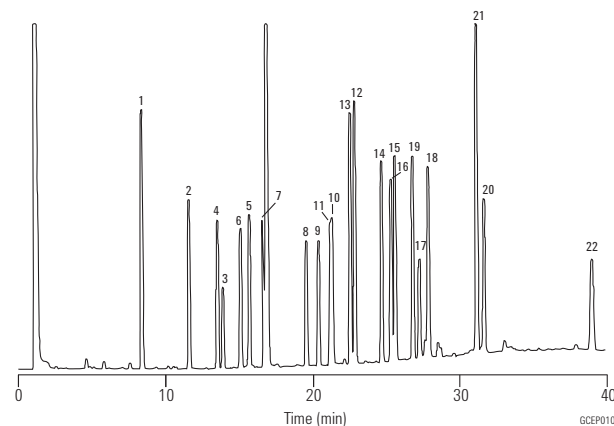
Suggested Supplies

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Seal: 11 mm Advanced Green septa, 5183-4759

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

- | | |
|--------------------------------------|-----------------------------|
| 1. 2,4,5,6-Tetrachloro-m-xylene (IS) | 12. Dieldrin |
| 2. α-BHC | 13. p,p'-DDE |
| 3. β-BHC | 14. Endrin |
| 4. γ-BHC | 15. Endosulfan II |
| 5. δ-BHC | 16. p,p'-DDD |
| 6. Heptachlor | 17. Endrin aldehyde |
| 7. Aldrin | 18. Endosulfan sulfate |
| 8. Heptachlor epoxide | 19. p,p'-DDT |
| 9. γ-Chlordane | 20. Endrin ketone |
| 10. Endosulfan I | 21. Methoxychlor |
| 11. α-Chlordane | 22. Decachlorobiphenyl (IS) |



GCEP010

Organochlorine Pesticides III

Column: DB-1701
125-0737
30 m x 0.53 mm, 0.50 µm

Carrier: Helium at 30 cm/sec (4.0 mL/min)

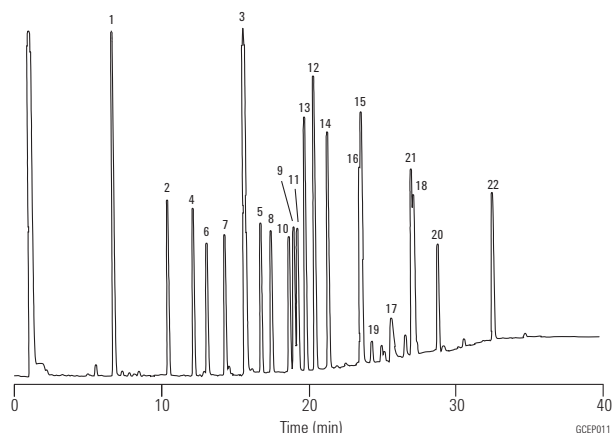
Oven: 150-275 °C at 4 °C/min
275 °C for 30 min

Injection: Splitless, 250 °C

Detector: ECD, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 0.7 µL of 100 pg/µL standard in isooctane

- | | |
|--------------------------------------|-----------------------------|
| 1. 2,4,5,6-Tetrachloro-m-xylene (IS) | 12. Dieldrin |
| 2. α-BHC | 13. p,p'-DDE |
| 3. β-BHC | 14. Endrin |
| 4. γ-BHC | 15. Endosulfan II |
| 5. δ-BHC | 16. p,p'-DDD |
| 6. Heptachlor | 17. Endrin aldehyde |
| 7. Aldrin | 18. Endosulfan sulfate |
| 8. Heptachlor epoxide | 19. p,p'-DDT |
| 9. γ-Chlordane | 20. Endrin ketone |
| 10. Endosulfan I | 21. Methoxychlor |
| 11. α-Chlordane | 22. Decachlorobiphenyl (IS) |

**Suggested Supplies**

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Organochlorine Pesticides IV

Column: DB-35
125-1937
30 m x 0.53 mm, 0.50 µm

Carrier: Helium at 30 cm/sec (4.0 mL/min)

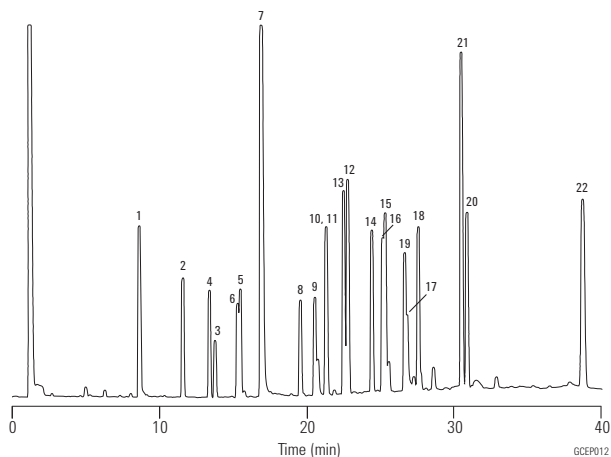
Oven: 150-275 °C at 4 °C/min
275 °C for 30 min

Injection: Splitless, 250 °C

Detector: ECD, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 0.7 µL of 100 pg/µL standard in isooctane

- | | |
|--------------------------------------|-----------------------------|
| 1. 2,4,5,6-Tetrachloro-m-xylene (IS) | 12. Dieldrin |
| 2. α-BHC | 13. p,p'-DDE |
| 3. β-BHC | 14. Endrin |
| 4. γ-BHC | 15. Endosulfan II |
| 5. δ-BHC | 16. p,p'-DDD |
| 6. Heptachlor | 17. Endrin aldehyde |
| 7. Aldrin | 18. Endosulfan sulfate |
| 8. Heptachlor epoxide | 19. p,p'-DDT |
| 9. γ-Chlordane | 20. Endrin ketone |
| 10. Endosulfan I | 21. Methoxychlor |
| 11. α-Chlordane | 22. Decachlorobiphenyl (IS) |

**Suggested Supplies**

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Organochlorine Pesticides, DB-5/DB-1701P

Column: DB-5
123-5032
30 m x 0.32 mm, 0.25 µm

Column: DB-1701P
123-7732
30 m x 0.32 mm, 0.25 µm

Column: Guard Column
160-2535-10
30 m x 0.32 mm, 0.25 µm

Carrier: Helium at 29.2 cm/sec, measured at 150 °C

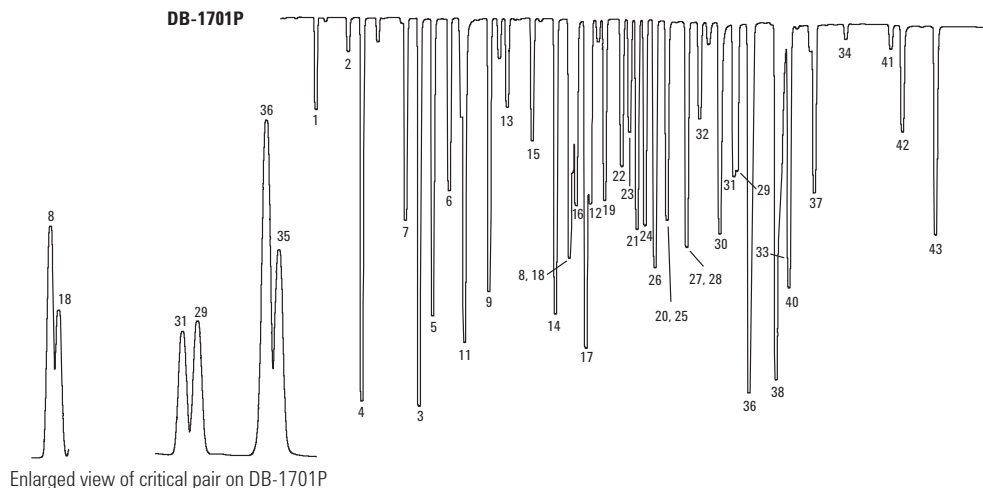
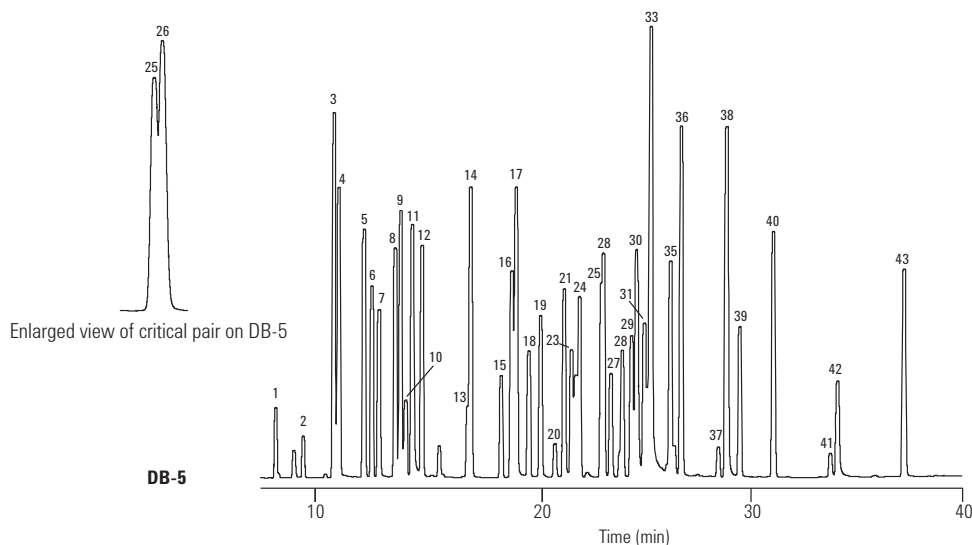
Oven: 60 °C for 0.5 min
60-140 °C at 20 °C/min
140-280 °C at 11 °C/min
280 °C for 23 min

Injection: Splitless, 200 °C

Detector: ECD, 325 °C
Nitrogen makeup gas at 30 mL/min

Sample: 2.0 µL, 20-200 pg/µL

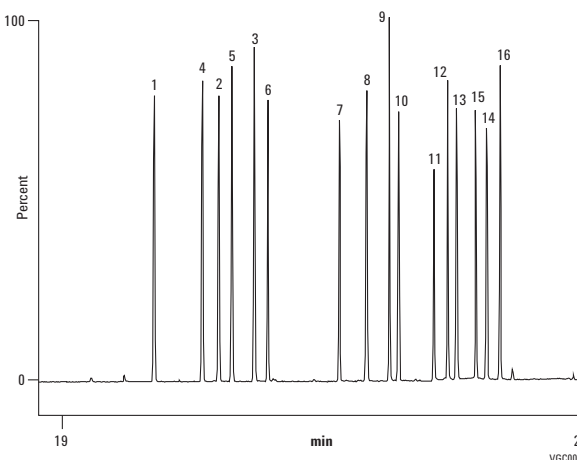
- | | |
|------------------------------|-----------------------------|
| 1. Etridiazole | 22. o,p'-DDE |
| 2. Chloroneb | 23. Endosulfan I |
| 3. Propachlor | 24. α-Chlordane |
| 4. Tetrachloro-m-xylene (IS) | 25. Dieldrin |
| 5. Trifluralin | 26. p,p'-DDE |
| 6. α-BHC | 27. o,p'-DDD |
| 7. Hexachlorobenzene | 28. Endrin |
| 8. β-BHC | 29. Endosulfan II |
| 9. γ-BHC | 30. Chlorobenzilate |
| 10. Pentachloronitrobenzene | 31. p,p'-DDD |
| 11. p,p'-Dichlorobiphenyl | 32. o,p'-DDT |
| 12. δ-BHC | 33. Endrin aldehyde |
| 13. Heptachlor | 34. Endrin ketone |
| 14. Alachlor | 35. Carbofenothion |
| 15. Aldrin | 36. p,p'-DDT |
| 16. Chlorpyrifos | 37. Endosulfan sulfate |
| 17. DCPA | 38. Hexabromobenzene (HBB) |
| 18. Isodrin | 39. Methoxychlor |
| 19. Heptachlor epoxide | 40. Mirex |
| 20. Captan | 41. cis-Permethrin |
| 21. γ-Chlordane | 42. trans-Permethrin |
| | 43. Decachlorobiphenyl (IS) |



Organochlorine Pesticides

Column: VF-17ms
CP8982
30 m x 0.25 mm, 0.25 µm

Sample: 1.0 µL
Sample Conc: 200 µg/mL
Carrier: Helium, 70 kPa
Injection: Splitter, 1:100
Detector: MS, Ion Trap, TIC



1. α-BHC
2. β-BHC
3. δ-BHC
4. γ-BHC (lindane)
5. Heptachlor
6. Aldrin
7. Heptachlorepoxide
8. Endosulfan I
9. 4,4'-DDE
10. Dieldrin
11. Endrin
12. 4,4'-DDD
13. Endosulfan II
14. Endrin aldehyde
15. 4,4'-DDT
16. Endosulfan sulfate

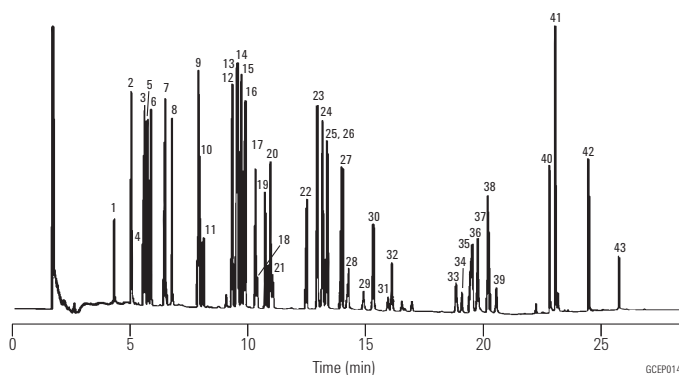
**Nitrogen/Phosphorus Containing Pesticides,
EPA Method 507**

Column: HP-5ms
19091S-433
30 m x 0.25 mm, 0.25 µm

Carrier: Helium, 30 cm/sec (13.6 psi) pressure program
Oven: 80-178 °C at 30 °C/min
178 °C for 4 min
178-205 °C at 2 °C/min
205-310 °C at 30 °C/min
310 °C for 4 min
Injection: Splitless, 260 °C
1 min purge delay
Detector: NPD, 290 °C
Helium makeup gas at 30 mL/min

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



- | | |
|------------------|------------------|
| 1. Dichlorvos | 22. Metribuzin |
| 2. EPTC | 23. Simetryn |
| 3. Butylate | 24. Alachlor |
| 4. Mevinphos | 25. Ametryn |
| 5. Vernolate | 26. Prometryn |
| 6. Pebulate | 27. Terbutryn |
| 7. Tebuthiuron | 28. Bromacil |
| 8. Molinate | 29. Metolachlor |
| 9. Ethoprop | 30. Triademefon |
| 10. Cycloate | 31. MGK-264 |
| 11. Chlorpropham | 32. Diphenamid |
| 12. Atraton | 33. Stirofos |
| 13. Simazine | 34. Butachlor |
| 14. Prometon | 35. Fenamiphos |
| 15. Atrazine | 36. Napropamide |
| 16. Propazine | 37. Tricyclazole |
| 17. Terbufos | 38. Merphos |
| 18. Pronamide | 39. Carboxin |
| 19. Diazinon | 40. Norflurazon |
| 20. Disulfoton | 41. Hexazinone |
| 21. Terbacil | 42. Fenarimol |
| | 43. Fluridone |

Herbicides I

Column: DB-XLB
122-1232
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 32 cm/sec, measured at 50 °C

Oven: 50 °C for 1 min
50-180 °C at 10 °C/min
180-230 °C at 5 °C/min
230-320 °C at 10 °C/min
320 °C for 2 min

Injection: Splitless, 250 °C
30 sec purge activation time

Detector: MSD, 300 °C transfer line
Full scan 50-400

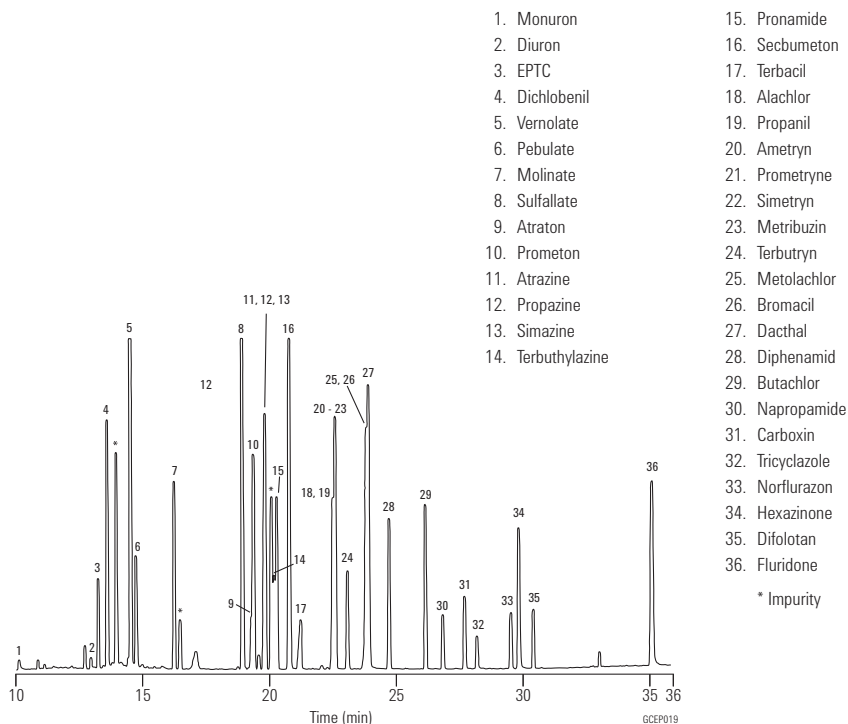
Sample: 2 µL x 10-50 ng/µL solution
in acetone

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

**Herbicides II**

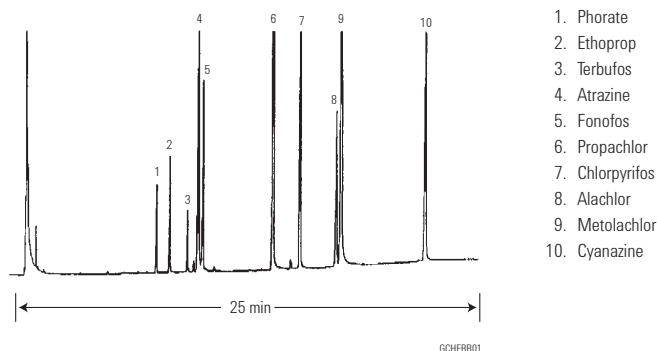
Column: DB-210
122-0232
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 35 cm/sec

Oven: 140-215 °C at 3 °C/min

Injection: Split 1:50, 1 µL

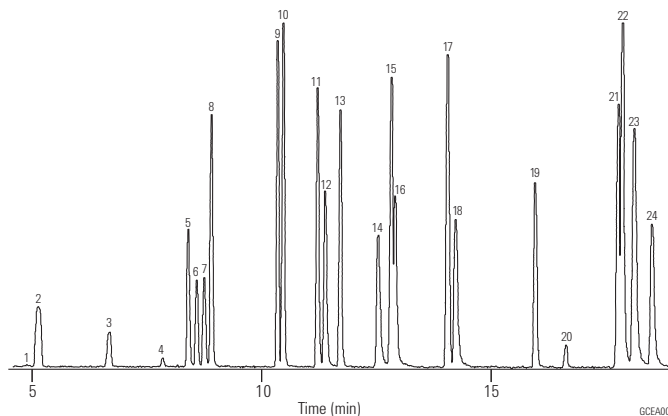
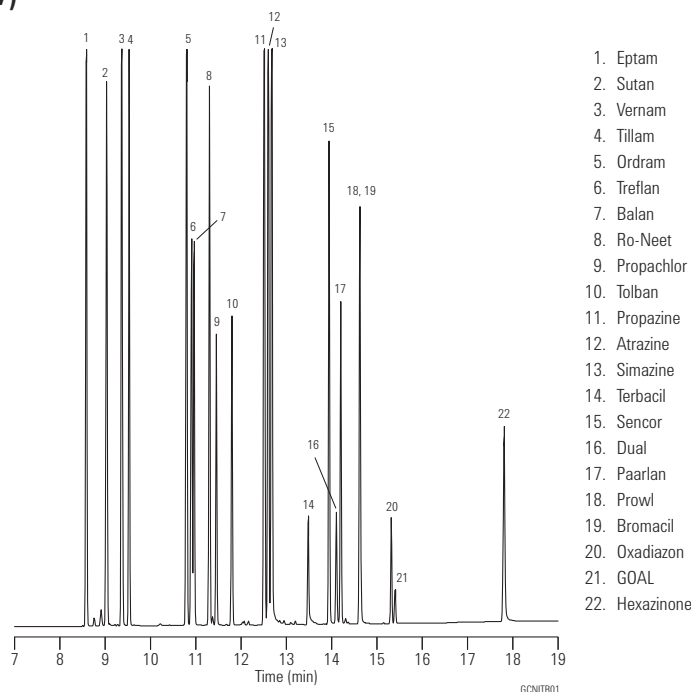
Detector: ECD, 300 °C
Nitrogen makeup gas at 30 mL/min



C₁ and C₂ Halocarbons (Freons)**Column:** GS-GasPro**113-4362****60 m x 0.32 mm****Carrier:** Helium at 35 cm/sec,
constant velocity**Oven:** 40 °C for 2 min,
40-120 °C at 10 °C/min
120 °C for 3 min
120-200 °C at 10 °C/min**Injection:** Splitless, 250 °C
0.20 min purge activation time**Detector:** MSD, 280 °C,
full scan 45-180 amu**Sample:** 1.0 µL of 100 ppm mixture
of AccuStandard M-REF &
M-REF-X in methanol

	Freon #	Freon #
1. Chlorotrifluoromethane*	13	13. 1,1-Difluoroethane
2. Trifluoromethane	23	14. 1,2-Dichloro-1,1,2,2-tetrafluoroethane
3. Bromotrifluoromethane	13B1	15. 2-Chloro-1,1,1,2-tetrafluoroethane
4. Chloropentafluoroethane	115	16. 1-Chloro-1,1-difluoroethane
5. Pentafluoroethane	125	17. Dichlorofluoromethane
6. 1,1,1-Trifluoroethane	143a	18. Trichlorofluoromethane
7. Dichlorodifluoromethane	12	19. Chloroethane
8. Chlorodifluoromethane	22	20. Dichloromethane
9. 1,1,1,2-Tetrafluoroethane	134a	21. 1,1-Dichloro-1-fluoroethane
10. Chloromethane	40	22. 2,2-Dichloro-1,1,1-trifluoroethane
11. 1,1,2,2-Tetrafluoroethane	134	23. 1,1,2-Trichloro-1,2,2-trifluoroethane
12. Bromochlorodifluoromethane	12B1	24. 1,2-Dibromo-1,1,2,2-tetrafluoroethane

*Peak not shown

**Suggested Supplies****Septum:** 11 mm Advanced Green septa, 5183-4759**Liner:** Splitless, single taper, deactivated, 4 mm id, 5181-3316**Seal:** Gold plated seal, 18740-20885**Syringe:** 10 µL tapered, FN 23-26s/42/HP, 5181-1267**Nitrogen Containing Herbicides (EPA Method 507)****Column:** DB-35**125-1937****30 m x 0.53 mm, 0.50 µm****Carrier:** Helium at 38 cm/sec (5 mL/min),
measured at 150 °C**Oven:** 60 °C for 1 min
60-290 °C at 15 °C/min
290 °C for 5 min**Injection:** Megabore Direct, 290 °C, 1 µL of 3 ng/µL standard**Detector:** NPD, 290 °C

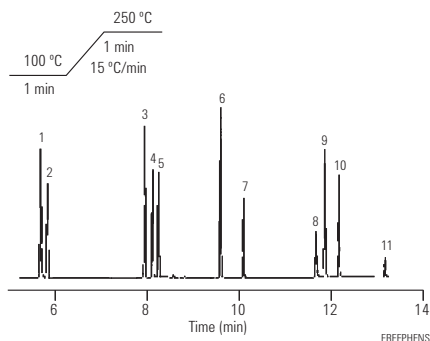
Free Phenols

Column: HP-50+
19091L-433
30 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen, constant flow 45 cm/sec

Injection: Split 100:1

Detector: FID 300 °C



1. Phenol
2. 2-chlorophenol
3. 2,4-dimethylphenol
4. 2-nitrophenol
5. 2,4-dichlorophenol
6. 4-chloro-3-methylphenol
7. 2,4,6-trichlorophenol
8. 2,4-dinitrophenol
9. 4-nitrophenol
10. 2-methyl-4,6-dinitrophenol
11. Pentachlorophenol

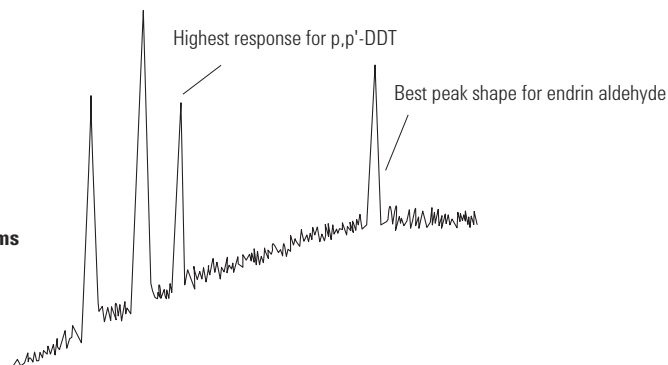
EPA 625 Halogenated Pesticides on "1701" Type Phases

Column: VF-1701 Pesticides
CP9070
30 m x 0.25 mm, 0.25 µm

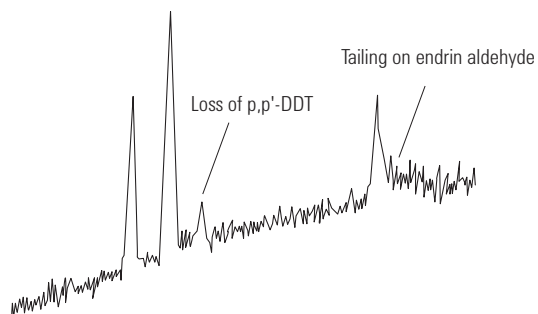
Oven: 150 °C, 5 °C/min to 275 °C

Injection: Split, T=275 °C
ECD: T=275 °C, 2 pg

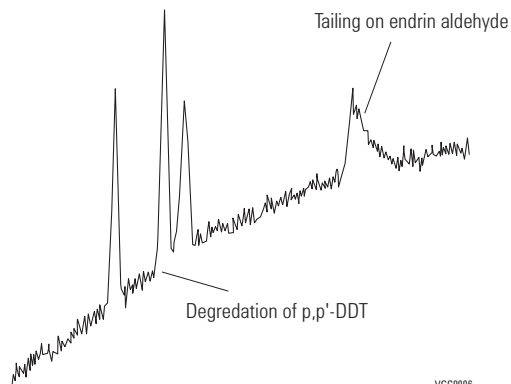
FactorFour VF-1701ms



Vendor X '1701'



Vendor Y '1701'



VGC0006

Organochlorine Pesticides to EPA 625 via GC/MS

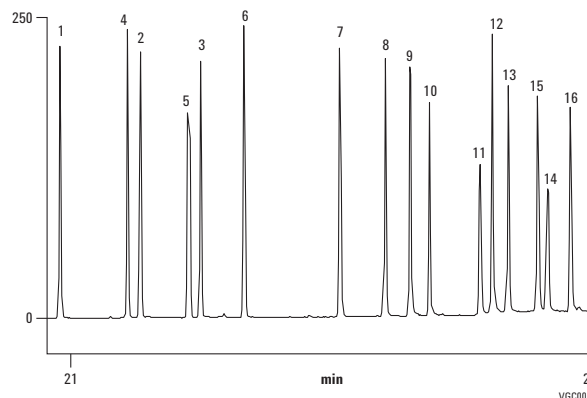
Column: VF-35ms
CP8877
30 m x 0.25 mm, 0.25 µm

Carrier: Helium, approx. 1.0 mL/min, 60 kPa

Oven: 45 °C + 10 °C/min to 325 °C

Injection: Split/splitless, in split mode, 1:100

Detector: Ion Trap MS



1. α-BHC
2. β-BHC
3. δ-BHC
4. γ-BHC (lindane)
5. Heptachlor
6. Aldrin
7. Heptachlorepoxyde
8. Endosulfan I
9. 4,4'-DDE
10. Dieldrin
11. Endrin
12. 4,4'-DDD
13. Endosulfan II
14. Endrin aldehyde
15. 4,4'-DDT
16. Endosulfan sulfate

Organochlorine Pesticides I EPA Method 8081A

Column: DB-35ms
122-3832
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 35 cm/sec, measured at 50 °C

Oven: 50 °C for 1 min
50-100 °C at 25 °C/min
100-300 °C at 5 °C/min
300 °C for 5 min

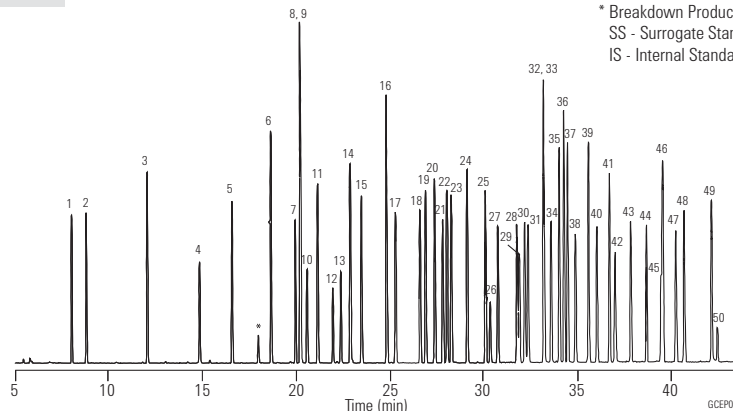
Injection: Splitless, 250 °C
30 sec purge activation time

Detector: MSD, 300 °C transfer line
Full scan at m/z 50-500

Sample: 1 µL of 35 µg/mL composite 8081A
standards, AccuStandard Inc.

- | | |
|--|----------------------------|
| 1. 1,2-Dibromo-3-chloropropane | 26. Kelthane |
| 2. 4-Chloro-3-nitrobenzotrifluoride (SS) | 27. Heptachlor epoxide |
| 3. Hexachloropentadiene | 28. γ-Chlordane |
| 4. 1-Bromo-2-nitrobenzene (IS) | 29. trans-Nonachlor |
| 5. Terrazole | 30. α-Chlordane |
| 6. Chloroneb | 31. Endosulfan I |
| 7. Trifluralin | 32. Captan |
| 8. 2-Bromobiphenyl (SS) | 33. p,p'-DDE |
| 9. Tetrachloro m-xylene (SS) | 34. Dieldrin |
| 10. α, α-Dibromo-m-xylene | 35. Chlorobenzilate |
| 11. Propachlor | 36. Perthane |
| 12. Di-allate A | 37. Chloropropylate |
| 13. Di-allate B | 38. Endrin |
| 14. Hexachlorobenzene | 39. p,p'-DDD |
| 15. α-BHC | 40. Endosulfan II |
| 16. Pentachloronitrobenzene (IS) | 41. p,p'-DDT |
| 17. γ-BHC | 42. Endrin aldehyde |
| 18. β-BHC | 43. Endosulfan sulfate |
| 19. Heptachlor | 44. Dibutylchloredate (SS) |
| 20. Alachlor | 45. Captafol |
| 21. δ-BHC | 46. Methoxychlor |
| 22. Chlorothalonil | 47. Endrin ketone |
| 23. Aldrin | 48. Mirex |
| 24. Dacthal | 49. cis-Permethrin |
| 25. Isodrin | 50. trans-Permethrin |

* Breakdown Products
SS - Surrogate Standard
IS - Internal Standard



Standards used were a composite of individual solutions
supplied courtesy of AccuStandard Inc., 25 Science Park,
New Haven, CT 06511, 800-442-5290.

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Organochlorine Pesticides II EPA Method 8081A

Column: DB-5ms
122-5532
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 35 cm/sec, measured at 50 °C

Oven: 50 °C for 1 min
50-100 °C at 25 °C/min
100-300 °C at 5 °C/min
300 °C for 5 min

Injection: Splitless, 250 °C
30 sec purge activation time

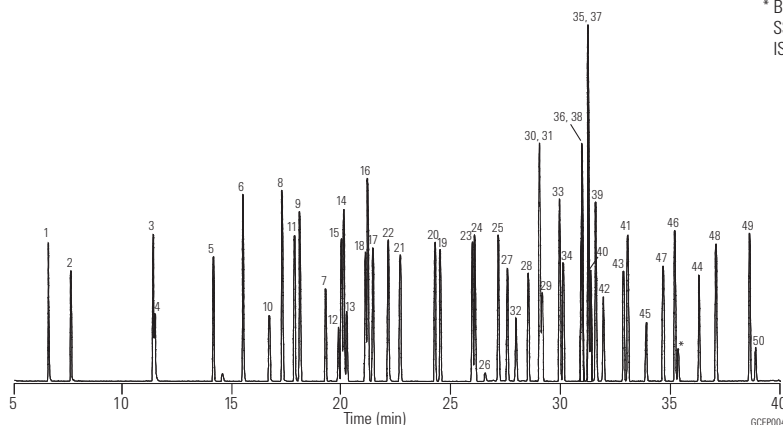
Detector: MSD, 300 °C transfer line
Full scan at m/z 50-500

Sample: 1 µL of 35 µg/mL composite 8081A standards, AccuStandard Inc.

Standards used were a composite of individual solutions supplied courtesy of AccuStandard Inc., 25 Science Park, New Haven, CT 06511, 800-442-5290.

- | | |
|--|----------------------------|
| 1. 1,2-Dibromo-3-chloropropane | 26. Kelthane |
| 2. 4-Chloro-3-nitrobenzotrifluoride (SS) | 27. Heptachlor epoxide |
| 3. Hexachloropentadiene | 28. γ-Chlordane |
| 4. 1-Bromo-2-nitrobenzene (IS) | 29. trans-Nonachlor |
| 5. Terrazole | 30. α-Chlordane |
| 6. Chloroneb | 31. Endosulfan I |
| 7. Trifluralin | 32. Captan |
| 8. 2-Bromobiphenyl (SS) | 33. p,p'-DDE |
| 9. Tetrachloro m-xylene (SS) | 34. Dieldrin |
| 10. α, α-Dibromo-m-xylene | 35. Chlorobenzilate |
| 11. Propachlor | 36. Perthane |
| 12. Di-allate A | 37. Chloropropylate |
| 13. Di-allate B | 38. Endrin |
| 14. Hexachlorobenzene | 39. p,p'-DDD |
| 15. α-BHC | 40. Endosulfan II |
| 16. Pentachloronitrobenzene (IS) | 41. p,p'-DDT |
| 17. γ-BHC | 42. Endrin aldehyde |
| 18. β-BHC | 43. Endosulfan sulfate |
| 19. Heptachlor | 44. Dibutylchlorodate (SS) |
| 20. Alachlor | 45. Captafol |
| 21. δ-BHC | 46. Methoxychlor |
| 22. Chlorothalonil | 47. Endrin ketone |
| 23. Aldrin | 48. Mirex |
| 24. Dacthal | 49. cis-Permethrin |
| 25. Isodrin | 50. trans-Permethrin |

* Breakdown Products
SS - Surrogate Standard
IS - Internal Standard



Environmental Applications, Semivolatiles

Agilent's Ultra Inert Test Probe Mixture

Column: DB-5ms Ultra Inert
122-5532UI
30 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen, constant pressure, 38 cm/s

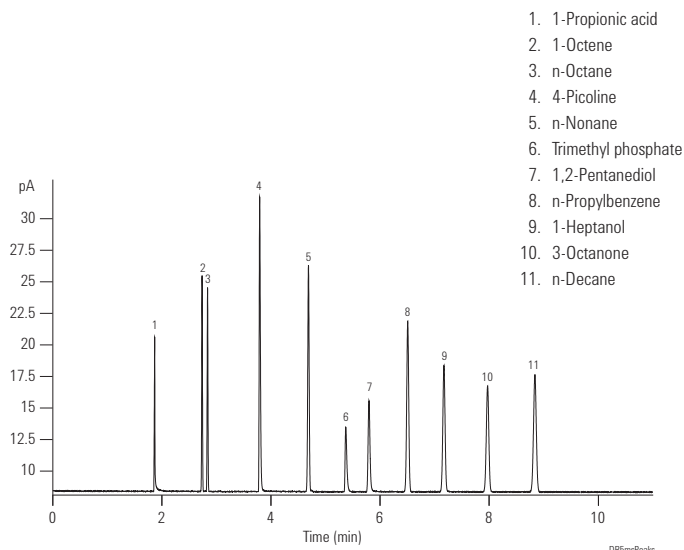
Oven: 65 °C isothermal

Sampler: Agilent 7683B, 0.5 µL syringe
(P/N 5188-5246), 0.02 µL split injection

Injection: Split/splitless; 250 °C, 1.4 mL/min; split column flow
900 mL/min; gas saver flow 75 mL/min at 2.0 min

Detector: FID at 325 °C; 450 mL/min air, 40 mL/min hydrogen,
45 mL/min nitrogen makeup

A properly deactivated DB-5ms Ultra Inert column delivers symmetrical peak shapes, along with increased peak heights, which allow for accurate integration and detection of trace analytes.



Trace Level Polycyclic Aromatic Hydrocarbon (PAH) Analyses

Column: DB-5ms Ultra Inert
122-5532UI
30 m x 0.25 mm, 0.25 µm

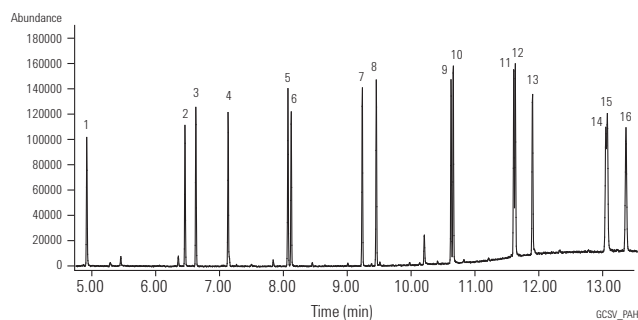
Carrier: Helium constant flow 30 cm/s

Oven: 40 °C (1 min) to 100 °C (15 °C/min)
10 °C to 210 °C (1 min)
5 °C/min. to 310 °C (8 min)

Injection: Split/splitless; 260 °C, 53.7 mL/min. total flow,
purge flow 50 mL/min. on at 0.5 min.,
gas saver flow 80 mL/min. on at 3.0 min.

Detector: MSD source at 300 °C
Quadrapole at 180 °C
Transfer line at 290 °C
Scan range 50-550 AMU

- | | |
|-------------------|----------------------------|
| 1. Naphthalene | 9. Benz[a]anthracene |
| 2. Acenaphthylene | 10. Chrysene |
| 3. Acenaphthene | 11. Benzo[b]fluoranthene |
| 4. Fluorene | 12. Benzo[k]fluoranthene |
| 5. Phenanthrene | 13. Benzo[a]pyrene |
| 6. Anthracene | 14. Indeno[1,2,3-cd]pyrene |
| 7. Fluoranthene | 15. Dibenzo[a,h]anthracene |
| 8. Pyrene | 16. Benzo[g,h,i]perylene |



Tetrachlorodibenzo-p-furans

Column A: DB-225
122-2232
30 m x 0.25 mm, 0.25 µm

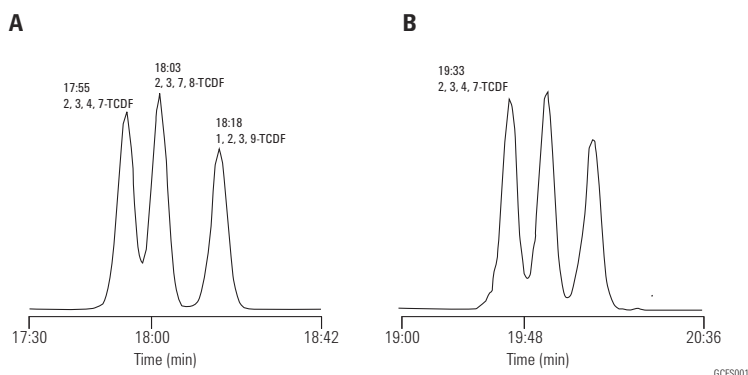
Column B: DB-225ms
122-2932
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 12 mL/min

Oven: 160-250 °C at 7 °C/min
250 °C until compounds elute

Injection: Splitless, 240 °C

Detector: VG Autospec Ultima



Note the separation between 2,3,7,8-TCDF and 2,3,4,7-TCDF on DB-225 is also easily achievable (and actually a little better!) on DB-225ms.

Congeners in DIN Method PCBs

Column: DB-XLB
122-1236
30 m x 0.25 mm, 0.50 µm

Carrier: Helium at 34.2 cm/sec,
measured at 150 °C

Oven: 100 °C for 1 min
100-320 °C at 5.6 °C/min

Injection: Hot on-column, 250 °C
Split flow 100 mL/min

Detector: MSD, 300 °C transfer line
SIM of 221.9, 255.9,
291.9, 325.8, 359.8,
395.8, 429.7, 463.7

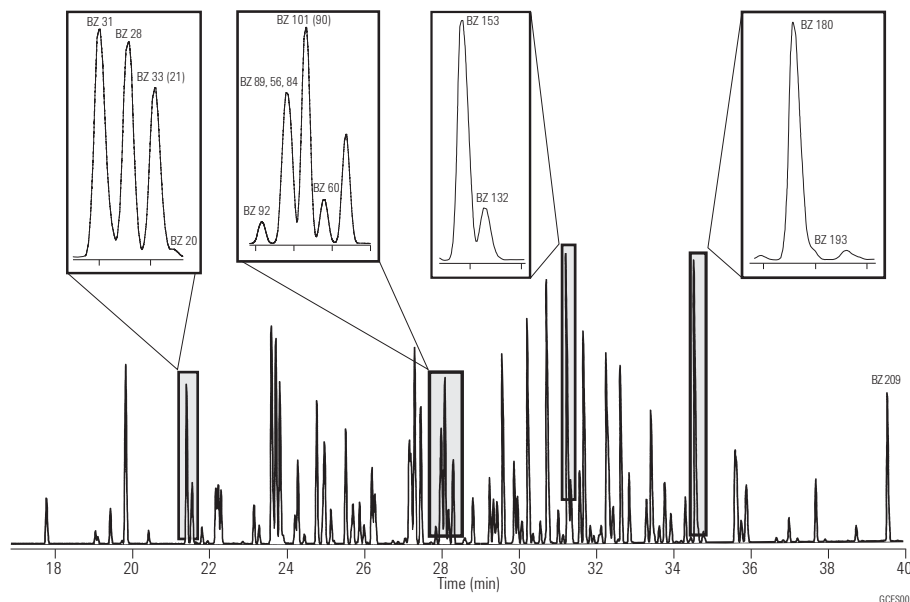
Sample: 2 µL dilute Aroclor mixture

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



Extended Temperature Program Resolving Congeners 52 and 138

Column: DB-XLB
122-1236
30 m x 0.25 mm, 0.50 µm

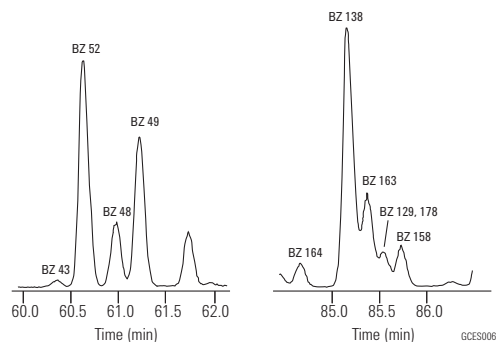
Carrier: Helium at 34.2 cm/sec, measured at 150 °C

Oven: 100 °C for 1 min
100-275 °C at 1.6 °C/min

Injection: Hot on-column, 250 °C
Split flow 100 mL/min

Detector: MSD, 300 °C transfer line
SIM of 221.9, 255.9, 291.9, 325.8, 359.8, 395.8,
429.7, 463.7

Sample: 2 µL dilute Aroclor mixture



PCBs by EPA Method 8082

Column: DB-35ms
123-3832
30 m x 0.32 mm, 0.25 µm

Column: DB-XLB
123-1236
30 m x 0.32 mm, 0.50 µm

Carrier: Helium at 45 cm/sec (EPC in constant flow mode)

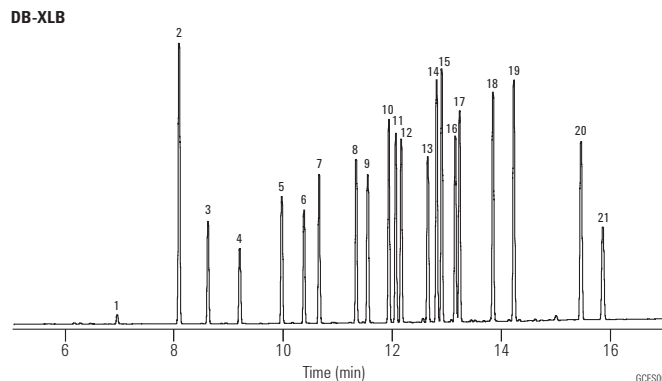
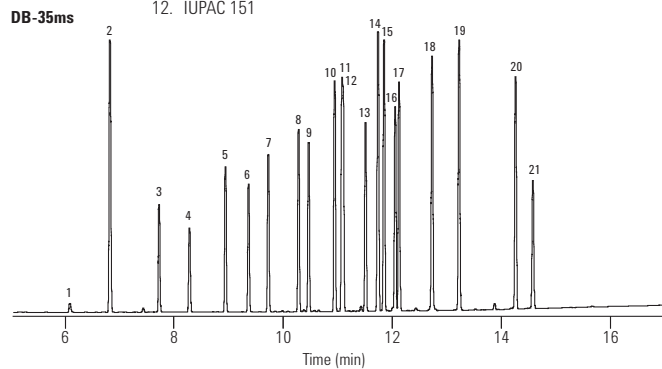
Oven: 110 °C for 0.5 min
110-320 °C at 15 °C/min
320 °C for 5 min

Injection: Splitless, 250 °C
30 sec purge activation time

Detector: µECD, 350 °C
Nitrogen makeup gas
(column + makeup flow = 30 mL/min constant flow)

Sample: 50 pg per component

- | | |
|---------------------------------|--|
| 1. IUPAC 1 | 13. IUPAC 153 |
| 2. Tetrachloro-m-xylene (IS/SS) | 14. IUPAC 141 |
| 3. IUPAC 5 | 15. IUPAC 137 |
| 4. IUPAC 18 | 16. IUPAC 187 |
| 5. IUPAC 31 | 17. IUPAC 183 |
| 6. IUPAC 52 | 18. IUPAC 180 |
| 7. IUPAC 44 | 19. IUPAC 170 |
| 8. IUPAC 66 | 20. IUPAC 206 |
| 9. IUPAC 101 | 21. Decachlorobiphenyl (IS/SS) |
| 10. IUPAC 87 | IS/SS - Internal Standard/
Surrogate Standard |
| 11. IUPAC 110 | |
| 12. IUPAC 151 | |



Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Pyrethrins

Column: DB-1
123-1032
30 m x 0.32 mm, 0.25 µm

Carrier: Helium at 39 cm/sec, measured at 150 °C

Oven: 180 °C for 11 min
180-200 °C at 10 °C/min
200 °C for 8 min
200-210 °C at 10 °C/min
210 °C for 18 min
210-245 °C at 30 °C/min
245 °C for 4 min

Injection: Split, 250 °C
Split ratio 1:20

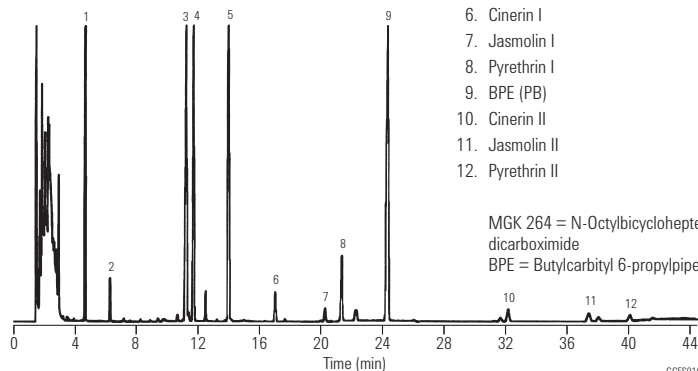
Detector: FID, 300 °C
Helium makeup gas at 30 mL/min

Sample: 1 µL

1. Heptadecane
2. Octadecane
3. Endo-MGK 264
4. Exo-MGK 264
5. Methoprene
6. Cinerin I
7. Jasmolin I
8. Pyrethrin I
9. BPE (PB)
10. Cinerin II
11. Jasmolin II
12. Pyrethrin II

MGK 264 = N-Octylbicycloheptene dicarboximide
BPE = Butylcarbityl 6-propylpiperonyl ether

Chromatogram courtesy of Khan Nguyen and Richard Moorman of Sandoz Agro Inc.



GCE5010

Organotin Compounds I

Column: HP-1
19091Z-012
25 m x 0.32 mm, 0.17 µm

Carrier: Helium, 100 kPa

Injection: Splitless

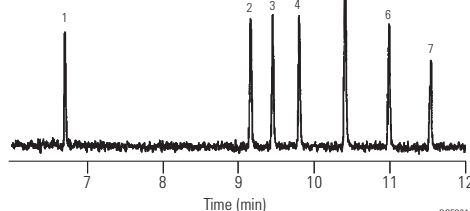
Oven: 50 °C for 1 min
50-260 °C at 15 °C/min

Detector: AED, 330 °C

Sample: 1 µL

Sn (303 nm)

1. Dimethylpentyltin
2. Tetraethyltin
3. Methyltripentyltin
4. Tributylpentyltin
5. Dibutylpentyltin
6. Butylpentyltin
7. Tetrapentyltin



GCE5011

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Organotin Compounds II

Column: HP-5
19091J-002
25 m x 0.20 mm, 0.11 µm

Carrier: Helium, 0.75 mL/min constant flow

Detector: AED, 300 °C
Hg selective at 254 nm

Oven: 60-360 °C at 5 °C/min

Sample: 1 µL

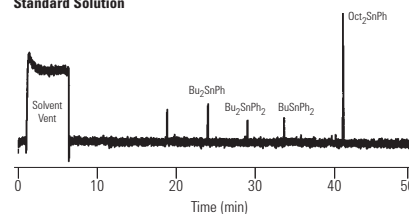
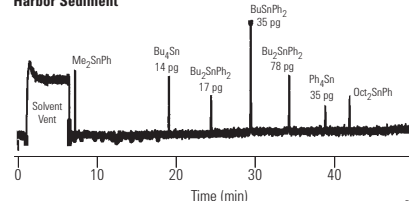
Injection: Splitless, 300 °C

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Standard Solution**Harbor Sediment**

GCE5013

Semivolatile Compounds, US EPA Method 8270

Column: HP-5ms
19091S-133
30 m x 0.25 mm, 0.50 μ m

Carrier: Ramped flow 1.2 mL/min for 0.0 min
Ramp at 99 mL/min to 2.0 mL/min
2.0 mL/min for 0.35 min
Ramp at 10 mL/min to 1.2 mL/min

Oven: 40 °C for 1.0 min
40-100 °C at 15 °C/min
100-240 °C at 20 °C/min
240-310 °C at 10 °C/min

Injection: Splitless, 250 °C
30 mL/min purge flow at 0.35 min

Detector: 5973 MSD, 310 °C transfer line
Scan range 35-500 amu, 3.25 scans/sec

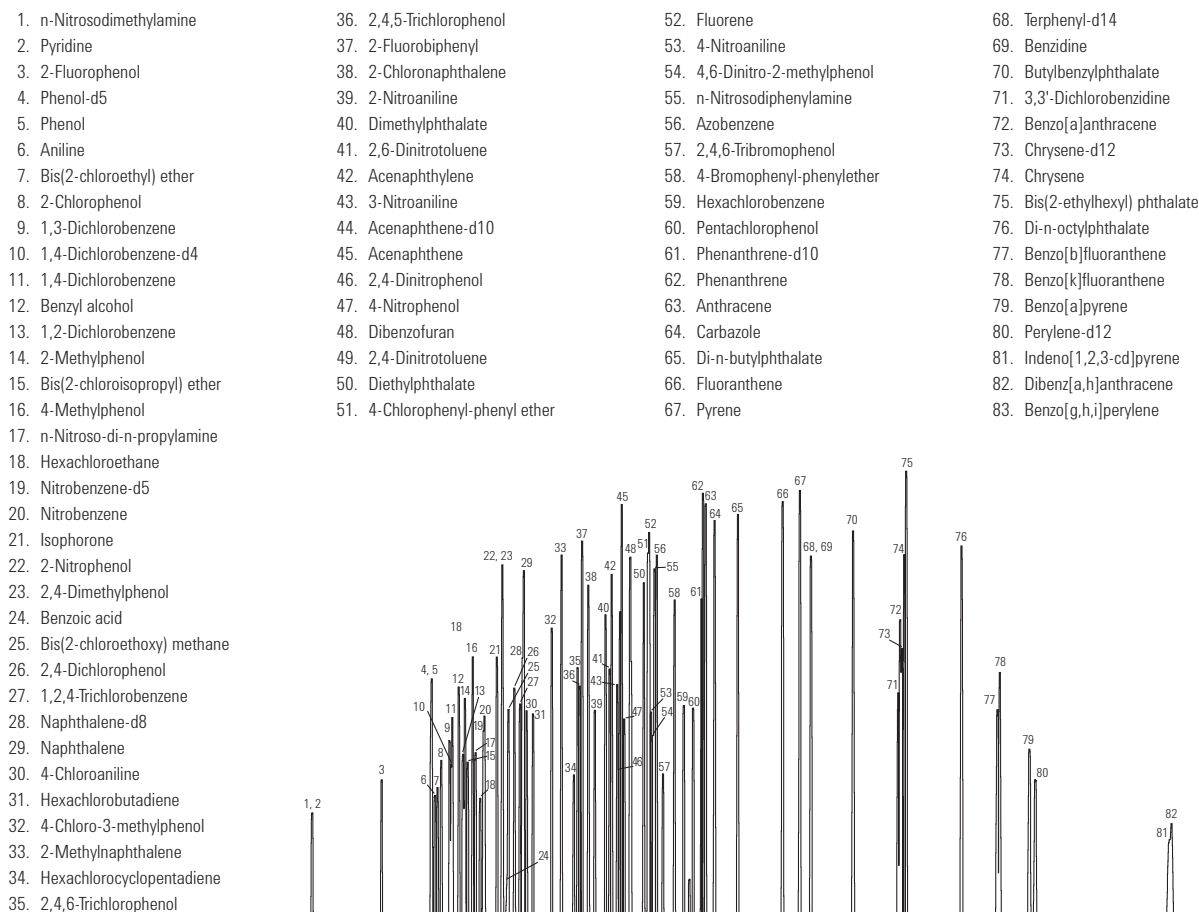
Sample: 1 μ L of 50 ng standard

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Syringe: 10 μ L tapered, FN 23-26s/42/HP, 5181-1267



GCE5015

A variety of Agilent HP-5ms and DB-5ms columns can be used for 8270 and similar semivolatiles applications. The column shown above was chosen to maximize inertness and robustness to residues with a thicker 0.5 μ m film, but the price paid is a slightly longer run time.

An HP-5ms, 30 m x 0.25 mm id, 0.25 μ m, P/N 19091S-433 would give shorter run times, with slightly less inertness and robustness.

A DB-5ms, 30 m x 0.25 mm id, 0.25 μ m, P/N 122-5532, would give slightly less inertness, but offer better resolution of PAHs such as Benzo[b]fluoranthene and Benzo[k]fluoranthene. A DB-5ms, 20 m x 0.18 mm x 0.18 μ m, P/N 121-5522, can offer significantly reduced run times with a modest loss of inertness.

EPA Method 8061 (Phthalate Esters)

Column: DB-5ms
121-5522
20 m x 0.18 mm, 0.18 µm

Carrier: Helium at 49 cm/sec, measured at 80 °C
constant flow program

Oven: 80 °C for 0.5 min
80-160 °C at 30 °C/min
160-320 °C at 15 °C/min

Injection: Splitless, 300 °C
30 sec purge activation time

Detector: MSD, 325 °C transfer line
Full scan m/z 50-400

Sample: 1 µL of 20 ng/µL
Method 8061 mixture (Accustandard) in hexane

Suggested Supplies

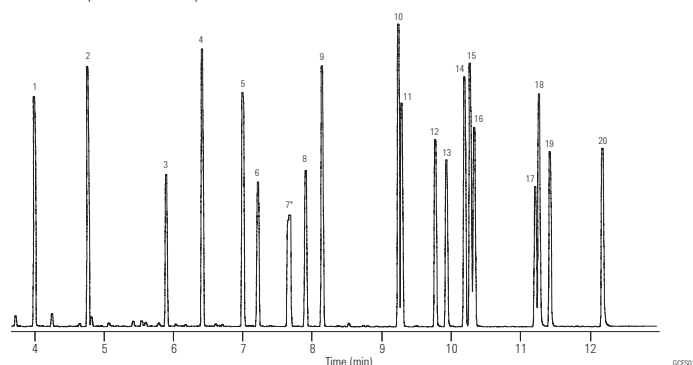
Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

- | | |
|---------------------------------------|------------------------------------|
| 1. Dimethyl phthalate | 11. Butyl benzyl phthalate |
| 2. Diethyl phthalate | 12. Hexyl 2-ethylhexyl phthalate |
| 3. Benzyl benzoate (IS) | 13. Bis(2-n-butoxyethyl) phthalate |
| 4. Diisobutyl phthalate | 14. Dicyclohexyl phthalate |
| 5. Di-n-butyl phthalate | 15. Bis(2-ethylhexyl) phthalate |
| 6. Bis(4-methoxyethyl) phthalate | 16. Diphenyl phthalate (SS) |
| 7. Bis(4-methyl-2-pentyl) phthalate * | 17. Diphenyl isophthalate (SS) |
| 8. Bis(2-ethoxyethyl) phthalate | 18. Di-n-octyl phthalate |
| 9. Diamyl phthalate | 19. Dibenzyl phthalate (SS) |
| 10. Dihexyl phthalate | 20. Dinonyl phthalate |

* Two isomers
IS - Internal Standard
SS - Surrogate Standard

**US EPA Method 8270 Short Mix**

Column: DB-5ms Ultra Inert
122-5532UI
30 m x 0.25 mm, 0.25 µm

Carrier: Helium constant flow 30 cm/s

Oven: 40 °C (1 min) to 100 °C (15 °C/min),
10 °C to 210 °C (1 min),
5 °C/min to 310 °C (8 min)

Injection: Split/splitless; 260 °C, 53.7 mL/min
total flow, purge flow 50 mL/min on
at 0.5 min, gas saver flow 80 mL/min
on at 3.0 min

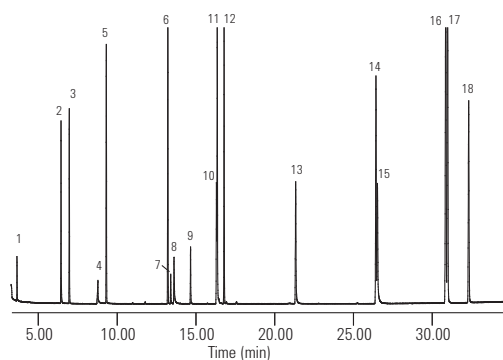
Detector: MSD source at 300 °C, quadrupole
at 180 °C, transfer line at 290 °C,
full scan m/z 50-550

Sample: 1.0 µL splitless injection,
5 ng each component on-column

Suggested Supplies

Liner: Direct connect, dual taper, deactivated, 4 mm id, G1544-80700

Syringe: Autosampler syringe, 0.5 µL, 23g, cone, 5188-5246



1. N-nitrosodimethylamine
2. Aniline
3. 1,4-dichlorobenzene-D4
4. 1,4-dichlorobenzene
5. Naphthalene-D8
6. Acenaphthene-D10
7. 2,4-dinitrophenol
8. 4-nitrophenol
9. 2-methyl-4,6-dinitrophenol
10. Pentachlorophenol
11. 4-aminobiphenyl
12. Phenanthrene-D10
13. Benzidine
14. Chrysene-D12
15. 3,3'-dichlorobenzidine
16. Benzo [b] fluoranthene
17. Benzo [k] fluoranthene
18. Perylene-D12

Semivolatile analysis using methods similar to US EPA Method 8270 is becoming increasingly important in environmental laboratories worldwide. Acidic compounds such as benzoic acid or 2,4-dinitrophenol – along with strong bases such as pyridine or benzidine – are examples of active species found in the semivolatile sample set. This DB-5ms Ultra Inert column demonstrates excellent inertness performance for these difficult analytes.

Phenols

Column: DB-5ms
122-5532
30 m x 0.25 mm, 0.25 μ m

Column: DB-XLB
122-1232
30 m x 0.25 mm, 0.25 μ m

Carrier: He at 1.2 mL/min Constant Flow

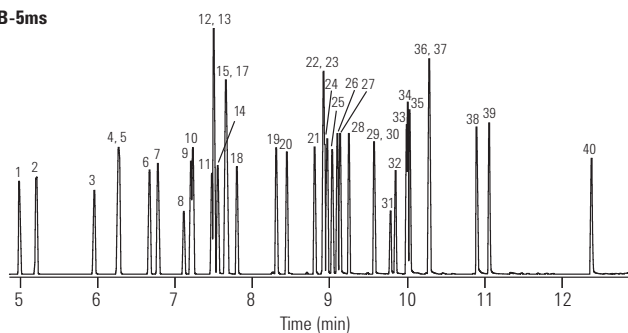
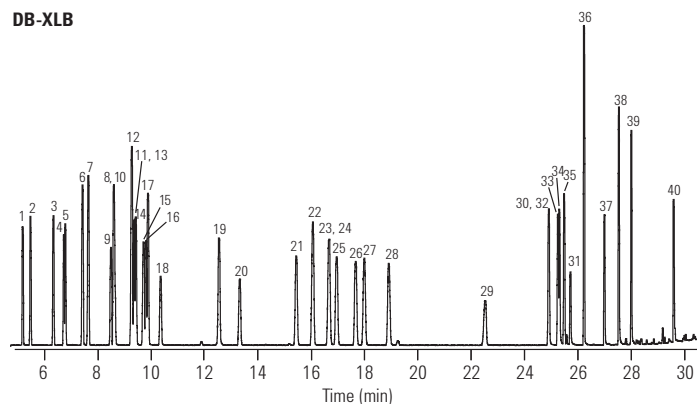
Oven: 40 °C for 2.00 min
40-100 °C at 40 °C/min
100 °C for 0.50 min
100-140 °C at 2 °C/min
140-340 °C at 30 °C/min

Injection: Pulsed Splitless, 200 °C
Pulse Pressure & Time: 25.0 psi for 1.00 min
Purge Flow & Time: 50.0 mL/min for 0.25 min
Gas Saver Flow & Time: 20.0 mL/min for 3.00 min

Detector: MSD, 320 °C Transfer Line
Quadrapole at 150 °C
Source at 230 °C

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730
Syringe: 10 μ L tapered, FN 23-26s/42/HP, 5181-1267

DB-5ms**DB-XLB**

1. Phenol
2. 2-Chlorophenol
3. 2-Methylphenol
4. 4-Methylphenol
5. 3-Methylphenol
6. 2-Chloro-5-methylphenol
7. 2,6-Dimethylphenol
8. 2-Nitrophenol
9. 2,4-Dimethylphenol
10. 2,5-Dimethylphenol
11. 2,4-Dichlorophenol
12. 2,3-Dimethylphenol
13. 2,5-Dichlorophenol
14. 2,3-Dichlorophenol
15. 2-Chlorophenol
16. 4-Chlorophenol
17. 3,4-Dimethylphenol
18. 2,6-Dichlorophenol
19. 4-Chloro-2-methylphenol
20. 4-Chloro-3-methylphenol
21. 2,3,5-Trichlorophenol
22. 2,4-Dibromophenol
23. 2,4,6-Trichlorophenol
24. 2,4,5-Trichlorophenol
25. 2,3,4-Trichlorophenol
26. 3,5-Dichlorophenol
27. 2,3,6-Trichlorophenol
28. 3,4-Dichlorophenol
29. 3-Nitrophenol
30. 2,5-Dinitrophenol
31. 2,4-Dinitrophenol
32. 4-Nitrophenol
33. 2,3,5,6-Tetrachlorophenol
34. 2,3,4,5-Tetrachlorophenol
35. 2,3,4,6-Tetrachlorophenol
36. 3,4,5-Trichlorophenol
37. 2-Methyl-4,6-dinitrophenol
38. Pentachlorophenol
39. Dinoseb
40. 2-Cyclohexyl-4,6-dinitrophenol

GCE3019

PAHs

Column: DB-17ms
122-4732
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at: 34.1 cm/sec, measured at 150 °C

Oven: 95 °C for 0.5 min
95-340 °C at 5 °C/min
340 °C for 5 min

Injection: Split, 300 °C
Split ratio 1:40

Detector: MSD, 340 °C transfer line
Scan 80-330 amu

Sample: 2 µL, PAH standard

Suggested Supplies

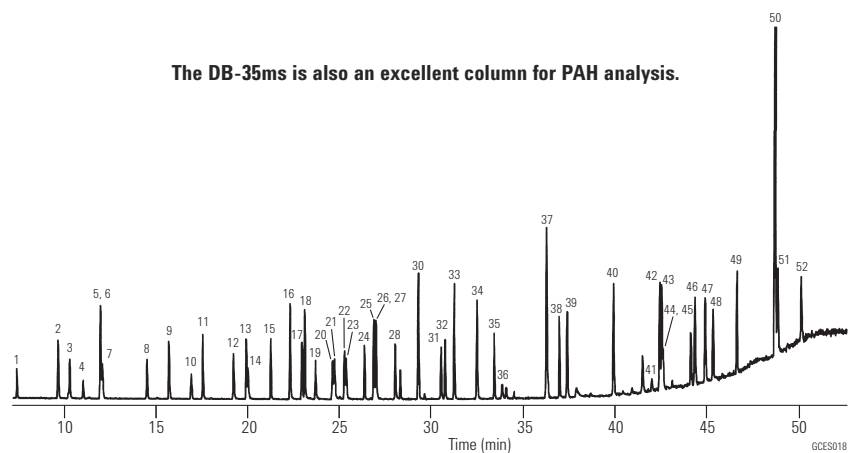
Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Ions		Ions	
1. Naphthalene	128	27. 3,6-Dimethylphenanthrene	206, 191
2. 2-Methylnaphthalene	142, 141	28. 1,3-Dinitronaphthalene	126, 218
3. 1-Methylnaphthalene	142, 141	29. 1,5-Dinitronaphthalene	218, 114
4. Azulene	128	30. Fluoranthene	202
5. Acenaphthene	154	31. 2,2'-Dinitrobiphenyl	198, 139
6. Biphenyl	154	32. Pyrene	202
7. 2,6-Dimethylnaphthalene	156, 155	33. 2-Methylfluoranthene	216, 215
8. Acenaphthalene	152	34. 2,3-Benzofluorene	216, 215
9. Dibenzofuran	168, 139	35. Dodecahydrotriphenylene	240, 198
10. Dibenzo-p-dioxin	184	36. 1-Amino-4-nitronaphthalene	188, 115
11. Fluorene	166, 165	37. 9-Phenylanthracene	254, 253
12. 1-Nitronaphthalene	127, 173	38. 1,2-Benzanthracene	228
13. 9,10-Dihydroanthracene	179, 180	39. Chrysene	240
14. 2-Nitronaphthalene	127, 173	40. Benz[a]anthracene-7,12-dione	258, 202
15. 2-Nitrobiphenyl	152, 115	41. 2,7-Dinitrofluorene	256, 163
16. Dibenzothiophene	184	42. Benzo[b]fluoranthene	252
17. Phenanthrene	178	43. Benzo[k]fluoranthene	252
18. Anthracene	178	44. 7,12-Dimethylbenz[a]anthracene	256, 241
19. 3-Nitrobiphenyl	199, 152	45. Benzo[e]pyrene	252
20. 4-Nitrobiphenyl	199, 152	46. Benzo[a]pyrene	252
21. 5,6-Benzoquinoline	179	47. Perylene	252
22. Carbazole	167	48. 3-Methylcholanthrene	268
23. 2-Methylanthracene	192, 191	49. 9,10-Diphenylanthracene	330
24. 1,2,3,4-Tetrahydrofluoranthene	178, 206	50. 1,2,3,4-Dibenzanthracene	278
25. 2-Phenylnaphthalene	204	51. 1,2,5,6-Dibenzanthracene	278
26. 9-Methylanthracene	192, 191	52. Benzo[g,h,i]perylene	276

The DB-35ms is also an excellent column for PAH analysis.



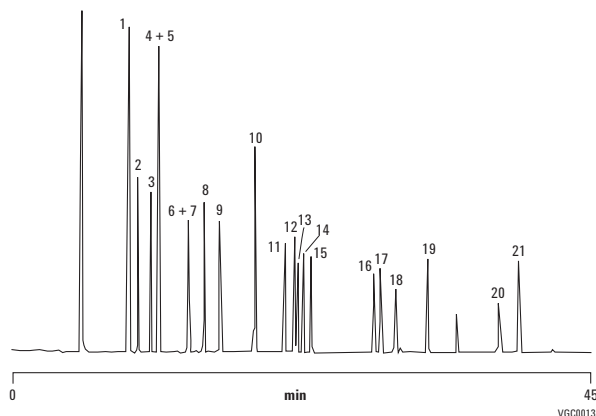
High Resolution Phenol Analysis by GC/MS**Column:** VF-5ms, CP8944, 30 m x 0.25 mm, 0.25 μ m

Sample Conc: Approx. 5-10 ng per component on-column

Carrier: Helium, 70 kPa

Injection: Split, 1:200, T=275 °C

Detector: Ion Trap MS



1. Phenol
2. 2-Chlorophenol
3. o-Cresol
4. m-Cresol
5. p-Cresol
6. 2-Nitrophenol
7. 2,4-Dimethylphenol
8. 2,4-Dichlorophenol
9. 2,6-Dichlorophenol
10. 4-Chloro-3-methylphenol
11. 2,3,5-Trichlorophenol
12. 2,4,6-Trichlorophenol
13. 2,4,5-Trichlorophenol
14. 2,3,4-Trichlorophenol
15. 2,3,6-Trichlorophenol
16. 4-Nitrophenol
17. 2,4-Dinitrophenol
18. 2,3,5,6-Tetrachlorophenol
19. 2-Methyl-4,6-dinitrophenol
20. Pentachlorophenol
21. 2-Se-butyl-4,6-dinitrophenol

Phenols According to EPA Method 8040**Column:** CP-Sil 8 CB
CP7454
50 m x 0.32 mm, 0.25 μ m

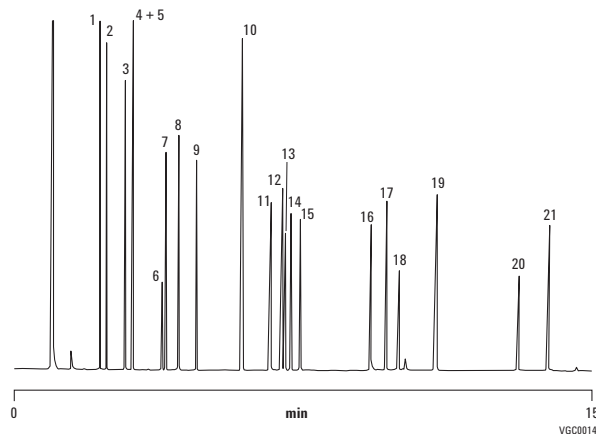
Sample Conc: 1 ppm

Oven: 80 °C to 200 °C, 8 °C/min

Carrier: H₂, 150 kPa (1.5 bar, 21 psi)

Injection: Split, 100 mL/min

Detector: FID



1. Phenol
2. 2-Chlorophenol
3. o-Cresol
4. m-Cresol
5. p-Cresol
6. 2-Nitrophenol
7. 2,4-Dimethylphenol
8. 2,4-Dichlorophenol
9. 2,6-Dichlorophenol
10. 4-Chloro-3-methylphenol
11. 2,3,5-Trichlorophenol
12. 2,4,6-Trichlorophenol
13. 2,4,5-Trichlorophenol
14. 2,3,4-Trichlorophenol
15. 2,3,6-Trichlorophenol
16. 4-Nitrophenol
17. 2,4-Dinitrophenol
18. 2,3,5,6-Tetrachlorophenol
19. 2-Methyl-4,6-dinitrophenol
20. Pentachlorophenol
21. 2-Sec-butyl-4,-dinitrophenol (Dinoseb)

EPA Method 552.2

Column: DB-35ms
123-3832
30 m x 0.32 mm, 0.25 µm

Column: DB-XLB
123-1236
30 m x 0.32 mm, 0.50 µm

Carrier: Helium at 45 cm/sec
(EPC in constant flow mode)

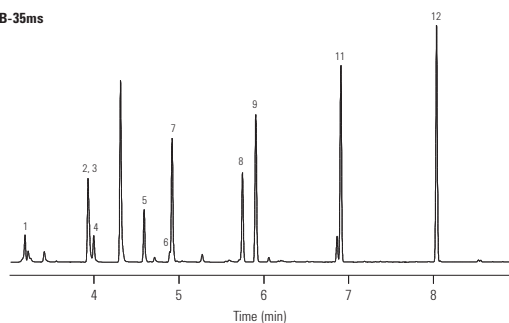
Oven: 40 °C for 0.5 min
40-200 °C at 15 °C/min
200 °C for 2 min

Injection: Splitless, 250 °C
30 sec purge activation time

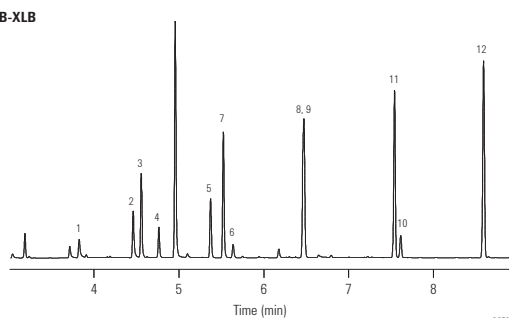
Detector: µECD, 350 °C
Nitrogen makeup gas
(column + makeup flow = 30 mL/min constant flow)

Sample: 50 pg per component

DB-35ms



DB-XLB



1. Chloroacetic acid
 2. Bromoacetic acid
 3. Dichloroacetic acid
 4. Dalapon
 5. Trichloroacetic acid
 6. 1,2,3-Trichloropropane (IS)
 7. Bromochloroacetic acid
 8. Bromodichloroacetic acid
 9. Dibromoacetic acid
 10. 2,3-Dibromopropionic acid (SS)
 11. Chlorodibromoacetic acid
 12. Tribromoacetic acid
- IS - Internal Standard
SS - Surrogate Standard

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, dual taper, deactivated, 4 mm id,
G1544-80700

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Environmental Applications, Volatiles

Extended Analyte List for EPA Method 8021

Column: DB-624
124-1374
75 m x 0.45 mm, 2.55 µm

Column: DB-VRX
124-1574
75 m x 0.45 mm, 2.55 µm

Carrier: Helium at 9 mL/min, measured at 35 °C

Oven: 35 °C for 12 min
35-60 °C at 5 °C/min
60 °C for 1 min
60-200 °C at 17 °C/min
200 °C for 5 min

Sampler: Purge and Trap (O.I.A. 4560)
Trap: Vocarb 3000
Preheat: 175 °C
Desorb: 260 °C for 1 min

Injection: J&W LVI (Low Volume Injector), 150 °C

Detector: A: PID (O.I.A. 4430), 200 °C Helium makeup gas at 20 mL/min
B: ELCD (O.I.A. 4420), with NiCat reaction tube in the halogen mode, 950 °C reactor temperature

Sample: 20 ppb per component in 5 mL water

Suggested Supplies

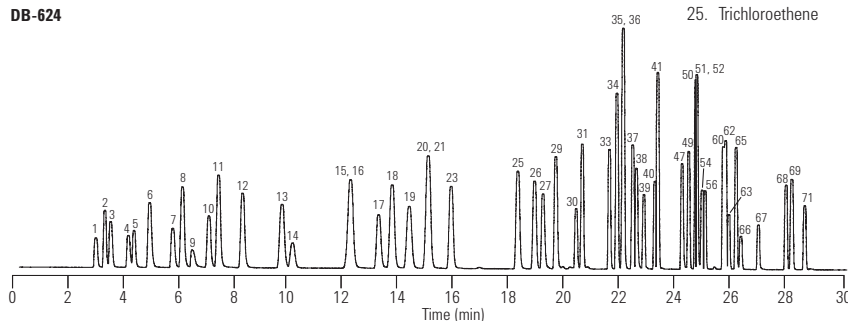
Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

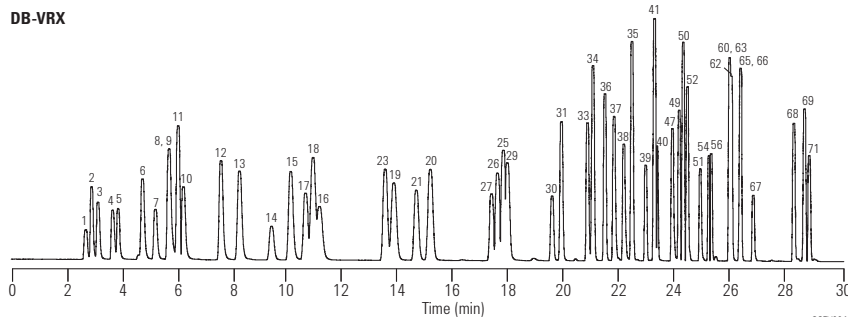
Septum: 11 mm Advanced Green septa, 5183-4759

- | | |
|------------------------------|-----------------------------------|
| 1. Dichlorodifluoromethane | 26. 1,2-Dichloropropane |
| 2. Chloromethane | 27. Dibromomethane |
| 3. Vinyl chloride | 28. Trifluorotoluene (IS) |
| 4. Bromomethane | 29. Bromodichloromethane |
| 5. Chloroethane | 30. 2-Chloroethyl vinyl ether |
| 6. Trichlorofluoromethane | 31. cis-1,3-Dichloropropene |
| 7. 2-Chloropropane (IS) | 32. Toluene |
| 8. 1,1-Dichloroethene | 33. trans-1,3-Dichloropropene |
| 9. Iodomethane | 34. 1,1,2-Trichloroethane |
| 10. Allyl chloride | 35. Tetrachloroethene |
| 11. Methylene chloride | 36. 1,3-Dichloropropane |
| 12. trans-1,2-Dichloroethene | 37. Dibromochloromethane |
| 13. 1,1-Dichloroethane | 38. 1,2-Dibromoethane |
| 14. Chloroprene | 39. 1-Chloro-3-fluorobenzene (IS) |
| 15. cis-1,2-Dichloroethene | 40. Chlorobenzene |
| 16. 2,2-Dichloropropane | 41. 1,1,1,2-Tetrachloroethane |
| 17. Bromochloromethane | 42. Ethylbenzene |
| 18. Chloroform | 43. m-Xylene |
| 19. 1,1,1-Trichloroethane | 44. p-Xylene |
| 20. Carbon tetrachloride | 45. Styrene |
| 21. 1,1-Dichloropropene | 46. o-Xylene |
| 22. Benzene | 47. Bromoform |
| 23. 1,2-Dichloroethane | 48. Isopropylbenzene |
| 24. Fluorobenzene (IS) | 49. cis-1,4-Dichlorobutene |
| 25. Trichloroethene | 50. 1,1,2,2-Tetrachloroethane |
| | 51. Bromobenzene |
| | 52. 1,2,3-Trichloropropane |
| | 53. n-Propylbenzene |
| | 54. 2-Chlorotoluene |
| | 55. 1,3,5-Trimethylbenzene |
| | 56. 4-Chlorotoluene |
| | 57. tert-Butylbenzene |
| | 58. 1,2,4-Trimethylbenzene |
| | 59. sec-Butylbenzene |
| | 60. 1,3-Dichlorobenzene |
| | 61. p-Isopropyltoluene |
| | 62. 1,4-Dichlorobenzene |
| | 63. Benzyl chloride |
| | 64. n-Butylbenzene |
| | 65. 1,2-Dichlorobenzene |
| | 66. Bis(2-chloroisopropyl) ether |
| | 67. 1,2-Dibromo-3-chloropropane |
| | 68. 1,2,4-Trichlorobenzene |
| | 69. Hexachlorobutadiene |
| | 70. Naphthalene |
| | 71. 1,2,3-Trichlorobenzene |

DB-624



DB-VRX



GCEV004

Fast VOC Analysis

Column: DB-624
121-1324
20 m x 0.18 mm, 1.00 µm

Carrier: Helium at 37 cm/sec, (constant flow mode)

Oven: 35 °C for 4 min
35-200 °C at 15 °C/min
200 °C for 0.1 min
60-200 °C at 17 °C/min

Sampler: Purge and trap (Tekmar LSC 3000)
Purge: Helium for 11 min at 50 mL/min
Preheat: 250 °C
Desorb: 260 °C for 2 min
Line & valve: 100 °C

Detector: MSD, 250 °C transfer line
Full scan 35 -260 amu
3.25 scans per second

Sample: 10 ppb per component in 25 mL water

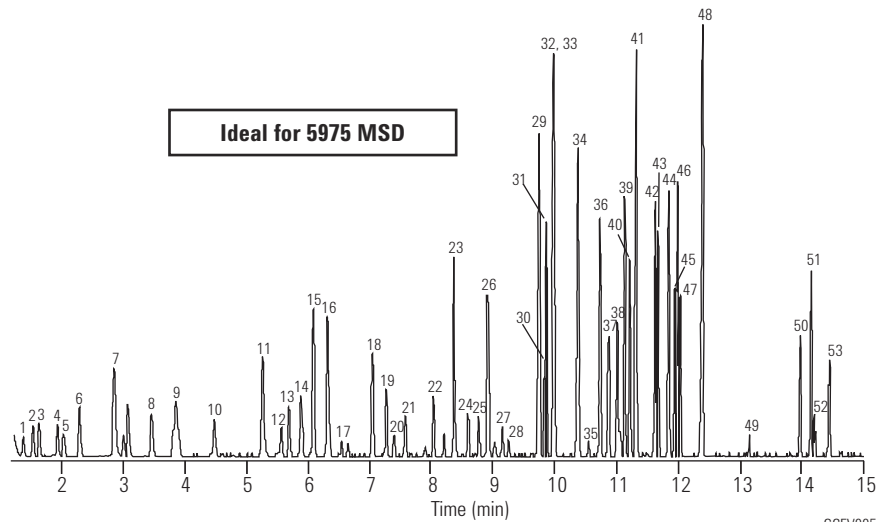
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

- | | |
|-----------------------------|---------------------------------|
| 1. Dichlorofluoromethane | 21. Bromodichloromethane |
| 2. Chloromethane | 22. cis-1,3-Dichloropropene |
| 3. Vinyl chloride | 23. Toluene |
| 4. Bromomethane | 24. trans-1,3-Dichloropropene |
| 5. Chloroethane | 25. 1,1,2-Trichloroethane |
| 6. Trichlorofluoromethane | 26. Tetrachloroethene |
| 7. 1,1-Dichloroethene | 27. Dibromochloromethane |
| 8. Methylene chloride | 28. 1,2-Dibromomethane |
| 9. trans-1,2-Dichloroethene | 29. Chlorobenzene |
| 10. 1,1-Dichloroethane | 30. 1,1,1,2-Tetrachloroethane |
| 11. 2,2-Dichloropropane | 31. Ethylbenzene |
| 12. Bromochloromethane | 32. m-Xylene |
| 13. Chloroform | 33. p-Xylene |
| 14. 1,1,1-Trichloroethane | 34. o-Xylene |
| 15. Carbon tetrachloride | 35. Bromoform |
| 16. Benzene | 36. Isopropylbenzene |
| 17. Fluorobenzene | 37. Bromofluorobenzene |
| 18. Trichloroethene | 38. Bromobenzene |
| 19. 1,2-Dichloropropane | 39. n-Propylbenzene |
| 20. Dibromomethane | 40. 2-Chlorotoluene |
| | 41. 1,3,5-Trimethylbenzene |
| | 42. tert-Butylbenzene |
| | 43. 1,2,4-Trimethylbenzene |
| | 44. sec-Butylbenzene |
| | 45. 1,3-Dichlorobenzene |
| | 46. 4-Isopropyltoluene |
| | 47. 1,4-Dichlorobenzene |
| | 48. 1,2-Dichlorobenzene |
| | 49. 1,2-Dibromo-3-chloropropane |
| | 50. 1,2,4-Trichlorobenzene |
| | 51. Hexachlorobutadiene |
| | 52. Naphthalene |
| | 53. 1,2,3-Trichlorobenzene |



EPA Method 551

Column: DB-1
122-1033
30 m x 0.25 mm, 1.00 µm

Carrier: Helium at 24.8 cm/sec, measured at 150 °C

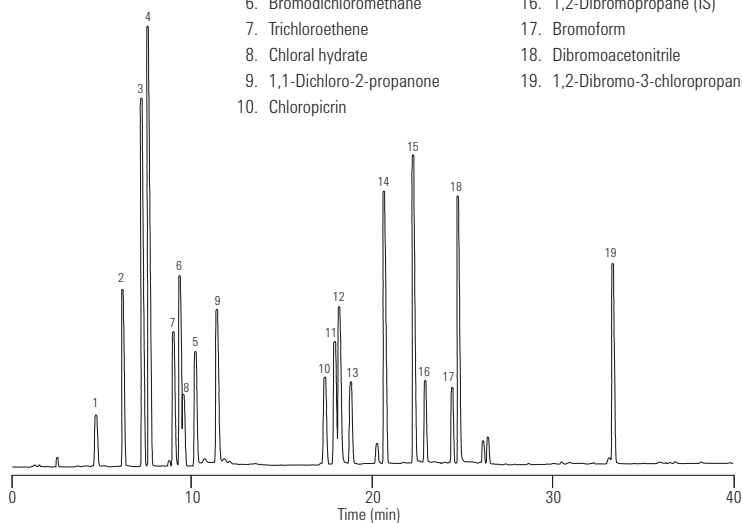
Oven: 35 °C for 9 min
35-40 °C at 10 °C/min
40 °C for 3 min
40-150 °C at 6 °C/min
150 °C for 1 min

Injection: Splitless, 200 °C
15 sec purge activation time

Detector: ECD, 300 °C

Sample: 1 µL of 50 pg/µL, AccuStandard

- | | |
|-----------------------------|---------------------------------|
| 1. Chloroform | 11. Dibromochloromethane |
| 2. 1,1,1-Trichloroethane | 12. Bromochloroacetonitrile |
| 3. Carbon tetrachloride | 13. 1,2-Dibromoethane |
| 4. Trichloroacetonitrile | 14. Tetrachloroethene |
| 5. Dichloroacetonitrile | 15. 1,1,1-Trichloropropanone |
| 6. Bromodichloromethane | 16. 1,2-Dibromopropane (IS) |
| 7. Trichloroethene | 17. Bromoform |
| 8. Chloral hydrate | 18. Dibromoacetonitrile |
| 9. 1,1-Dichloro-2-propanone | 19. 1,2-Dibromo-3-chloropropane |
| 10. Chloropicrin | |



GCEV008

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

European Red List Volatiles

Column: DB-5.625
122-5632
30 m x 0.25 mm, 0.50 µm

Column: DB-624
122-1334
30 m x 0.25 mm, 1.40 µm

Carrier: Helium at 35 cm/sec, measured at 40 °C

Oven: 40 °C for 2 min
40-140 °C at 12 °C/min

Injection: Split, 250 °C
Split ratio 1:50

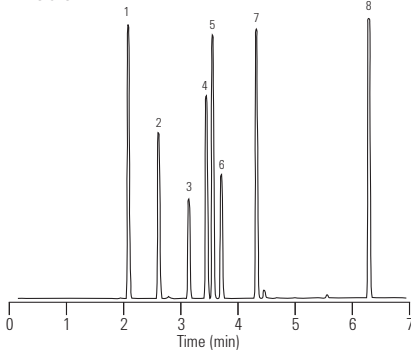
Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL of headspace of neat mixture

Suggested Supplies

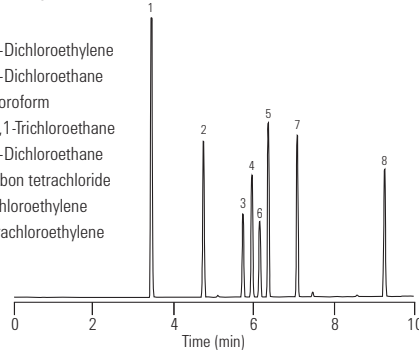
Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct, 1.5 mm id, 18740-80200
Seal: Gold plated seal, 18740-20885

DB-5.625



DB-624

- | |
|--------------------------|
| 1. 1,1-Dichloroethylene |
| 2. 1,1-Dichloroethane |
| 3. Chloroform |
| 4. 1,1,1-Trichloroethane |
| 5. 1,2-Dichloroethane |
| 6. Carbon tetrachloride |
| 7. Trichloroethylene |
| 8. Tetrachloroethylene |



GCEV010

EPA Volatiles by GC/MS (Split Injector)

Column: DB-VRX
122-1564
60 m x 0.25 mm, 1.40 µm

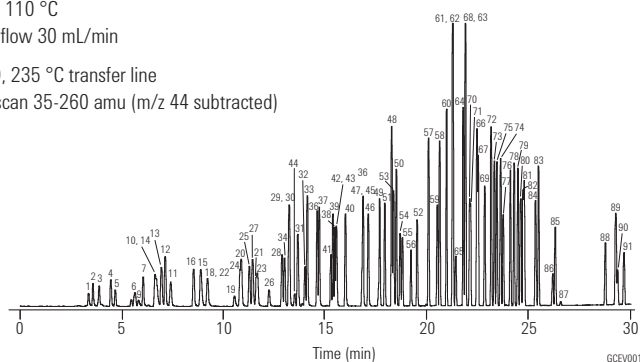
Carrier: Helium at 30 cm/sec, measured at 45 °C

Oven: 45 °C for 10 min
45-190 °C at 12 °C/min
190 °C for 2 min
190-225 °C at 6 °C/min
225 °C for 1 min

Sampler: Purge and trap (O.I.A. 4560)
Purge: Helium for 11 min at 40 mL/min
Trap: Tenax/Silica Gel/Carbosieve
Preheat: 175 °C
Desorb: 220 °C for 0.6 min

Injection: Split, 110 °C
Split flow 30 mL/min

Detector: MSD, 235 °C transfer line
Full scan 35-260 amu (m/z 44 subtracted)



GCEV001

Column: DB-624
122-1364
60 m x 0.25 mm, 1.40 µm

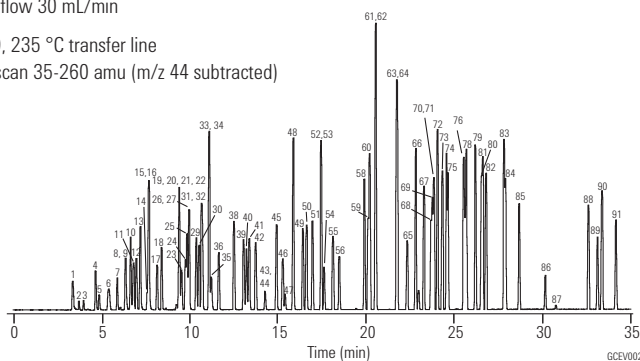
Carrier: Helium at 31 cm/sec, measured at 40 °C

Oven: 45 °C for 3 min
45-90 °C at 8 °C/min
90 °C for 4 min
90-200 °C at 6 °C/min
200 °C for 5 min

Sampler: Purge and trap (O.I.A. 4560)
Purge: Helium for 11 min at 40 mL/min
Trap: Tenax/Silica Gel/Carbosieve
Preheat: 175 °C
Desorb: 220 °C for 0.6 min

Injection: Split, 110 °C
Split flow 30 mL/min

Detector: MSD, 235 °C transfer line
Full scan 35-260 amu (m/z 44 subtracted)



GCEV002

- | | | | | |
|------------------------------|------------------------------|-----------------------------------|---------------------------------|---------------------------------|
| 1. Dichlorodifluoromethane | 21. 2,2-Dichloropropane | 41. Dibromomethane | 61. m-Xylene | 81. p-Isopropyltoluene |
| 2. Chloromethane | 22. Propionitrile | 42. Bromodichloromethane | 62. p-Xylene | 82. 1,4-Dichlorobenzene |
| 3. Vinyl chloride | 23. Methyl acrylate | 43. 2-Nitropropane | 63. o-Xylene | 83. n-Butylbenzene |
| 4. Bromomethane | 24. Methacrylonitrile | 44. Chloroacetonitrile | 64. Styrene | 84. 1,2-Dichlorobenzene |
| 5. Chloroethane | 25. Bromochloromethane | 45. cis-1,3-Dichloropropene | 65. Bromoform | 85. Hexachloroethane |
| 6. Trichlorofluoromethane | 26. Tetrahydrofuran | 46. 4-Methyl-2-pentanone | 66. Isopropylbenzene | 86. 1,2-Dibromo-3-chloropropane |
| 7. Diethyl ether | 27. Chloroform | 47. 1,1-Dichloro-2-propanone | 67. 4-Bromofluorobenzene (SS) | 87. Nitrobenzene |
| 8. 1,1-Dichloroethene | 28. Pentafluorobenzene (IS) | 48. Toluene | 68. 1,1,2,2-Tetrachloroethane | 88. 1,2,4-Trichlorobenzene |
| 9. Acetone | 29. 1,1,1-Trichloroethane | 49. trans-1,3-Dichloropropene | 69. Bromobenzene | 89. Hexachlorobutadiene |
| 10. Iodomethane | 30. 1-Chlorobutane | 50. Ethyl methacrylate | 70. 1,2,3-Trichloropropane | 90. Naphthalene |
| 11. Carbon disulfide | 31. 1,1-Dichloropropene | 51. 1,1,2-Trichloroethane | 71. trans-1,4-Dichloro-2-butene | 91. 1,2,3-Trichlorobenzene |
| 12. Allyl chloride | 32. Carbon tetrachloride | 52. Tetrachloroethene | 72. n-Propylbenzene | |
| 13. Methylene chloride | 33. Benzene | 53. 1,3-Dichloropropane | 73. 2-Chlorotoluene | |
| 14. Acrylonitrile | 34. 1,2-Dichloroethane | 54. 2-Hexanone | 74. 1,3,5-Trimethylbenzene | |
| 15. Methyl-tert-butyl ether | 35. 2,2-Dimethylhexane | 55. Dibromochloromethane | 75. 4-Chlorotoluene | |
| 16. trans-1,2-Dichloroethene | 36. Fluorobenzene (IS) | 56. 1,2-Dibromoethane | 76. tert-Butylbenzene | |
| 17. Hexane | 37. 1,4-Difluorobenzene (IS) | 57. 1-Chloro-3-fluorobenzene (IS) | 77. Pentachloroethane | |
| 18. 1,1-Dichloroethane | 38. Trichloroethene | 58. Chlorobenzene | 78. 1,2,4-Trimethylbenzene | |
| 19. 2-Butanone | 39. 1,2-Dichloropropane | 59. 1,1,1,2-Tetrachloroethane | 79. sec-Butylbenzene | |
| 20. cis-1,2-Dichloroethene | 40. Methyl methacrylate | 60. Ethylbenzene | 80. 1,3-Dichlorobenzene | |

IS - Internal Standard
SS - Surrogate Standard
Note: Some compounds not present in both chromatograms

High Speed VOC, EPA Method 8260

Column: DB-VRX
121-1524
20 m x 0.18 mm, 1.00 µm

Carrier: Helium at 55 cm/sec (1.5 mL/min)

Oven: 45 °C for 3.0 min
45-190 °C at 36 °C/min
190-225 °C at 20 °C/min
225 °C for 0.5 min

Sampler: Purge and trap (Tekmar 3100)
Purge: 11 min
Trap: Vocarb 3000
Preheat: 245 °C
Desorb: 250 °C for 1 min
Bake: 260 °C for 10 min
Line & valve: 100 °C

Injection: Split, 150 °C
Split ratio 60:1

Detector: Agilent 5975 MSD,
Scan range: 35-260 amu
Scan rate: 3.25 scans/sec
Quad temperature: 150 °C
Source temperature: 200 °C
Transfer line temp: 200 °C

Sample: 5 mL

- Halogenated and aromatic analytes at 40 ppb
- Internal standards at 20 ppb
- Polar analytes (i.e., ethers, alcohols and ketones at 100-800 ppb)

Suggested Supplies

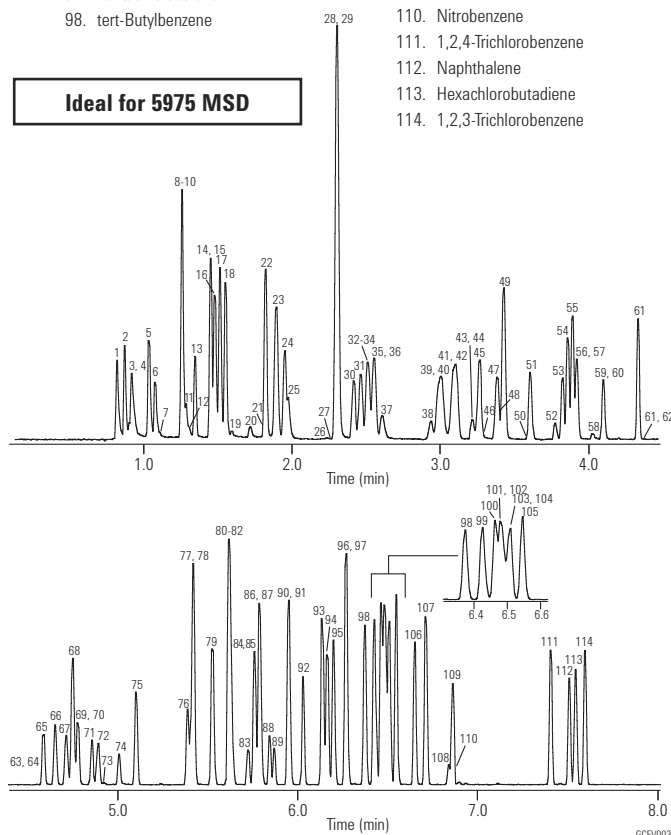
Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

- | | |
|-------------------------------|-------------------------------|
| 1. Dichlorodifluoromethane | 44. 2-Chloroethanol |
| 2. Chloromethane | 45. 1,1-Dichloropropene |
| 3. Hydroxypropionitrile | 46. 1-Butanol |
| 4. Vinyl chloride | 47. Carbon tetrachloride |
| 5. Bromomethane | 48. Chloroacetonitrile |
| 6. Chloroethane | 49. Benzene |
| 7. Ethanol | 50. tert-Amylmethyl ether |
| 8. Acetonitrile | 51. Fluorobenzene (IS) |
| 9. Acrolein | 52. 2-Pentanone |
| 10. Trichlorofluoromethane | 53. Dibromomethane |
| 11. Isopropyl alcohol | 54. 1,2-Dichloropropene |
| 12. Acetone | 55. Trichloroethene |
| 13. Ethyl ether | 56. Bromodichloromethane |
| 14. 1,1-Dichloroethene | 57. 2-Nitropropane |
| 15. tert-Butyl alcohol | 58. 1,4-Dioxane |
| 16. Acrylonitrile | 59. Epichlorohydrin |
| 17. Methylene chloride | 60. Methyl methacrylate |
| 18. Allyl chloride | 61. cis-1,3-Dichloropropene |
| 19. Allyl alcohol | 62. Propiolactone |
| 20. 1-Propanol | 63. Bromoacetone |
| 21. Propargyl alcohol | 64. Pyridine |
| 22. trans-1,2-Dichloroethene | 65. trans-1,3-Dichloropropene |
| 23. MTBE | 66. 1,1,2-Trichloroethane |
| 24. 1,1-Dichloroethane | 67. Toluene-d8 (IS) |
| 25. Propionitrile | 68. Toluene |
| 26. 2-Butanone | 69. 1,3-Dichloropropane |
| 27. Diisopropyl ether | 70. Paraldehyde |
| 28. cis-1,2-Dichloroethene | 71. Ethyl methacrylate |
| 29. Methacrylonitrile | 72. Dibromochloromethane |
| 30. Bromochloromethane | 73. 3-Chloropropionitrile |
| 31. Chloroform | 74. 1,2-Dibromoethane |
| 32. 2,2-Dichloropropane | 75. Tetrachloroethene |
| 33. Ethyl acetate | 76. 1,1,1,2-Tetrachloroethane |
| 34. Ethyl-tert-butyl ether | 77. 1-Chlorohexane |
| 35. Methyl acrylate | 78. Chlorobenzene |
| 36. Dibromofluoromethane (IS) | 79. Ethylbenzene |
| 37. Isobutanol | 80. Bromoform |
| 38. Dichloroethane-d4 (IS) | 81. m-Xylene |
| 39. Pentafluorobenzene | 82. p-Xylene |
| 40. 1,2-Dichloroethane | 83. trans-Dichlorobutene |
| 41. 1,1,1-Trichloroethane | 84. 1,3-Dichloro-2-propanol |
| 42. 1-Chlorobutane | 85. Styrene |
| 43. Crotonaldehyde | 86. 1,1,2,2-Tetrachloroethane |

- | | |
|-------------------------------|----------------------------------|
| 87. o-Xylene | 99. 1,2,4-Trimethylbenzene |
| 88. 1,2,3-Trichloropropane | 100. sec-Butylbenzene |
| 89. cis-Dichlorobutene | 101. 1,3-Dichlorobenzene |
| 90. 4-Bromofluorobenzene (IS) | 102. Benzylchloride |
| 91. Isopropylbenzene | 103. 1,4-Dichlorobenzene-d4 (IS) |
| 92. Bromobenzene | 104. 1,4-Dichlorobenzene |
| 93. Propylbenzene | 105. Isopropyltoluene |
| 94. 2-Chlorotoluene | 106. 1,2-Dichlorobenzene |
| 95. 4-Chlorotoluene | 107. Butylbenzene |
| 96. 1,3,5-Trimethylbenzene | 108. 1,2-Dibromo-3-chloropropane |
| 97. Pentachloroethane | 109. Hexachloroethane |
| 98. tert-Butylbenzene | 110. Nitrobenzene |
| | 111. 1,2,4-Trichlorobenzene |
| | 112. Naphthalene |
| | 113. Hexachlorobutadiene |
| | 114. 1,2,3-Trichlorobenzene |



Environmental Applications, Air Analysis

EPA Air Analysis Compendium Method TO-14 Standard

Column: DB-1
123-1063
60 m x 0.32 mm, 1.00 µm

Carrier: Helium at 25 cm/sec measured off of CO₂
at 35 °C constant flow mode

Oven: 35 °C for 5 min
35-120 °C at 5 °C/min
120-220 °C at 30 °C/min
220 °C for 5 min

Injection: Entech 7100 cryogenic sample preconcentrator

Detector: MSD
Full scan of m/z 40-250

Sample: 400 mL of a 10 ppbV TO-14 standard
and 100 mL of a 20 ppbV IS/SS standard

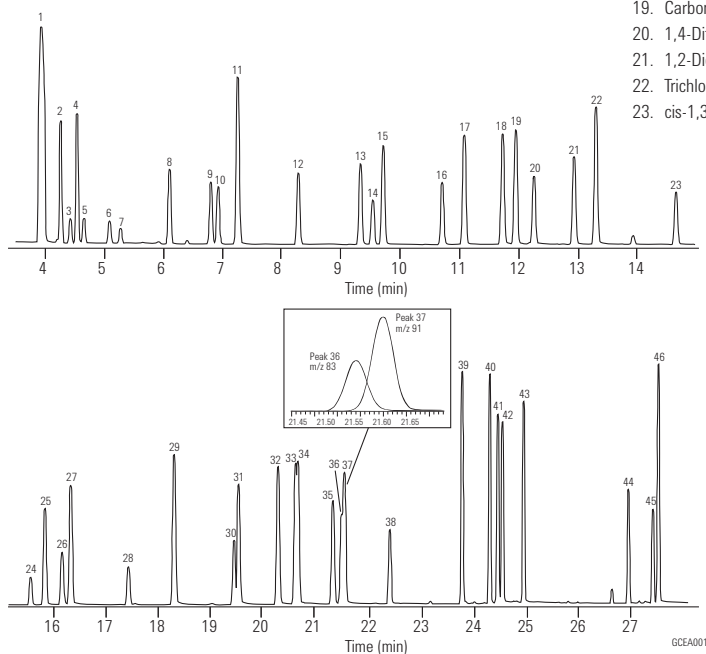
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

- | | |
|---|-------------------------------|
| 1. CO ₂ | 24. trans-1,3-Dichloropropene |
| 2. Freon 12 (Dichlorodifluoromethane) | 25. 1,1,2-Trichloroethane |
| 3. Chloromethane | 26. Toluene-d8 (SS) |
| 4. Freon 114 (1,2-Dichloro-1,1,2,2-tetrafluoroethane) | 27. Toluene |
| 5. Vinyl chloride | 28. 1,2-Dibromoethane |
| 6. Bromomethane | 29. Tetrachloroethene |
| 7. Chloroethane | 30. Chlorobenzene-d5 (SS) |
| 8. Freon 11 (Trichlorofluoromethane) | 31. Chlorobenzene |
| 9. 1,1-Dichloroethene | 32. Ethylbenzene |
| 10. Methylene chloride | 33. m-Xylene |
| 11. Freon 113 (1,1,2-Trichloro-1,2,2-trifluoroethane) | 34. p-Xylene |
| 12. 1,1-Dichloroethane | 35. Styrene |
| 13. cis-1,2-Dichloroethene | 36. 1,1,2,2-Tetrachloroethane |
| 14. Bromochloromethane (IS) | 37. o-Xylene |
| 15. Chloroform | 38. 4-Bromofluorobenzene (SS) |
| 16. 1,2-Dichloroethane | 39. 1,3,5-Trimethylbenzene |
| 17. 1,1,1-Trichloroethane | 40. 1,2,4-Trimethylbenzene |
| 18. Benzene | 41. 1,3-Dichlorobenzene |
| 19. Carbon tetrachloride | 42. 1,2-Dichlorobenzene |
| 20. 1,4-Difluorobenzene (IS) | 43. 1,4-Dichlorobenzene |
| 21. 1,2-Dichloropropane | 44. 1,2,4-Trichlorobenzene |
| 22. Trichloroethene | 45. 1,2-Dibromobenzene (IS) |
| 23. cis-1,3-Dichloropropene | 46. Hexachloro-1,3-butadiene |



Agilent wishes to thank Entech Instruments for providing this chromatogram.

Formaldehyde, 50ppb

Column: DB-5ms
123-5563
60 m x 0.32 mm, 1.00 µm

Carrier: Helium, 1.5 mL/min

Oven: 35 °C for 5 min
35-85 °C at 10 °C/min

Sampler: Entech 7100 cryogenic sample preconcentrator

Detector: GC/MS 6890/5973N
Scan 29-180 amu 0-6 min
33-280 amu 6-30 min
Electron Impact 70 eV

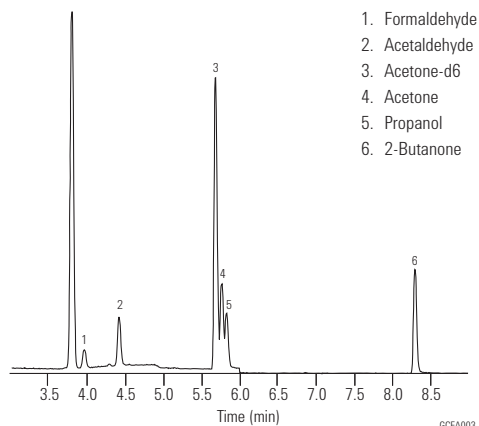
Sample: 100 cc 50 ppb Formaldehyde/20 ppb others

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



Agilent wishes to thank Entech Instruments for providing this chromatogram.

Sulfur in Air

Column: DB-5ms
123-5563
60 m x 0.32 mm, 1.00 µm

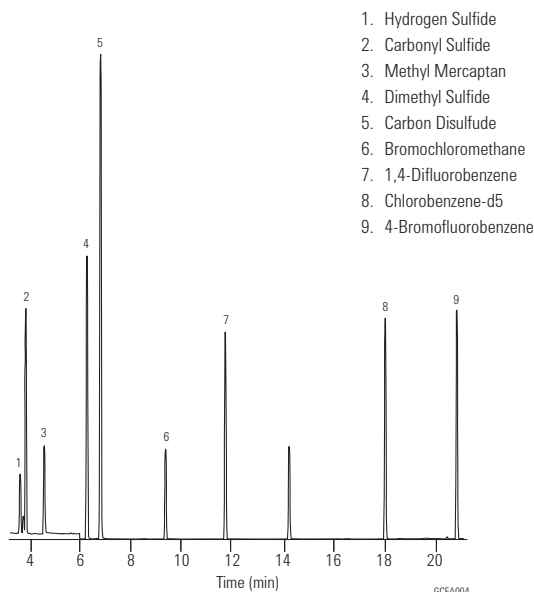
Carrier: Helium, 1.5 mL/min

Oven: 35 °C for 5 min
35-140 °C at 6 °C/min
140-220 °C at 15 °C/min
220 °C for 3 min

Sampler: Entech 7100 cryogenic sample preconcentrator

Detector: GC/MS 6890/5973N
Scan 29-180 amu 0-6 min
33-280 amu 6-30 min
Electron Impact 70 eV

Sample: 400 cc 10 ppb Sulfurs



Agilent wishes to thank Entech Instruments for providing this chromatogram.

N₂O I

Column: HP PLOT Q
19095P-Q04
30 m x 0.53 mm, 40.00 µm

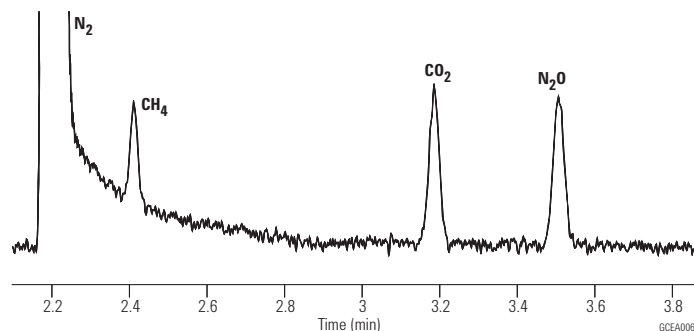
Carrier: Helium, 5 psi (approximately 8 mL/min)

Oven: 35 °C isothermal

Injection: 250 µL, injected
Split ratio 1:3

Detector: TCD, 200 °C

Sample: approximately 200 ppmV methane
200 ppmV CO₂
250 ppmV N₂O (nitrogen balance gas)

**N₂O II**

Column: HP PLOT
19095P-MS6
30 m x 0.53 mm, 25.00 µm

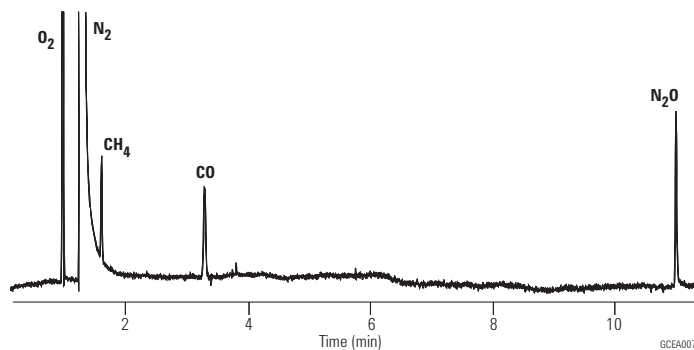
Carrier: Helium, 6 psi (approximately 10 mL/min)

Oven: 50 °C (5 min), 25 °C/min to 200 °C and hold

Injection: 250 µL injected
Split ratio 1:4

Detector: TCD, 250 °C
Column compensation on

Sample: approximately 200 ppmV methane
200 ppmV CO₂
250 ppmV N₂O (nitrogen balance gas)

**N₂O III**

Column: GS-CarbonPLOT
113-3133
30 m x 0.32 mm, 3.00 µm

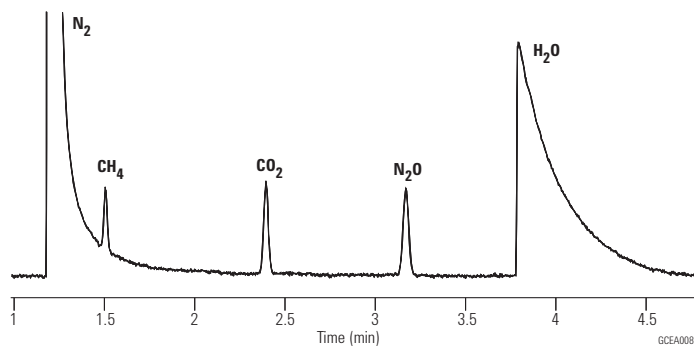
Carrier: Helium, 12 psi (approximately 3 mL/min)

Oven: 35 °C isothermal

Injection: 250 µL injected
Split ratio 1:4

Detector: TCD, 200 °C

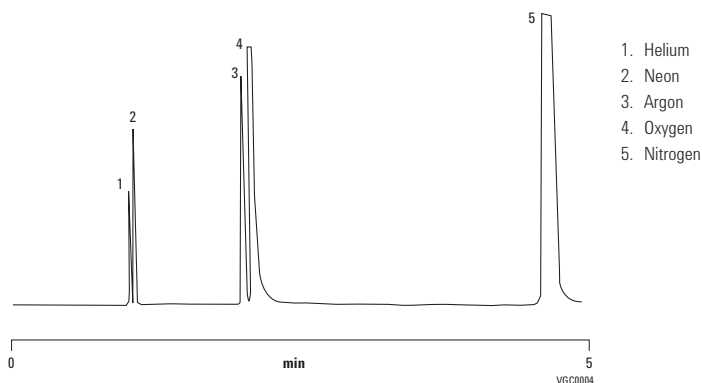
Sample: approximately 200 ppmV methane
200 ppmV CO₂
250 ppmV N₂O (nitrogen balance gas)



Permanent Gases on a Thick Film Molsieve Column

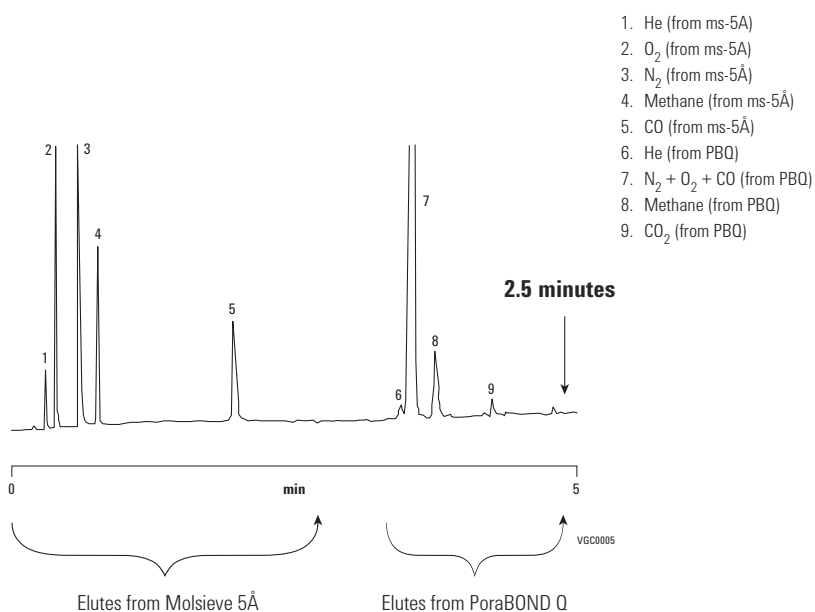
Column: Molsieve 5Å
CP7538
25 m x 0.53 mm, 50.00 µm

Sample: 10 µL
Sample Conc: % range
Carrier: H₂
Oven: 30 °C
Injection: Split, 100 mL/min
Detector: TCD

**Fast Analysis of Permanent Gases and CO₂ using Tandem PLOT Columns**

Column: CP-Sil PAH UltiMetal
CP7429

Sample: 10 µL
Sample Conc: % level
Carrier: H₂, 60 kPa
Oven: 45 °C
Injection: Split 50 mL/min
Detector: µ-TCD



**EPA Air Analysis Method TO-15
(1 ppbV Standard)**

Column: DB-5ms
123-5563
60 m x 0.32 mm, 1.00 µm

Carrier: Helium, 1.5 mL/min

Oven: 35 °C for 5 min
35-140 °C at 6 °C/min
140-220 °C at 15 °C/min
220 °C for 3 min

Sampler: Entech 7100 cryogenic sample preconcentrator

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

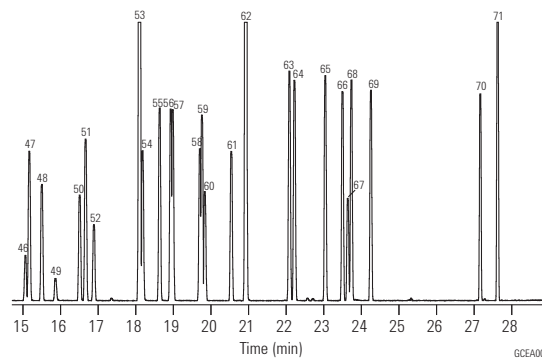
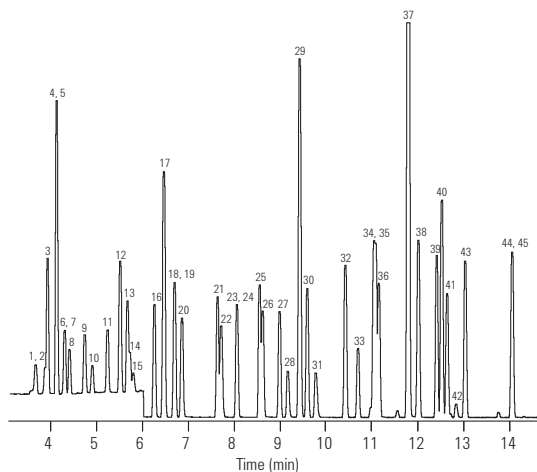
Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

Detector: GC/MS 6890/5973N
Scan 29-180 amu 0-6 min
33-280 amu 6-30 min
Electron Impact 70 eV

Sample: 400 mL sample load,
All compounds at 10 ppbV except Formaldehyde (50 ppbV),
Acetaldehyde (20 ppbV), Propanol (20 ppbV), Acetone (30 ppbV),
2-Butanone (30 ppbV)

	Quantitation Ion		Quantitation Ion		Quantitation Ion
1. Formaldehyde	30	26. n-Hexane	57	51. Tetrachloroethene	166
2. Propene	41	27. cis-1,2-Dichloroethene	96	52. 1,2-Dibromoethane	107
3. Dichlorodifluoromethane	85	28. Ethyl acetate	43	53. Chlorobenzene-d5 (IS)	117
4. Chloromethane	50	29. Bromochloromethane (IS)	128	54. Chlorobenzene	112
5. Dichlorotetrafluoroethane	85	30. Chloroform	83	55. Ethylbenzene	91
6. Acetaldehyde	29	31. Tetrahydrofuran	42	56. m-Xylene	91
7. Vinyl chloride	62	32. 1,1,1-Trichloroethane	97	57. p-Xylene	91
8. 1,3-Butadiene	39	33. 1,2-Dichloroethane	62	58. Styrene	104
9. Bromomethane	94	34. Benzene	78	59. o-Xylene	91
10. Chloroethane	64	35. Carbon tetrachloride	117	60. Bromoform	173
11. Bromoethene	106	36. Cyclohexane	56	61. 1,1,2,2-Tetrachloroethane	83
12. Trichlorofluoromethane	101	37. 1,4-Difluorobenzene (IS)	114	62. 4-Bromofluorobenzene	95
13. Acetone	58	38. 2,2,4-Trimethylpentane (Isooctane)	57	63. 4-Ethyltoluene	105
14. Propanal	29	39. n-Heptane	41	64. 1,3,5-Trimethylbenzene	105
15. Isopropyl alcohol	45	40. Trichloroethene	130	65. 1,2,4-Trimethylbenzene	105
16. 1,1-Dichloroethene	61	41. 1,2-Dichloropropane	63	66. 1,3-Dichlorobenzene	146
17. 1,1,2-Trichloro-1,2,2-trifluoroethane	101	42. 1,4-Dioxane	88	67. Benzyl chloride	91
18. Methylene chloride	49	43. Bromodichloromethane	83	68. 1,4-Dichlorobenzene	146
19. 3-Chloro-1-propene (Allyl chloride)	76	44. 4-Methyl-2-pentanone (MIBK)	43	69. 1,2-Dichlorobenzene	146
20. Carbon disulfide	76	45. cis-1,3-Dichloropropene	75	70. 1,2,4-Trichlorobenzene	180
21. trans-1,2-Dichloroethene	96	46. trans-1,3-Dichloropropene	75	71. Hexachlorobutadiene	225
22. tert-Butyl methyl ether (MTBE)	73	47. Toluene	91		
23. 1,1-Dichloroethane	63	48. 1,1,2-Trichloroethane	97		
24. Vinyl acetate	43	49. 2-Hexanone	43		
25. 2-Butanone (MEK)	72	50. Dibromochloromethane	129		



GCEA002

Agilent wishes to thank Entech Instruments for providing this chromatogram.

Food, Flavor, and Fragrance Applications

DB-624UI 1 μ L/L Fermented Beverage Standard Mix

Column: DB-624UI
123-1334UI
30 m x 0.32 mm, 1.8 μ m

Carrier: Helium, 2.3 mL/min, constant flow set at 35 $^{\circ}$ C

Oven: 35 $^{\circ}$ C for 5 min
10 $^{\circ}$ C/min to 100 $^{\circ}$ C for 1.5 min
15 $^{\circ}$ C/min to 220 $^{\circ}$ C for 3.0 min
25 $^{\circ}$ C/min to 250 $^{\circ}$ C for 2.8 min

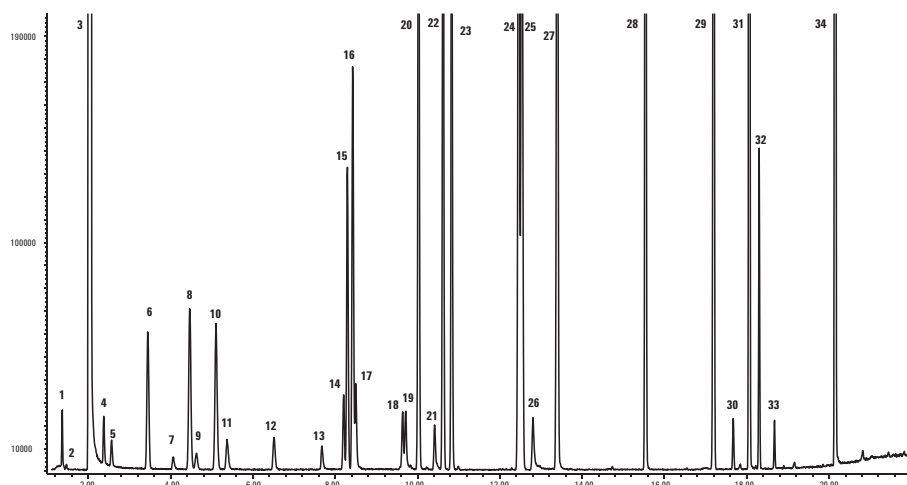
Inlet: Split/splitless, 220 $^{\circ}$ C, 1 μ L, split 20:1

MSD Restrictor: Scan mode 30-400 amu, source temp 230 $^{\circ}$ C,
quad temp 150 $^{\circ}$ C, transfer line temp 260 $^{\circ}$ C

Instrument: Agilent 7890/5975C equipped with MMI and FID

Sampler: Agilent 7697A headspace with 111 position tray, 1 mL sample loop

1. acetyl aldehyde
2. methanol
3. ethanol
4. acetone
5. isopropanol
6. isobutyl aldehyde
7. 1-propanol
8. butyl aldehyde
9. 2,3 butanedione (VDK)
10. ethyl acetate
11. 2-butanol
12. isobutyl alcohol
13. 1-butanol
14. 2,3 pentanedione (VDK)
15. ethyl propanoate
16. propyl acetate
17. 3 pentanol
18. isoamyl alcohol
19. active amyl alcohol
20. isobutyl acetate
21. 1-pentanol
22. ethyl butanolate
23. hexanal
24. isoamyl acetate
25. active amyl acetate
26. 1-hexanol
27. heptanal
28. octanal
29. 1,3,5-trioxane imp
30. 1,3,5-trioxane imp
31. ethyl caprylate
32. 1-phenyl ethyl acetate
33. benzaldehyde, 3 methoxy
34. ethyl caprate



Spearmint Oil

Column A: DB-1
122-1032
30 m x 0.25 mm, 0.25 μ m

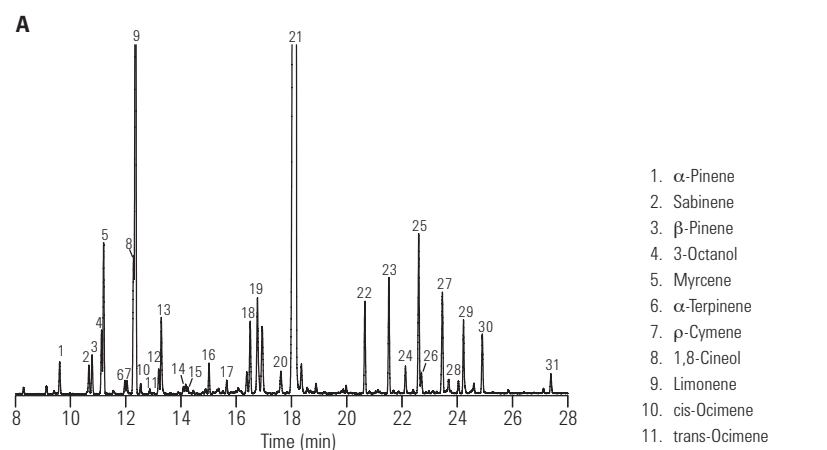
Column B: DB-1
121-1022
20 m x 0.18 mm, 0.18 μ m

Carrier: A: Helium 25 cm/sec measured at 40 °C
B: Hydrogen 47 cm/sec measured at 40 °C

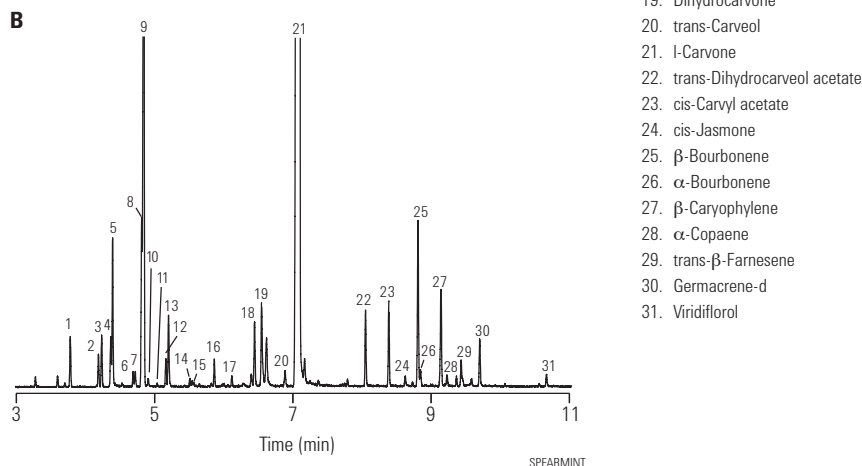
Oven: A: 40 °C hold 1 min, 5 °C/min to 290 °C
B: 40 °C hold 0.38 min, 13 °C/min to 290 °C hold 13.09 min

Injection: 250 °C, Split 40:1, 1 μ L injection

**Original Method with a
DB-1, 30 m x 0.25 mm,
0.25 μ m column and Helium carrier**



**Faster Method with a high efficiency
DB-1, 20 m x 0.18 mm, 0.18 μ m column
and Hydrogen carrier**



Using hydrogen as a carrier gas in conjunction with the high efficiency column resulted in an overall speed gain of 61% compared to the original method. In addition, the resolution was well maintained throughout the method translation process.

Lavender Oil Characterization

Column: DB-1ms Ultra Inert
122-0132UI
30 m x 0.25 mm, 0.25 μ m

Instrument: Agilent 7890A/5975B MSD
and a 6890N FID equipped

Sampler: Agilent 7683B, 5.0 μ L syringe (P/N 5188-5246),
1.0 μ L injection

Carrier: Helium 40 cm/s, constant flow MSD system,
35 cm/s FID system

Inlet: 200:1 split

Oven: 62 °C 12.5 min hold, 3 °C/min to 92 °C,
then 5 °C/min to 165 °C, then 100 °C/min
to 310 °C, 2.5 min hold

Detector: MSD source at 300 °C, quadrupole at 180 °C,
transfer line at 280 °C, scan range 45-450 amu

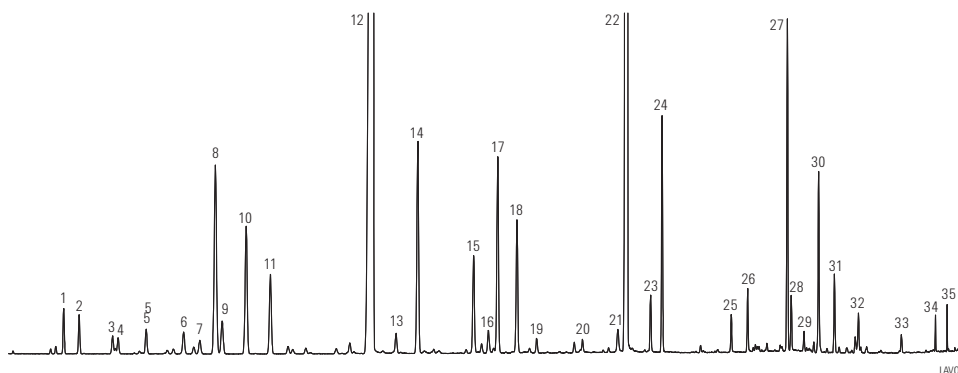
- | | |
|----------------------------|---------------------------|
| 1. α -Pinene | 19. Hexyl butyrate |
| 2. Camphene | 20. Cumic aldehyde |
| 3. 1-Octen-3-ol | 21. cis-Geraniol |
| 4. 3-Octanone | 22. Linalool acetate |
| 5. β -Myrcene | 23. Borneol acetate |
| 6. 3-Carene | 24. Lavandulyl acetate |
| 7. α -Cymene | 25. Nerol acetate |
| 8. Eucalyptol | 26. Geranyl Acetate |
| 9. D-Limonene | 27. Caryophyllene |
| 10. β -trans-Ocimene | 28. α -Santolene |
| 11. β -cis-Ocimene | 29. α -Bergamotene |
| 12. β -Linalool | 30. β -Farnesene |
| 13. Octen-1-ol acetate | 31. Germacrene D |
| 14. Camphor | 32. γ -Cardinene |
| 15. Borneol | 33. Caryophyllene oxide |
| 16. Lavandulol | 34. tau-Cardinol |
| 17. Terpinen-4-ol | 35. α -Bisabolol |
| 18. α -Terpinol | |

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split liner, single taper MS certified liner with restriction to hold glass wool,
5188-6576

Syringe: 5 μ L tapered, FN 23-26s/42/HP, 5181-1273



GC/MS total ion chromatogram of lavender oil sample on an Agilent J&W DB-1ms Ultra Inert 30 m x 0.25 mm, 0.25 μ m capillary GC column (P/N 122-0132UI). The well-resolved, sharp peaks observed on the column ensure reliable analysis and fingerprinting of lavender oils.

Essential Oils

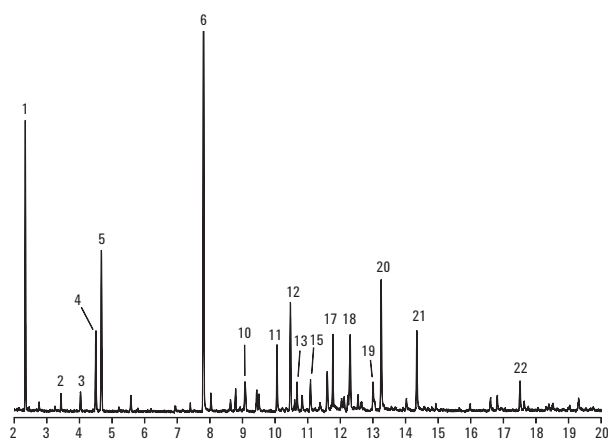
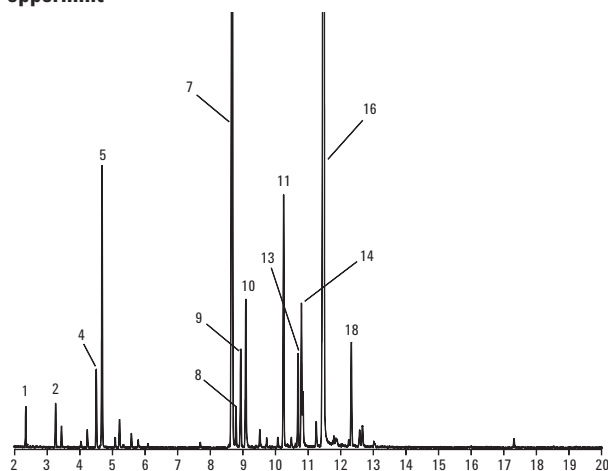
Column: DB-WAX
121-7022
20 m x 0.18 mm, 0.18 μ m

Carrier: Hydrogen @ 44.3 cm/sec
Measured @ 45 $^{\circ}$ C

Injection: Split 1:30, 250 $^{\circ}$ C
1 μ L of 1:35 oil in acetone

Oven: 45 $^{\circ}$ C hold 0.77 min
7.79 $^{\circ}$ C/min to 250 $^{\circ}$ C

Detector: MSD full scan at m/z 40-500
250 $^{\circ}$ C transfer line

Wild chamomile**Peppermint**

Fragrance Reference Standard

Column: DB-1
122-1032
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 25 cm/sec, measured at 150 °C

Oven: 40 °C for 1 min
40-290 °C at 5 °C/min

Injection: Split, 250 °C
Split ratio 1:50

Detector: MSD, 300 °C transfer line

Sample: 1 µL of a 1:20 dilution of neat sample in acetone

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

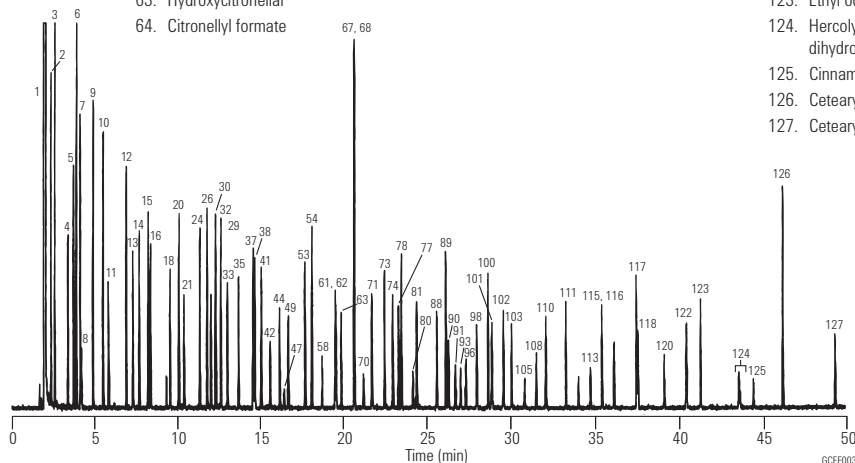
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273

Many thanks to Carl Frey, Manager of Analytical Services, Dragoco, and Kevin Myung, Director of Flavor and Perfumery Research, Bush Boake Allen, Inc. for contributing to this work.

- | | | | |
|--|-----------------------------|----------------------------------|--|
| 1. Acetone | 33. 2,6-Dimethylhept-5-enal | 66. Bornyl acetate | 97. trans-Nerolidol |
| 2. 2,3-Butanedione (diacetyl) | 34. γ-Terpinene | 67. Vertenex (isomer 1) | 98. n-Amyl salicylate |
| 3. Ethyl acetate | 35. Octanol | 68. Ethyl nonanoate | 99. Phenylethyl tiglate |
| 4. 2,3-Pentanedione (acetyl propionyl) | 37. Ethyl heptanoate | 69. Geranyl formate | 100. Ethyl dodecanoate |
| 5. Ethyl propionate | 38. Linalool | 70. Vertenex (isomer 2) | 101. Benzophenone |
| 6. Methyl butyrate | 39. Benzene ethanol | 71. γ-Nonalactone | 102. Dibenzyl ether |
| 7. 3-Methylbutyl alcohol | 41. Rose oxide, cis-rose | 72. Citronellyl acetate | 103. γ-Dodecalactone |
| 8. 2-Methylbutyl alcohol | 42. Rose oxide, trans-rose | 73. Neryl acetate | 104. Citronellyl tiglate |
| 9. Isobutyl acetate | 43. Camphor | 74. Geranyl acetate | 105. Evernyl |
| 10. Ethyl butyrate | 44. Citronellal | 76. Diphenyl oxide | 106. Geranyl tiglate |
| 11. Furfural | 45. Benzyl acetate | 78. Ethyl decanoate | 107. Geranyl-2-methyl valerate |
| 12. Ethyl isovalerate | 46. Menthone | 79. α-Copaene | 108. Celestocide |
| 13. Hexanol | 47. Isoborneol | 80. Florazone (isomer 1) | 109. Heptadec-1-ene |
| 14. Allyl butyrate | 48. Isomenthone | 81. Florazone (isomer 2) | 110. Benzyl benzoate |
| 15. Ethyl pentanoate | 49. Borneol | 82. β-Caryophyllene | 111. Ethyl tetradecanoate |
| 16. Hexylene glycol | 51. Terpinen-4-ol | 83. Citronellyl propionate | 112. Benzyl salicylate |
| 17. α-Thujone | 52. α-Terpineol | 85. 3,7-Guaiadiene | 113. Tonalid |
| 18. Benzaldehyde | 53. Ethyl octanoate | 88. Dodecanol | 114. Nonadec-1-ene |
| 19. α-Pinene | 54. Octyl acetate | 89. Ethyl undecanoate | 115. Isopropylmyristate |
| 20. Camphene | 56. Fenchyl acetate | 90. Eugenyl acetate | 116. Ethyl pentadecanoate |
| 21. 3,5,5-Trimethylhexanol | 57. Citronellol | 91. Frambione (raspberry ketone) | Nonadecane |
| 22. Sabinene | 58. Neral | 93. Isoamyl salicylate | 117. Ethyl hexadecanoate |
| 23. β-Pinene | 59. Carvone | 94. δ-Cadinene | 118. Musk T (ethylene brassylate) |
| 24. Ethyl hexanoate | Phenylethyl acetate | 95. cis-Nerolidol | 119. Eicosane |
| 25. Myrcene | 60. Geraniol | 96. Rosatol (rosetone) | 120. Cinnamyl phenyl acetate |
| 26. Hexyl acetate | 61. Linalyl acetate | Geranyl butyrate | 121. Heneicosane |
| cis-Linalool oxide | 62. Geranial | | 122. Phenyl ethyl cinnamate |
| Methyl benzoate | 63. Hydroxycitronellal | | 123. Ethyl octadecanoate |
| trans-Linalool oxide | 64. Citronellyl formate | | 124. Herculyn D (tetrahydro & dihydro methyl abietate) |
| 28. Methyl-cresol | | | 125. Cinnamyl cinnamate |
| 29. Benzyl alcohol | | | 126. Cetearyl octanoate |
| 30. para-Cymene | | | 127. Cetearyl decanoate |
| 31. 1,8-Cineol | | | |
| 32. Limonene | | | |



Fragrance Reference Standard

Column: DB-WAX
122-7032
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 25 cm/sec,
measured at 150 °C

Oven: 45 °C for 2 min
45-250 °C at 3 °C/min
250 °C for 34 min

Injection: Split, 250 °C
Split ratio 1:50

Detector: MSD, 250 °C transfer line

Sample: 1 µL of a 1:20 dilution of neat sample in acetone

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

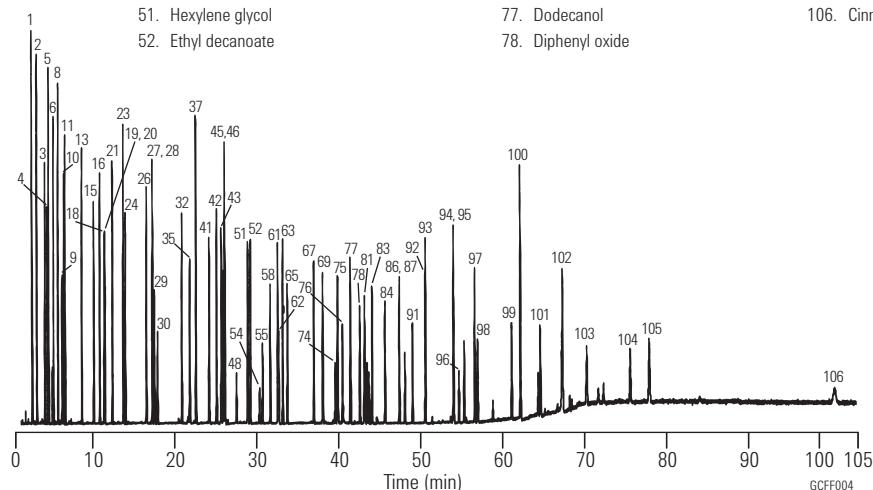
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273

Many thanks to Carl Frey, Manager of Analytical Services, Dragoco, and Kevin Myung, Director of Flavor and Perfumery Research, Bush Boake Allen, Inc. for contributing to this work.

- | | | | |
|--|--|--------------------------|-----------------------------------|
| 1. Acetone | 27. 2,6-Dimethylhept-5-enal (Melonal™) | 53. Citronellyl acetate | 79. Citronellyl tiglate |
| 2. Ethyl acetate | 28. Rose oxide, cis-rose | 54. Isoborneol | 80. Eugenyl methyl ether |
| 3. Ethyl propionate | 29. Hexanol | 55. Neral | 81. γ-Nonalactone |
| 4. 2,3-Butanedione (diacetyl) | 30. Rose oxide, trans-rose | 56. α-Terpineol | 83. Ethyl tetradecanoate |
| 5. Methyl butyrate | 31. Methyl-para-cresol | 57. Geranyl formate | 84. n-Amyl salicylate |
| 6. Isobutyl acetate | 32. Ethyl octanoate | 58. Borneol | 85. Geranyl tiglate |
| 7. α-Pinene | 33. cis-Linalool oxide | 59. β-Bisabolene | 86. Ethyl pentadecanoate |
| 8. Ethyl butyrate | 34. Menthone | 60. Benzyl acetate | 87. Isopropylmyristate |
| 9. 2,3-Pentanedione (acetyl propionyl) | 35. Furfural | 61. Neryl acetate | 90. Phenylethyl tiglate |
| 10. Camphene | 36. trans-Linalool oxide | 62. Geranial | 91. Rosatol (rosetone) |
| 11. Ethyl isovalerate | 37. Octyl acetate | 63. Ethyl undecanoate | 92. Eugenyl acetate |
| 12. β-Pinene | 38. Isomenthone | 64. δ-Cadinene | 93. Ethyl hexadecanoate |
| 13. Ethyl pentanoate | 39. α-Copaene | 65. Geranyl acetate | 94. γ-Dodecalactone |
| 14. Myrcene | 40. Camphor | 66. Citronellol | 95. Dibenzyl ether |
| 15. Allyl butyrate | 41. Benzaldehyde | 67. Ethyl dodecanoate | 96. Tonalid |
| 16. Limonene | 42. Ethyl nonanoate | 68. Geraniol | 97. Ethyl octadecanoate |
| 17. 1,8-Cineol | 43. Linalool | 69. Benzyl alcohol | 98. Benzophenone |
| 18. 3,5,5-Trimethylhexanol | 44. Linalyl acetate | 70. Geranyl butyrate | 99. Benzyl benzoate |
| 19. 3-Methylbutyl alcohol | 45. Vertenex (isomer 1) | 71. Nonadecane | 100. Cetearyl octanoate |
| 20. 2-Methylbutyl alcohol | 46. Octanol | 72. Benzene ethanol | 101. Musk T (ethylene brassylate) |
| 21. Ethyl hexanoate | 47. β-Caryophyllene | 73. Nonadec-1-ene | 102. Cetearyl decanoate |
| 22. γ-Terpinene | 48. Vertenex (isomer 2) | 74. Florazone (isomer 1) | 103. Frambione (raspberry ketone) |
| 23. p-Cymene | 49. Terpinen-4-ol | 75. Florazone (isomer 2) | 104. Cinnamyl phenyl acetate |
| 24. Hexyl acetate | 50. Methyl benzoate | 76. Hydroxycitronellal | 105. Phenyl ethyl cinnamate |
| 25. Terpinolene | 51. Hexylene glycol | 77. Dodecanol | 106. Cinnamyl cinnamate |
| 26. Ethyl heptanoate | 52. Ethyl decanoate | 78. Diphenyl oxide | |



Perfume

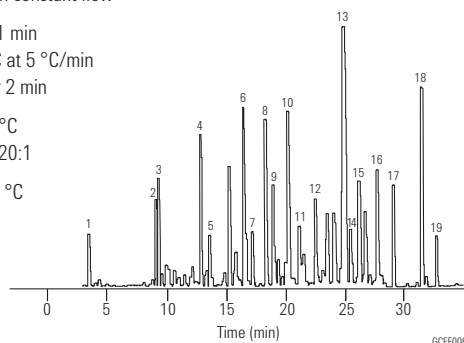
Column: HP-INNOWax
19091N-133
30 m x 0.25 mm, 0.25 µm

Carrier: Helium, 30 cm/sec
0.9 mL/min constant flow

Oven: 80 °C for 1 min
80-250 °C at 5 °C/min
250 °C for 2 min

Injection: Split, 250 °C
Split ratio 20:1

Detector: MSD, 280 °C



- | | |
|-------------------------|-----------------------|
| 1. Limonene | 10. n-Amyl salicylate |
| 2. Linalool | 11. Camphoryl acetate |
| 3. Linalyl acetate | 12. Acetylcedrene |
| 4. Benzyl acetate | 13. Diethyl phthalate |
| 5. Citronellol | 14. Tonalid |
| 6. Benzene ethanol | 15. Coumarin |
| 7. α-Methyl Ionone | 16. Musk xylene |
| 8. Carvocol and geraiol | 17. Benzyl benzoate |
| 9. Isoamyl salicylate | 18. Benzyl salicylate |
| | 19. Musk ketone |

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273

Chiral Compounds in Essential Oils and Fragrances

Column: HP Chiral β
19091G-B233
30 m x 0.25 mm, 0.25 µm

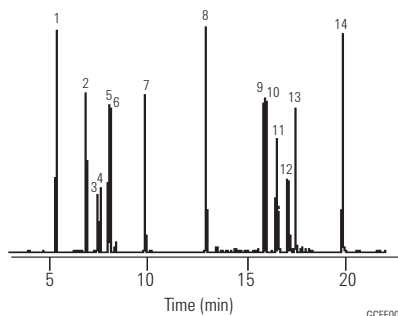
Carrier: Hydrogen, 39 cm/sec, constant pressure

Oven: 65 °C for 1 min
65-170 °C at 5 °C/min

Injection: Split, 250 °C
Split ratio 30:1

Detector: FID, 300 °C

Sample: 1 µL
0.25 ng/µL each analyte in Hexane



- | |
|---------------------------|
| 1. 1,2-Dimethylbenzene |
| 2. Myrcene |
| 3. (-)-Camphene |
| 4. (+)-Camphene |
| 5. (+)-β-Pinene |
| 6. 1S-(-)-β-Pinene |
| 7. Cineole |
| 8. (R)-(+)-Citronellal |
| 9. 1S,2R,5S-(+)-Menthhol |
| 10. 1R,2S,5R-(-)-Menthhol |
| 11. α-Terpineol |
| 12. (+/-)-Isoborneol |
| 13. (+)-Borneol |
| 14. trans-Cinnamaldehyde |

Menthhol

Column: Cyclodex-β
112-2532
30 m x 0.25 mm, 0.25 µm

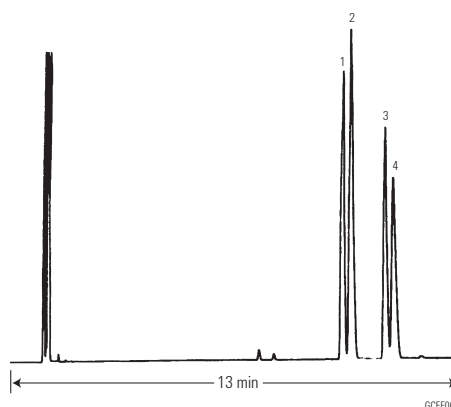
Carrier: Hydrogen, 55 cm/sec

Oven: 105 °C isothermal

Injection: Split, 250 °C
Split ratio 1:100

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL of 1 µg/µL each chloroform



- | |
|--------------------|
| 1. (+)-Neomenthol |
| 2. (-)- Neomenthol |
| 3. (+)-Menthhol |
| 4. (-)-Menthhol |

FAMEs

Column: DB-23
122-2362
60 m x 0.25 mm, 0.25 µm

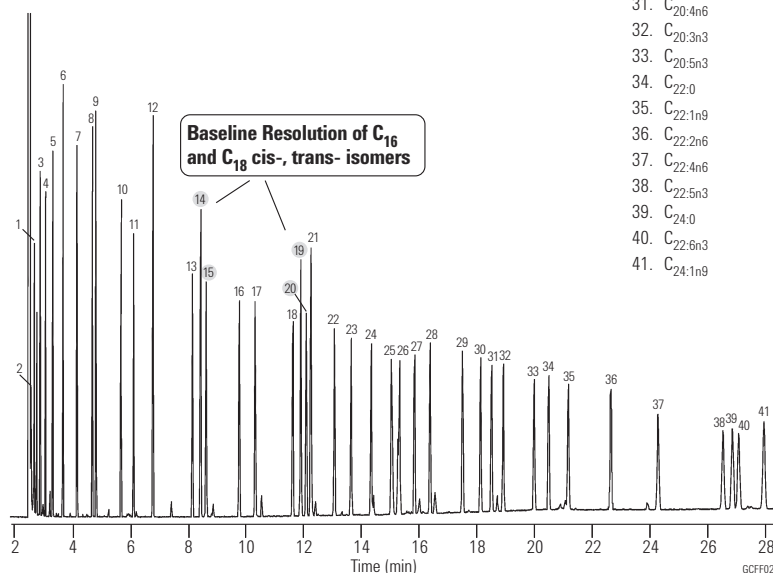
Carrier: Hydrogen at 43 cm/sec,
constant pressure mode

Oven: 130 °C for 1.0 min
130-170 °C at 6.5 °C/min
170-215 °C at 2.75 °C/min
215 °C for 12 min
215-230 °C at 40 °C/min
230 °C for 3 min

Injection: Split, 270 °C
Split ratio 50:1

Detector: FID, 280 °C

- | | | |
|-----------------------|--------------------------------|-------------------------------|
| 1. C _{6:0} | 11. C _{14:1n5} | 21. C _{18:1n7} |
| 2. C _{7:0} | 12. C _{15:0} | 22. C _{18:2n6} |
| 3. C _{8:0} | 13. C _{16:0} | 23. C _{18:3n6} |
| 4. C _{9:0} | 14. C _{16:1n7(trans)} | 24. C _{18:3n3} |
| 5. C _{10:0} | 15. C _{16:1n7(cis)} | 25. C _{18:2(d9,11)} |
| 6. C _{11:0} | 16. C _{17:0} | 26. C _{18:2(d10,12)} |
| 7. C _{12:0} | 17. C _{17:1} | 27. C _{20:0} |
| 8. BHT | 18. C _{18:0} | 28. C _{20:1n9} |
| 9. C _{13:0} | 19. C _{18:1n9(trans)} | 29. C _{20:2n6} |
| 10. C _{14:0} | 20. C _{18:1n9(cis)} | 30. C _{20:3n6} |
| | | 31. C _{20:4n6} |
| | | 32. C _{20:3n3} |
| | | 33. C _{20:5n3} |
| | | 34. C _{22:0} |
| | | 35. C _{22:1n9} |
| | | 36. C _{22:2n6} |
| | | 37. C _{22:4n6} |
| | | 38. C _{22:5n3} |
| | | 39. C _{24:0} |
| | | 40. C _{22:6n3} |
| | | 41. C _{24:1n9} |



Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273

Chromatogram provided courtesy of Steve Watkins and Jeremy Ching, FAME Analytics, <http://www.fameanalytics.com>

Analysis of Fragrance and Allergens

Column: VF-WAXms
CP9205
30 m x 0.25 mm, 0.25 µm

Oven: 100 °C to 250 °C with 10 °C/min

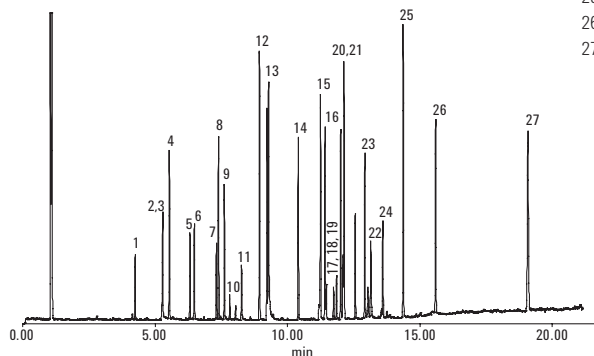
Carrier: Helium, 1.0 mL/min

Injection: Split 1:30, T = 250 °C

Detector: GC-MS Ion Trap
Trap: 200 °C
Manifold: 60 °C

Sample: 0.1 µL, Fragrances mixture (500 ppm)

- | | | |
|----------------------------|----------------------------|-----------------------------|
| 1. Linalool | 9. Benzyl alcohol | 17. Cinnamyl alcohol |
| 2. Methyl heptin carbonate | 10. Cinnamaldehyde | 18. Farnesol isomer I + II |
| 3. Phenyl acetalddehyde | 11. Hydroxy citronellal | 19. Farnesol isomer III |
| 4. Methyl chavicol | 12. Methyl eugenol | 20. iso-Eugenol |
| 5. Methyl octin carbonate | 13. Lilial | 21. Hexyl cinnamic aldehyde |
| 6. Citronellol | 14. Eugenol | 22. Lyril (4,4-isomer) |
| 7. Geraniol | 15. Amyl cinnamyl aldehyde | 23. Coumarine |
| 8. Methyl gamma ionone | 16. Anisic alcohol | 24. Amyl cinnamic alcohol |
| | | 25. Benzyl benzoate |
| | | 26. Benzyl salicylate |
| | | 27. Benzyl cinnamate |

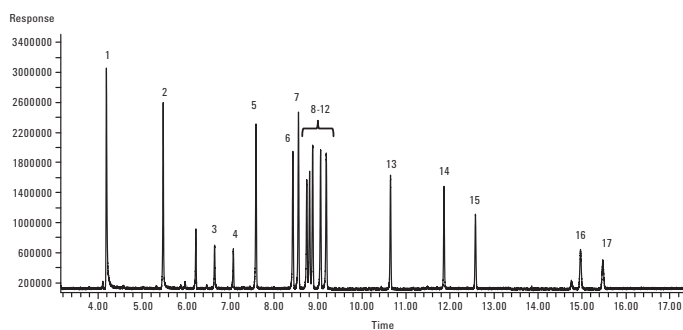


Organophosphorus Pesticide Residues in Olive Oil Extract

Column: DB-35ms Ultra Inert
122-3832UI
30 m x 0.25 mm, 0.25 μ m

Instrument: Agilent 7890/5975C
Sampler: Agilent 7683B, 5.0 μ L syringe (P/N 5181-1273)
CFT Device: Purged 2-way splitter (P/N G3180B)
Split Ratio MSD:FPD = 1:1
MSD Restrictor: 1.43 m x 0.18 mm id deactivated fused silica tubing
FPD Restrictor: 0.53 m x 0.18 mm id deactivated fused silica tubing
Aux EPC: 3.8 psi constant pressure
Inlet: 2 μ L splitless; 250 $^{\circ}$ C, purge flow 60 mL/min at 0.25 min, gas saver on at 2 min 20 mL/min
Carrier: Helium, constant pressure 28.85 psi at 95 $^{\circ}$ C
Oven: 95 $^{\circ}$ C (0.5 min), 25 $^{\circ}$ C/min to 210 $^{\circ}$ C, 10 $^{\circ}$ C/min to 250 $^{\circ}$ C (0.5 min), 20 $^{\circ}$ C to 290 $^{\circ}$ C (4.5 min)
Postrun Backflush: 7.5 min at 290 $^{\circ}$ C, Aux EPC pressure 54 psi during backflush, 2 psi inlet pressure during backflush
Detector: MSD: 300 $^{\circ}$ C transfer line, 300 $^{\circ}$ C source, 150 $^{\circ}$ C quad
FPD: 230 $^{\circ}$ C, Hydrogen 75 mL/min, Air 100 mL/min, Carrier + makeup (N_2) 60 mL/min

- | | |
|----------------------|---|
| 1. Methamidophos | 10. Fenitrothion |
| 2. Acephate | 11. Parathion |
| 3. Omethoate | 12. Fenthion |
| 4. Diazinon | 13. Methidathion |
| 5. Dimethoate | 14. Carbophenothion |
| 6. Pirimiphos-methyl | 15. Triphenyl-phosphate (surrogate std) |
| 7. Parathion-methyl | 16. Azinphos-methyl |
| 8. Malathion | 17. Azinphos-ethyl |
| 9. Chlorpyrifos | |



GC/FPD chromatogram of a 100 ng/mL matrix-matched organophosphorus pesticide standard with analyte protectant analyzed on an Agilent J&W DB-35ms UI GC column.



TIPS & TOOLS

View the latest GC column focused applications, products and educational resources at www.agilent.com/chem/myGCColumns

Fragrance Allergens

Column: HP-5ms
19091S-433
30 m x 0.25 mm, 0.25 µm

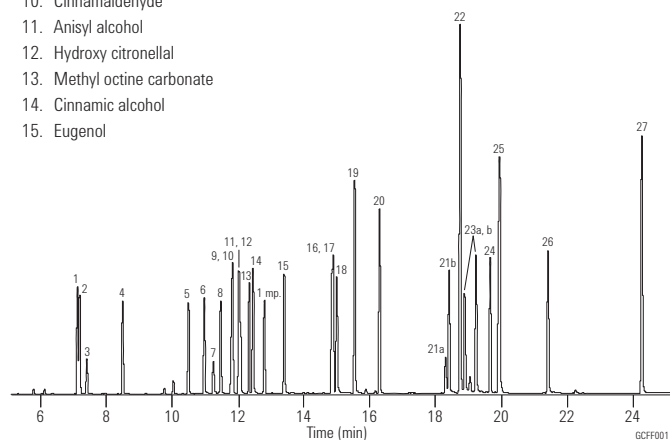
Carrier: Helium, 1.2 mL/min,
constant pressure of 70 kPa

Oven: 50 °C - 1 min - 8 °C/min - 250 °C,
250-300 °C @ 35 °C/min
300 °C Hold, 5 min
5973N MSD in scan (40-350 amu)
Solvent Delay, 3.0 min

Injection: Split, 250 °C
Split ratio 1:50

Sample: 1 µL, 50 ppm standard

- | | | |
|-----------------------------|----------------------------|--------------------------|
| 1. Limonene | 16. Coumarin | 23a. Farnesol 1 |
| 2. Benzyl alcohol | 17. Cinnamyl acetate | 23b. Farnesol 1 |
| 3. Phenyl acetaldehyde | 18. Isoeugenol | 24. Hexyl cinnamaldehyde |
| 4. Linalool | 19. Alpha isomethyl ionone | 25. Benzyl benzoate |
| 5. Methyl heptin carbonate | 20. Lilial (BMHCA) | 26. Benzyl salicylate |
| 6. Citronellol | 21a. Lyrall 1 | 27. Benzyl cinnamate |
| 7. Neral | 21b. Lyrall 2 | |
| 8. Geraniol | 22. Amyl cinnamyl alcohol | |
| 9. Citral (geranial) | | |
| 10. Cinnamaldehyde | | |
| 11. Anisyl alcohol | | |
| 12. Hydroxy citronellal | | |
| 13. Methyl octine carbonate | | |
| 14. Cinnamic alcohol | | |
| 15. Eugenol | | |

**Suggested Supplies**

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273

Flavor Mixture

Column: ULTRA 2
19091B-112
25 m x 0.32 mm, 0.52 µm

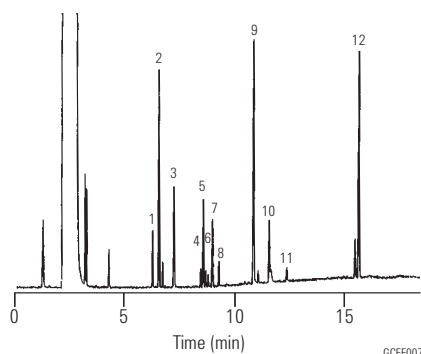
Carrier: Helium, 90 kPa., 2.2 mL/min constant flow

Oven: 80 °C for 1 min
80-210 °C at 8 °C/min
210 °C for 2 min

Injection: Split, 250 °C
Split ratio 20:1

Detector: IRD, 280 °C
Wide Band MCT, 550 to 4000 cm⁻¹

1. Fenchone
2. Thujone
3. Benzaldehyde
4. trans-Carveol
5. Farnesol
6. cis-Carveol
7. trans-Geraniol
8. Citral
9. Eugenol
10. Vanillin
11. trans-Isoeugenol
12. trans-Citronellyl tiglate
13. cis-Citronellyl tiglate

**Suggested Supplies**

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Lemon Oil

Column: DB-5
127-5022
20 m x 0.10 mm, 0.10 µm

Carrier: Hydrogen at 60 cm/sec, measured at 40 °C

Oven: 40 °C for 3 min
40-185 °C at 30 °C/min
185 °C for 3 min

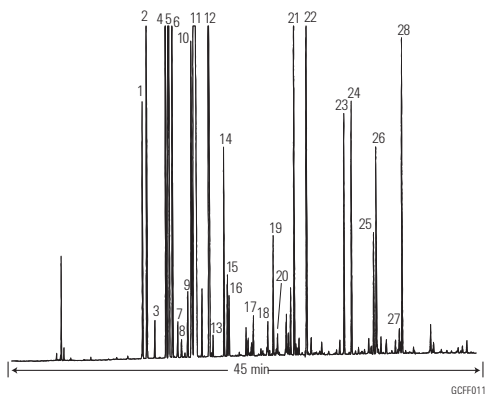
Injection: Split, 275 °C
Split ratio 1:275

Detector: Nitrogen makeup gas at 30 mL/min

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273

- | | | |
|--------------|-------------------|-------------------------|
| 1. α-Thujone | 7. Octanal | 13. Octanol |
| 2. β-Thujone | 8. α-Phellandrene | 14. Terpinolene |
| 3. Camphene | 9. α-Terpinene | 15. Linalool |
| 4. Sabinene | 10. r-Cymene | 16. Nonanal |
| 5. β-Pinene | 11. δ-Limonene | 17. Citronellal |
| 6. Myrcene | 12. γ-Terpinene | 18. Terpinen-4-ol |
| | | 19. α-Terpineol |
| | | 20. Decanal |
| | | 21. Neral |
| | | 22. Geranial |
| | | 23. Nerylacetate |
| | | 24. Geranylacetate |
| | | 25. β-Caryophyllene |
| | | 26. trans-α-Bergamotene |
| | | 27. α-Humulene |
| | | 28. β-Bisabolene |



Fast analysis of lemon oil using Rapid-MS

Column: Rapid MS

Sample: 0.3 µL

Sample Conc: Pure lemon oil

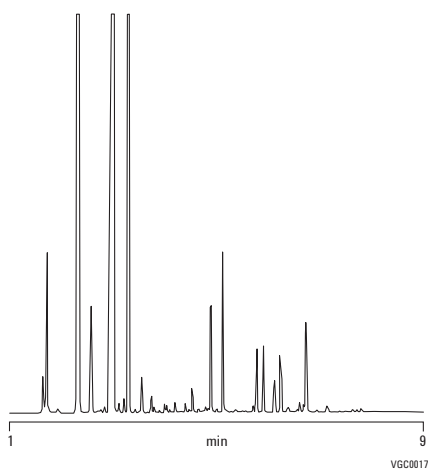
Solvent: Producto puro

Carrier: He, 100 kPa (1.0 bar, 14 psi)

Oven: 40 °C (2 min)
200 °C, 20 °C/min

Injection: Split

Detector: Ion Trap



Cold-Pressed Orange Oil

Column: DB-5
127-5022
20 m x 0.10 mm, 0.10 μ m

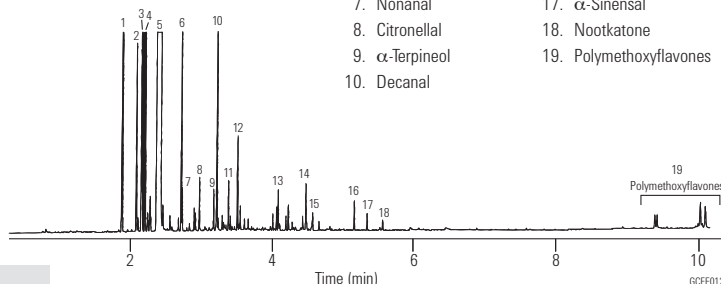
Carrier: Hydrogen at 60 cm/sec, measured at 70 °C

Oven: 70 °C for 1 min
70-250 °C at 30 °C/min
250-310 °C at 20 °C/min
310 °C for 2 min

Injection: Split, 275 °C
Split ratio 1:275

Detector: FID, 350 °C
Nitrogen makeup gas at 30 mL/min

- | | |
|------------------------|-------------------------|
| 1. α -Pinene | 11. Neral |
| 2. Sabinene | 12. Geranial |
| 3. Myrcene | 13. Dodecenal |
| 4. Octanal | 14. Valencene |
| 5. Limonen | 15. Cadinene |
| 6. Linalool | 16. β -Sinensal |
| 7. Nonanal | 17. α -Sinensal |
| 8. Citronellal | 18. Nootkatone |
| 9. α -Terpineol | 19. Polymethoxyflavones |
| 10. Decanal | |

**Suggested Supplies**

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 μ L tapered, FN 23-26s/42/HP, 5181-1273

Chromatogram courtesy of Tastemaker

Peppermint Oil

Column: DB-WAX
122-7062
60 m x 0.25 mm, 0.25 μ m

Carrier: Helium at 25 cm/sec (0.73 mL/min)

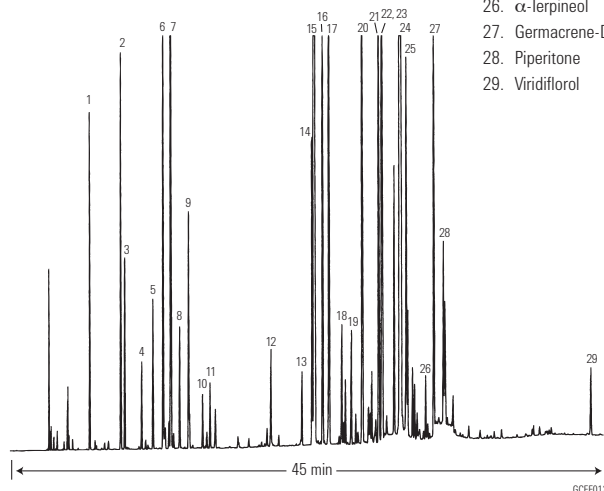
Oven: 75 °C for 8 min
75-200 °C at 4 °C/min
200 °C for 5 min

Injection: Split, 270 °C
Split ratio 1:150

Detector: FID, 270 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 μ L neat

- | | | |
|------------------------|----------------------------|----------------------------|
| 1. α -Pinene | 9. Terpinene | 17. d-Isomethone |
| 2. β -Pinene | 10. r-Cymene | 18. β -Bourbonene |
| 3. Sabinene | 11. γ -Terpinolene | 19. Linalool |
| 4. Myrcene | 12. 3-Octanol | 20. Menthyl acetate |
| 5. α -Terpinene | 13. 1-Octen-3-ol | 21. Neomenthol |
| 6. (+/-)-Limonene | 14. trans-Sabinene hydrate | 22. Trepinen-4-ol |
| 7. 1,8-Cineol | 15. (+/-)-Methone | 23. β -Caryophyllene |
| 8. cis-OCimene | 16. Methofuran | 24. (+/-)-Menthol |
| | | 25. Pulegone |
| | | 26. α -Terpineol |
| | | 27. Germacrene-D |
| | | 28. Piperitone |
| | | 29. Viridiflorol |



Thanks to Mr. William Faas of A.M. Todd Company for providing the sample and assisting with peak identification.

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 μ L tapered, FN 23-26s/42/HP, 5181-1273

Spearmint Oil (Western)

Column: DB-WAX
122-7062
60 m x 0.25 mm, 0.25 μ m

Carrier: Helium at 25 cm/sec (0.73 mL/min)

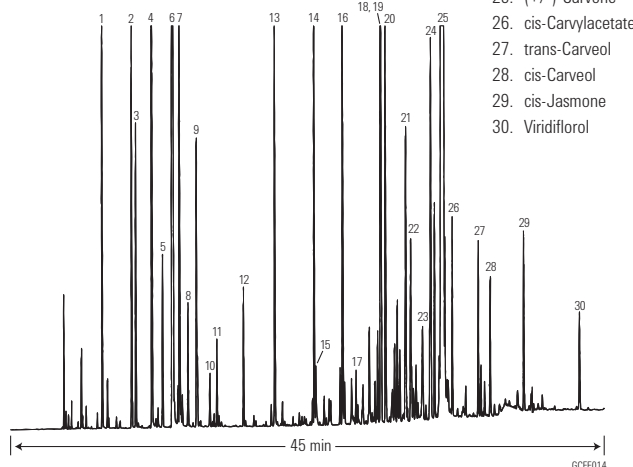
Oven: 75 °C for 8 min
75-200 °C at 4 °C/min
200 °C for 5 min

Injection: Split, 270 °C
Split ratio 1:150

Detector: FID, 270 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 μ L neat

- | | |
|------------------------|-------------------------------|
| 1. α -Pinene | 13. 3-Octanol |
| 2. β -Pinene | 14. trans-Sabinene hydrate |
| 3. Sabinene | 15. (+/-)-Methone |
| 4. Myrcene | 16. β -Bourbonene |
| 5. α -Terpinene | 17. Linalool |
| 6. (+/-)-Limonene | 18. Trepinen-4-ol |
| 7. 1,8-Cineol | 19. β -Caryophyllene |
| 8. cis-OCimene | 20. Dihydrocarvone |
| 9. γ -Terpinene | 21. trans-Dihydrocarvyl |
| 10. r-Cymene | 22. trans- β -Farnesene |
| 11. Terpinolene | 23. α -Terpineol |
| 12. 3-Octylacetate | 24. Germacrene-D |
| | 25. (+/-)-Carvone |
| | 26. cis-Carvylacetate |
| | 27. trans-Carveol |
| | 28. cis-Carveol |
| | 29. cis-Jasmone |
| | 30. Viridiflorol |



Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 μ L tapered, FN 23-26s/42/HP, 5181-1273

Thanks to Mr. William Faas of A.M. Todd Company for providing the sample and assisting with peak identification.

Ylang Ylang Oil

Column: DB-XLB
122-1232
30 m x 0.25 mm, 0.25 μ m

Carrier: Helium at 34 cm/sec, measured at 50 °C

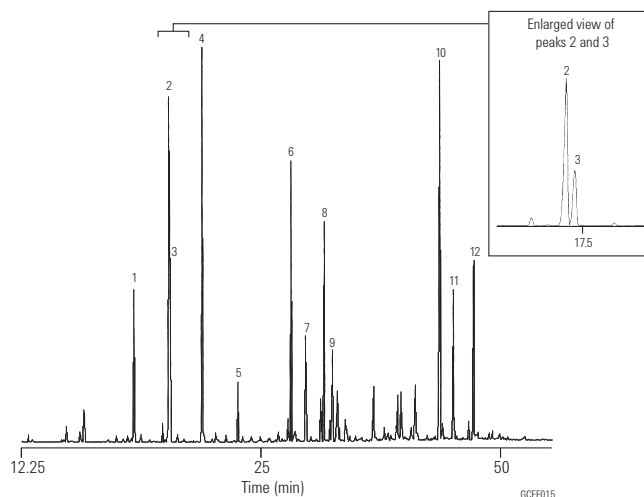
Oven: 50 °C for 1 min
50-250 °C at 3.5 °C/min

Injection: Split, 250 °C
Split ratio 1:125

Detector: MSD, 310 °C transfer line
full scan at m/z 35-550

Sample: 1 μ L of 10% oil in methylene chloride

- | | |
|--------------------|---------------------------|
| 1. r-Methylansiole | 7. β -Caryophyllene |
| 2. Linalool | 8. Cinnamylacetate |
| 3. Methylbenzoate | 9. Germacrene-D |
| 4. Benzylacetate | 10. Benzyl benzoate |
| 5. Geraniol | 11. Faneosolacetate |
| 6. Geranylacetate | 12. Benzyl salicylate |



Suggested Supplies

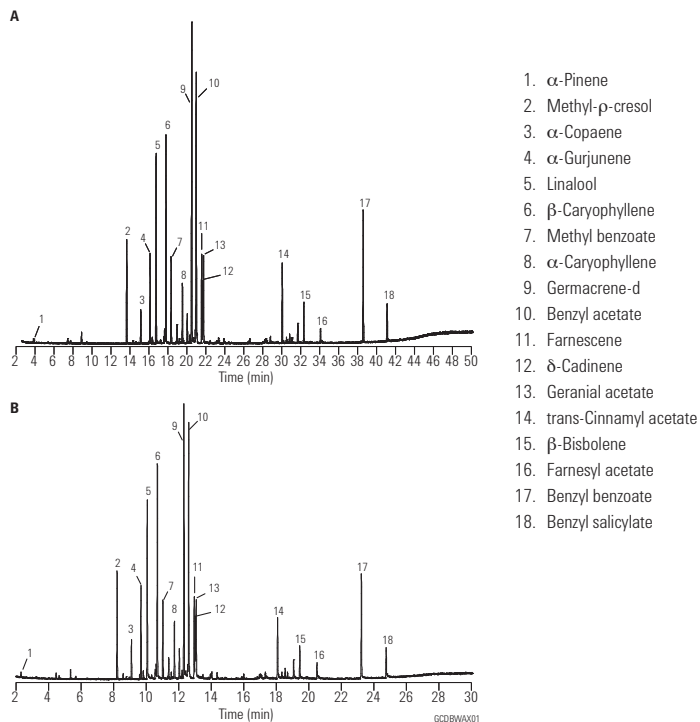
Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 μ L tapered, FN 23-26s/42/HP, 5181-1273

Ylang Ylang Oil

Column: DB-WAX
121-7022
20 m x 0.18 mm, 0.18 μ m

Carrier: A: Helium 26.3 cm/sec measured at 45 °C
B: Hydrogen 44.3 cm/sec measured at 45 °C

Oven: A: 45 °C hold 1.28 min
4.68 °C/min to 250 °C hold 21.81 min
B: 45 °C hold 0.77 min
7.79 °C/min to 250 °C hold 13.09 min

**Rosemary Oil**

Column: Cyclosil-B
112-6632
30 m x 0.25 mm, 0.25 μ m

Carrier: Hydrogen at 40 cm/sec, measured at 60 °C

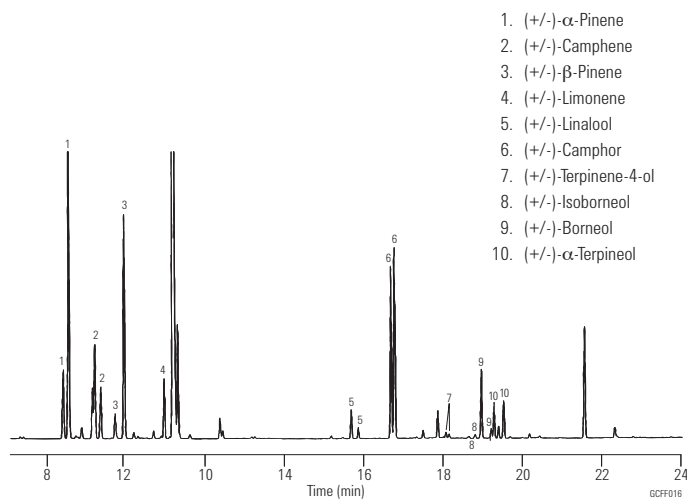
Oven: 55 °C for 1 min
50-180 °C at 5 °C/min

Injection: Split, 250 °C
Split ratio 50:1

Detector: FID, 340 °C

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 μ L tapered, FN 23-26s/42/HP, 5181-1273



Citrus Flavored Carbonated Beverage (Soda)

Column: Cyclosil-B
112-6632
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 37 cm/sec,
measured at 40 °C

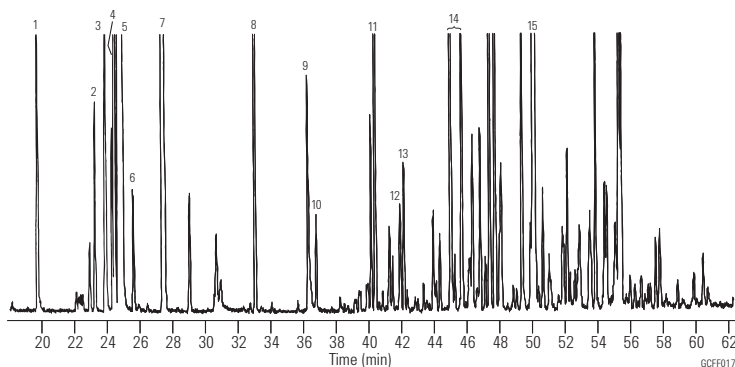
Oven: 40-190 °C at 2 min

Sampler: Headspace
no stir, NaCl 1g/10 mL sample
Adsorption: 27 °C for 68 min
Desorption: 250 °C for 15 min

Injection: Split, 1:5
Polyacrylate fiber, 85 µm

Detector: MSD, 280 °C transfer line

- | | |
|----------------------|----------------------|
| 1. S-(-)-Limonene | 8. Linalool |
| 2. p-Cymene | 9. Decanol |
| 3. (+)-Limonene | 10. Terpinen-4-ol |
| 4. Octanol | 11. Phenethylalcohol |
| 5. γ-Terpinene | 12. α-Terpineol |
| 6. Nonanol | 13. BHT |
| 7. 2-Ethyl-1-Hexanol | |



Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop,
glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP,
5181-1273

Alcohol Beverage Standard

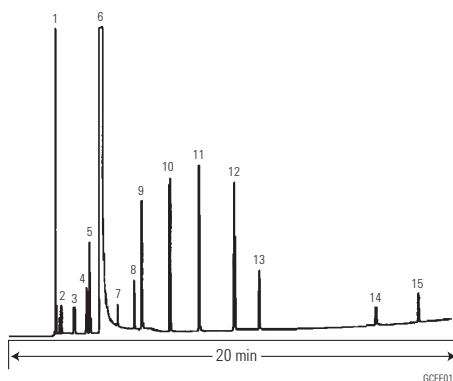
Column: HP-FFAP
19091F-105
50 m x 0.20 mm, 0.30 µm

Carrier: Hydrogen

Oven: 60 °C for 4 min
60-200° C at 6 °C/min
200 °C for 2 min

Detector: FID

1. Acetaldehyde
2. Acetone
3. Ethyl formate
4. Ethyl acetate
5. Methanol
6. Ethanol
7. Diacetyl
8. sec-Butanol
9. n-Propanol
10. Isobutanol
11. n-Butanol
12. Isoamyl alcohol
13. n-Amyl alcohol
14. Acetic acid
15. Propionic acid



Bourbon

Column: HP-INNOWax
19091N-133
30 m x 0.25 mm, 0.25 µm

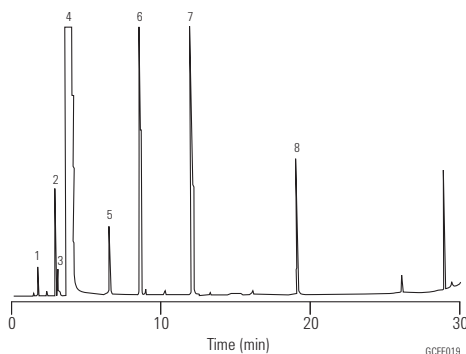
Carrier: Helium, 33 cm/sec, 15.5 psi (35°C)
1.5 mL/min constant flow

Oven: 35 °C for 5 min
35-150 °C at 5 °C/min
150-250 °C at 20 °C/min
250 °C for 2 min

Injection: Split, 220 °C
Split ratio 25:1

Detector: FID 280 °C

Sample: 1 µL



1. Acetaldehyde
2. Ethyl acetate
3. Methanol
4. Ethanol
5. Acetic acid
6. n-Propanol
7. Isobutanol
8. 2-Methyl-1-butanol or 3-Methyl-1-Butanol

Alditol Acetates

Column: DB-225
122-2231
30 m x 0.25 mm, 0.15 µm

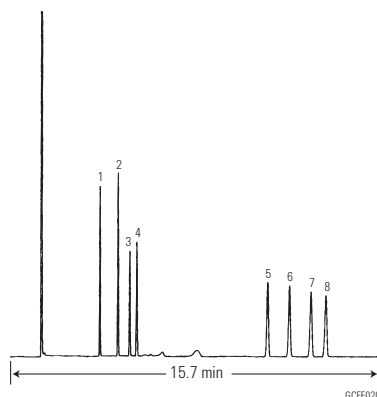
Carrier: Hydrogen at 36.5 cm/sec

Oven: 220 °C isothermal

Injection: Split, 225 °C
Split ratio 1:50

Detector: FID, 250 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL



1. Rhamnitol
2. Fucitol
3. Ribitol
4. Arabinitol
5. Mannitol
6. Galactitol
7. Glucitol
8. Inositol

Strawberry Syrup

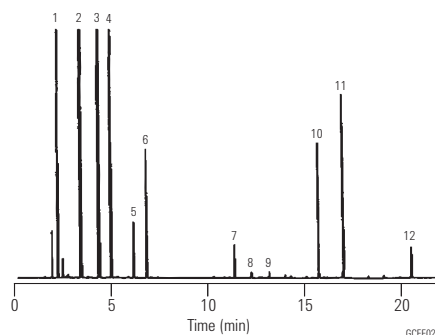
Column: HP-INNOWax
19091N-213
30 m x 0.32 mm, 0.50 µm

Carrier: Helium, 40 cm/sec, 11.7 psi (60°C)
2.5 mL/min constant flow

Oven: 60 °C for 1 min
60-250 °C at 10 °C/min
250 °C for 2 min

Injection: Split, 220 °C
Split ratio 60:1

Detector: FID 275 °C



1. Ethyl acetate
2. Ethyl butyrate
3. Isoamyl acetate
4. Amyl acetate
5. Isoamyl butyrate
6. Amyl butyrate
7. Ethyl benzoate
8. Citronellol
9. Geraniol
10. Ethyl-3-phenyl oxiran carboxylate
11. Strawberry aldehyde
12. Benzyl benzoate

Separation of TMS-derivatized sugars using VF-1ms

Column: VF-1ms
CP8912
30 m x 0.25 mm, 0.25 µm

Sample: 5 µL, splitless 1 µL

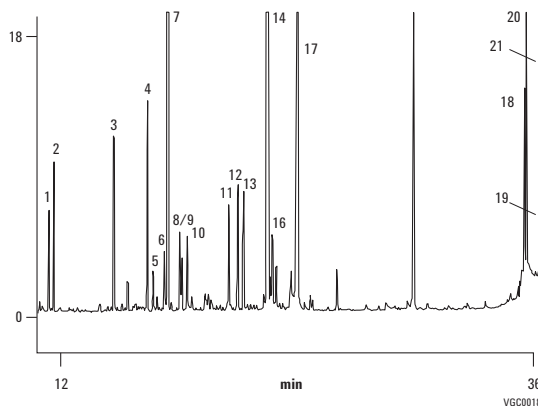
Sample Conc: 40 ppb

Carrier: He, 1.0 mL/min

Oven: 105 °C to 240 °C,
4 °C/min to 300 °C,
20 °C/min

Injection: Split; 1:15

Detector: MS



1. Threitol
2. Erythritol
3. Rhamnose 1
4. Rhamnose 2
5. Xylose 1
6. Arabinol
7. Ribitol
8. 3-O-Methylglucose 1
9. Xylose 2
10. Rhamnitol
11. 3-O-Methylglucose 2
12. Glucuron acid-1,5-lacton
13. Ribose 2
14. Manitol
15. Sorbitol (not identified)
16. Galactitol
17. Glucuron acid
18. Lactulose
19. Lactose
20. Sucrose
21. Threhalose

Organic Acids

Column: DB-FFAP
122-3232
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 40 cm/sec, measured at 100 °C

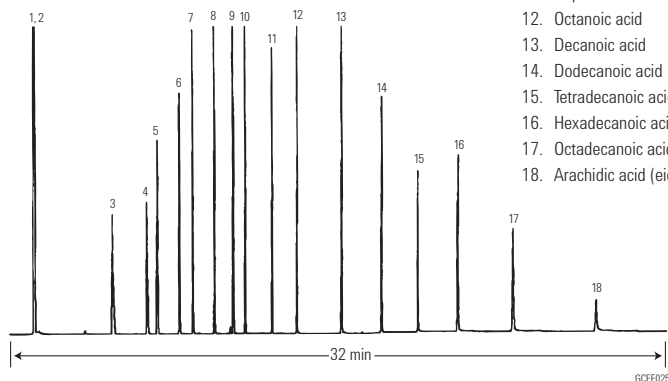
Oven: 100 °C for 5 min
100-250 °C at 10 °C/min
250 °C for 12 min

Injection: Split, 250 °C
Split ratio 1:50

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop,
glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



1. Acetone
2. Formic acid
3. Acetic acid
4. Propionic acid
5. Isobutyric acid
6. Butyric acid
7. Isovaleric acid
8. Valeric acid (pentanoic acid)
9. Isocaproic acid
10. Caproic acid (hexanoic acid)
11. Heptanoic acid
12. Octanoic acid
13. Decanoic acid
14. Dodecanoic acid
15. Tetradecanoic acid
16. Hexadecanoic acid
17. Octadecanoic acid
18. Arachidic acid (eicosanoic acid)

Acids

Column: VF-WAXms
CP9205
30 m x 0.25 mm, 0.25 µm

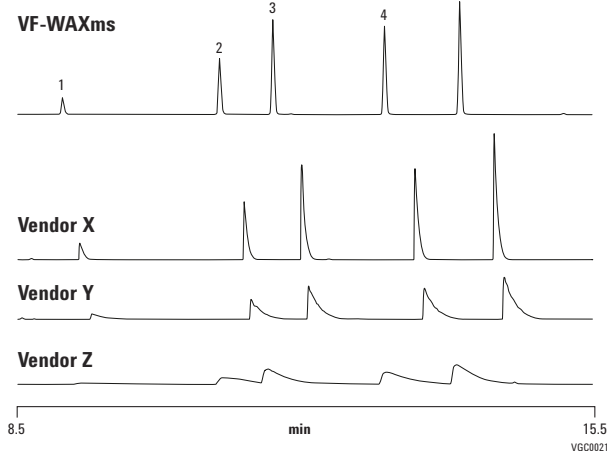
Sample: Acid sample, 0.1% (Cyclohexane), 1.0 µL

Carrier: Hydrogen, 75 kPa

Oven: 60 °C to 200 °C, 5 °C/min

Injection: 250 °C, split 100 mL/min

1. Acetic acid
2. Propionic acid
3. Iso-butyric acid
4. Butyric acid
5. Iso-valeric acid

**Bacterial Fatty Acid Methyl Esters**

Column: DB-5
122-5032
30 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen at 42 cm/sec

Oven: 150 °C for 4 min
150-250 °C at 4 °C/min

Injection: Split ratio 1:100

Detector: FID
Nitrogen makeup gas at 30 mL/min

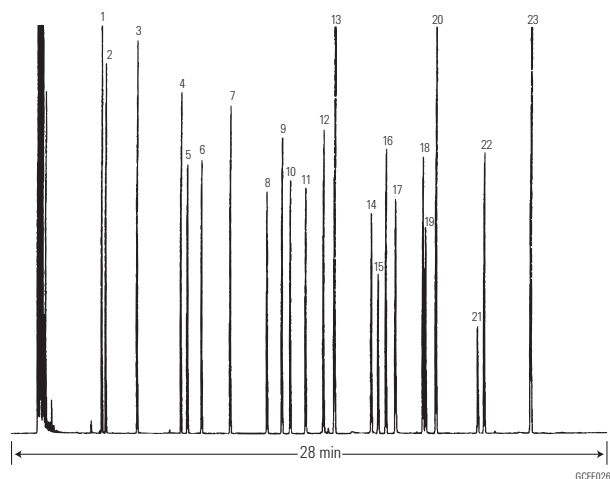
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



- | | |
|---------------------------------|---|
| 1. C _{11:0} | Methylundecanoate |
| 2. 2-OH C _{10:0} | Methyl 2-hydroxydecanoate |
| 3. C _{12:0} | Methyl laurate |
| 4. C _{13:0} | Methyl tridecanoate |
| 5. 2-OH C _{12:0} | Methyl 2-hydroxydodecanoate |
| 6. 3-OH C _{12:0} | Methyl 3-hydroxydodecanoate |
| 7. C _{14:0} | Methyl myristate |
| 8. 12-Me C _{14:0} | Methyl 12-methyltetradecanoate |
| 9. C _{15:0} | Methyl pentadecanoate |
| 10. 2-OH C _{14:0} | Methyl 2-hydroxytetradecanoate |
| 11. 3-OH C _{14:0} | Methyl 3-hydroxytetradecanoate |
| 12. C _{16:1} | Methyl palmitoleate |
| 13. C _{16:0} | Methyl palmitate |
| 14. 14-Me C _{16:0} | Methyl 14-methylhexadecanoate |
| 15. 9,10-diMe C _{16:0} | Methyl cis-9,10-methylene hexadecanoate |
| 16. C _{17:0} | Methyl heptadecanoate |
| 17. 2-OH C _{16:0} | Methyl 2-hydroxyhexadecanoate |
| 18. C _{18:1} | Methyl oleate |
| 19. C _{18:1} | Methyl elaidate |
| 20. C _{18:0} | Methyl stearate |
| 21. 9,10-diMe C _{18:0} | Methyl cis-9,10-methylene octadecanoate |
| 22. C _{19:0} | Methyl nonadecanoate |
| 23. C _{20:0} | Methyl arachidate |

Separation of cis-trans FAME isomers

Column: Select FAME
CP7421
200 m x 0.25 mm,

Sample: 0.5 μ L

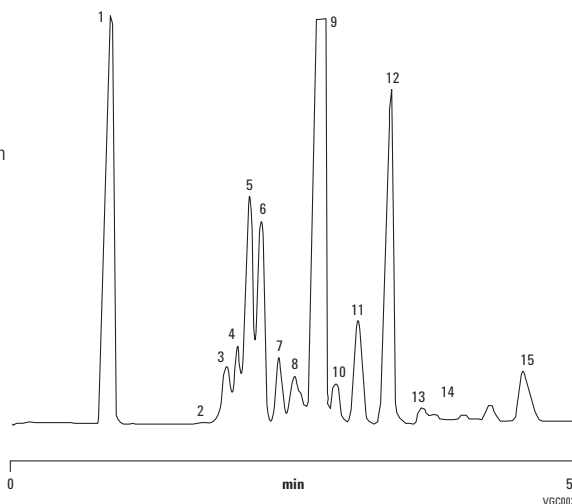
Sample Conc: 5 g approx. per component on the column

Carrier: Helium, 520 kPa

Oven: 185 °C

Injection: Split, 1:20

Detector: FID



1. C18:0
2. C18:1 7 trans
3. C18:1 8 trans
4. C18:1 9 trans
5. C18:1 10 trans
6. C18:1 11 trans
7. C18:1 12 trans
8. C18:1 13 trans + ?
9. C18:1 9 cls
10. C18:1 10 cls
11. C18:1 11 cls
12. C18:1 12 cls
13. C18:1 13 cls
14. C18:1 14 cls
15. C18:1 15 cls

69 Component FAME Mix

Column: HP-88
112-8867
60 m x 0.25 mm, 0.20 μ m

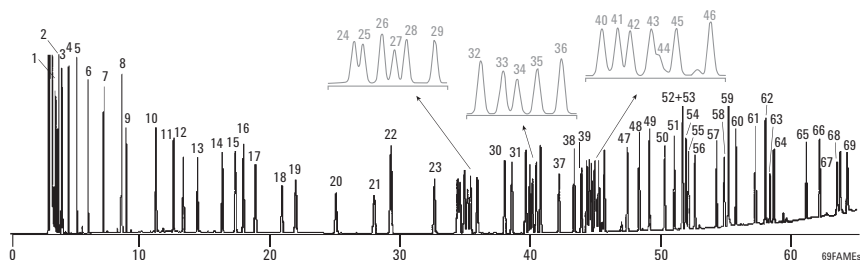
Carrier: He at 1.4 mL/min constant flow

Oven: 125 °C
125 °C to 145 °C at 8 °C/min
145 °C for 26 min
145 °C to 220 °C at 2 °C/min
220 °C for 1 min

Injection: Split, 250 °C
Split ratio 50:1
1 μ L of 70 ppm each in CHCl_3

Detector: FID, 260 °C

- | | | | | |
|-----------------|---------------------|------------------------|---------------------------|----------------------------|
| 1. nC6:0 | 16. C15:1 (14c) | 31. C19:1 (10t) | 46. C18:2 (10t,12c) | 61. nC24:0 |
| 2. nC7:0 | 17. nC16:0 | 32. nC19:0 | 47. nC21:0 | 62. C22:3 (13c,16c,19c) |
| 3. nC8:0 | 18. C16:1 (9t) | 33. C19:1 (7t) | 48. C20:2 (11c,14c) | 63. C22:4 (7c,10c,13c,16c) |
| 4. nC9:0 | 19. C16:1 (9c) | 34. C18:2 (9c,12c) | 49. C21:1 (12c) | 64. C24:1 (15c) |
| 5. nC10:0 | 20. nC17:0 | 35. C19:1 (7c) | 50. C20:3 (8c,11c,14c) | 65. C22:5 (DPA) |
| 6. nC11:0 | 21. C17:1 (10t) | 36. C19:1 (10c) | 51. nC22:0 | 66. C22:6 (DHA) |
| 7. nC12:0 | 22. C17:1 (10c) | 37. C18:3 g(6c,9c,12c) | 52. C22:1 (13t) | 67. C18:1-12 Hydroxy (9t) |
| 8. C12:1 (11c) | 23. nC18:0 | 38. nC20:0 | 53. C20:4 (5c,8c,11c,14c) | 68. C18:0 12 Hydroxy |
| 9. nC13:0 | 24. C18:1 (6t) | 39. C18:3 (9c,12c,15c) | 54. C20:3 (11c,14c,17c) | 69. C18:1-12 Hydroxy (9c) |
| 10. nC14:0 | 25. C18:1 (9t) | 40. C20:1 (5c) | 55. C21:2 (12c,15c) | |
| 11. C14:1 (9t) | 26. C18:1 (11t) | 41. C19:2 (10c,13c) | 56. C22:1 (13c) | |
| 12. C14:1 (9c) | 27. nC18:1 (6c) | 42. C20:1 (11t) | 57. nC23:0 | |
| 13. nC15:0 | 28. C18:1 (9c) | 43. C18:2 CONJ | 58. C20:5 (EPA) | |
| 14. C15:1 (10t) | 29. C18:1 (11c) | 44. C20:1 (8c) | 59. C22:2 (13c,16c) | |
| 15. C15:1 (10c) | 30. nC18:2 (9t,12t) | 45. C20:1 (11c) | 60. C23:1 (14c) | |



FAME Standard

Column: DB-WAX
127-7012
10 m x 0.10 mm, 0.10 µm

Carrier: Hydrogen at 77 cm/sec,
measured at 40 °C

Oven: 40 °C for 0.5 min
40-195 °C at 25 °C/min
195-205 °C at 3 °C/min
205-230 °C at 8 °C/min
230 °C for 1 min

Injection: Split, 250 °C
Split ratio 1:30

Detector: FID, 250 °C

Suggested Supplies

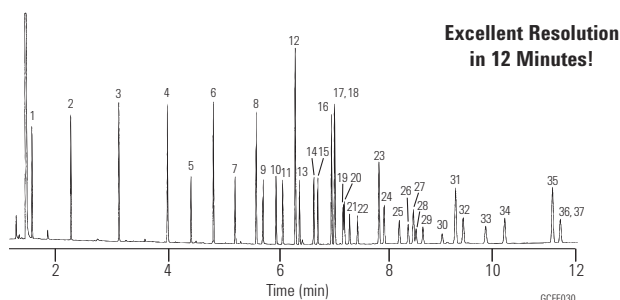
Septum: 11 mm Advanced Green septa,
5183-4759

Liner: Split, single taper, low pressure drop,
glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP,
5181-1273

1. Butyric acid methyl ester (C_{4:0})
2. Caproic acid methyl ester (C_{6:0})
3. Caprylic acid methyl ester (C_{8:0})
4. Capric acid methyl ester (C_{10:0})
5. Undecanoic acid methyl ester (C_{11:0})
6. Lauric acid methyl ester (C_{12:0})
7. Tridecanoic acid methyl ester (C_{13:0})
8. Myristic acid methyl ester (C_{14:0})
9. Myristoleic acid methyl ester (C_{14:1})
10. Pentadecanoic acid methyl ester (C_{15:0})
11. cis-10-Pentadecenoic acid methyl ester (C_{15:1})
12. Palmitic acid methyl ester (C_{16:0})
13. Palmitoleic acid methyl ester (C_{16:1})
14. Heptadecanoic acid methyl ester (C_{17:0})
15. cis-10-Heptadecenoic acid methyl ester (C_{17:1})
16. Stearic acid methyl ester (C_{18:0})
17. Oleic acid methyl ester (C_{18:1n9c})
18. Elaidic acid methyl ester (C_{18:1n9t})
19. Linoleic acid methyl ester (C_{18:2n6c})
20. Linolelaidic acid methyl ester (C_{18:2n6t})
21. γ-Linolenic acid methyl ester (C_{18:3n6})
22. Linolenic acid methyl ester (C_{18:3n3})
23. Arachidic acid methyl ester (C_{20:0})
24. cis-11-Eicosenoic acid methyl ester (C_{20:1})
25. cis-11,14-Eicosadienoic acid methyl ester (C_{20:2})
26. cis-8,11,14-Eicosatrienoic acid methyl ester (C_{20:3n6})
27. Heneicosanoic acid methyl ester (C_{21:0})
28. cis-11,14,17-Eicosatrienoic acid methyl ester (C_{20:3n3})
29. Arachidonic acid methyl ester (C_{20:4n6})
30. cis-5,8,11,14,17-Eicosapentaenoic acid methyl ester (C_{20:5n3})
31. Behenic acid methyl ester (C_{22:0})
32. Erucic acid methyl ester (C_{22:1n9})
33. cis-13,16-Docosadienoic acid methyl ester (C_{22:2})
34. Tricosanoic acid methyl ester (C_{23:0})
35. Lignoceric acid methyl ester (C_{24:0})
36. cis-4,7,10,13,16,19-Docosahexaenoic acid methyl ester (C_{22:6n3})
37. Nervonic acid methyl ester (C_{24:1})



FAME Standard

Column: DB-225
127-2222
20 m x 0.10 mm, 0.10 µm

Carrier: Hydrogen at 59.3 cm/sec,
measured at 35 °C

Oven: 35 ° for 0.5 min
35-195 °C at 25 °C/min
195-205 °C at 3 °C/min
205-230 °C at 8 °C/min
230 °C for 1 min

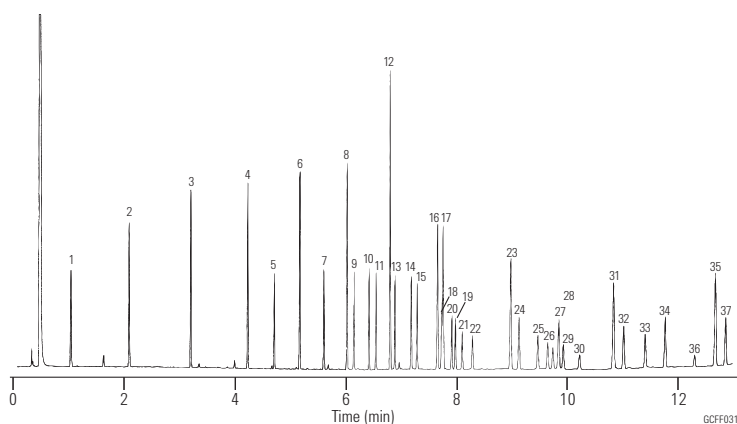
Injection: Split, 250 °C
Split ratio 1:30

Detector: FID, 250 °C

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273

1. Butyric acid methyl ester (C4:0)
2. Caproic acid methyl ester (C6:0)
3. Caprylic acid methyl ester (C8:0)
4. Capric acid methyl ester (C10:0)
5. Undecanoic acid methyl ester (C11:0)
6. Lauric acid methyl ester (C12:0)
7. Tridecanoic acid methyl ester (C13:0)
8. Myristic acid methyl ester (C14:0)
9. Myristoleic acid methyl ester (C14:1)
10. Pentadecanoic acid methyl ester (C15:0)
11. cis-10-Pentadecenoic acid methyl ester (C15:1)
12. Palmitic acid methyl ester (C16:0)
13. Palmitoleic acid methyl ester (C16:1)
14. Heptadecanoic acid methyl ester (C17:0)
15. cis-10-Heptadecenoic acid methyl ester (C17:1)
16. Stearic acid methyl ester (C18:0)
17. Oleic acid methyl ester (C18:1n9c)
18. Elaidic acid methyl ester (C18:1n9t)
19. Linoleic acid methyl ester (C18:2n6c)
20. Linolelaidic acid methyl ester (C18:2n6t)
21. γ-Linolenic acid methyl ester (C18:3n6)
22. Linolenic acid methyl ester (C18:3n3)
23. Arachidic acid methyl ester (C20:0)
24. cis-11-Eicosenoic acid methyl ester (C20:1)
25. cis-11,14-Eicosadienoic acid methyl ester (C20:2)
26. cis-8,11,14-Eicosatrienoic acid methyl ester (C20:3n6)
27. Heneicosanoic acid methyl ester (C21:0)
28. cis-11,14,17-Eicosatrienoic acid methyl ester (C20:3n3)
29. Arachidonic acid methyl ester (C20:4n6)
30. cis-5,8,11,14,17-Eicosapentaenoic acid methyl ester (C20:5n3)
31. Behenic acid methyl ester (C22:0)
32. Erucic acid methyl ester (C22:1n9)
33. cis-13,16-Docosadienoic acid methyl ester (C22:2)
34. Tricosanoic acid methyl ester (C23:0)
35. Lignoceric acid methyl ester (C24:0)
36. cis-4,7,10,13,16,19-Docosahexaenoic acid methyl ester (C22:6n3)
37. Nervonic acid methyl ester (C24:1)



Canola Oil Margarine Partially Hydrogenated FAMEs AOCS Method 1c-89

Column: DB-23
122-2362
60 m x 0.25 mm, 0.25 µm

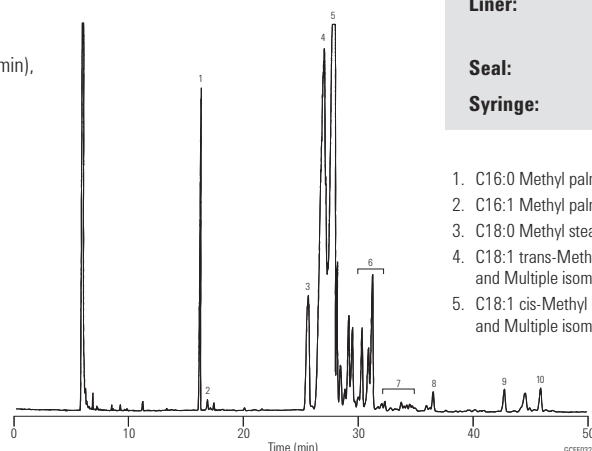
Carrier: Helium at 15 cm/sec (0.44 mL/min),
measured at 150 °C

Oven: 150-200 °C at 1.3 °C/min
200 °C for 10 min

Injection: Split, 210 °C
Split 1:100

Detector: FID, 210 °C

Sample: 1 µL



Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop,
glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273

- | | |
|--|---------------------------------|
| 1. C16:0 Methyl palmitate | 6. C18:2 trans-Multiple isomers |
| 2. C16:1 Methyl palmitoleate | 7. C18:2 cis-Multiple isomers |
| 3. C18:0 Methyl stearate | 8. C18:3 Methyl linolenate |
| 4. C18:1 trans-Methyl elaidate
and Multiple isomers | 9. C20:0 Methyl arachidate |
| 5. C18:1 cis-Methyl oleate
and Multiple isomers | 10. C20:1 Methyl 11-eicosanoate |

Butter Triglycerides I

Column: DB-5ht
123-5731
30 m x 0.32 mm, 0.10 µm

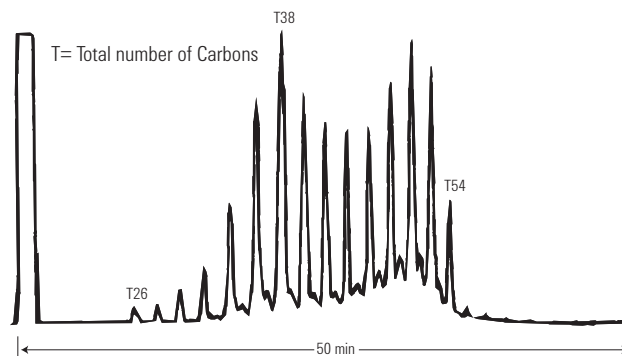
Carrier: Hydrogen at 55 cm/sec, measured at 250 °C

Oven: 35-250 °C at 70 °/min
250-400 °C at 5 °C/min
400 °C for 20 min

Injection: Cool on-column

Detector: FID, 400 °C
Nitrogen makeup gas at 30 mL/min
Baseline corrected

Sample: 1 µL of 9 µg/µL in toluene
(approx. 1% w/w solution)



Butter Triglycerides II

Column: DB-17ht
123-1831
30 m x 0.32 mm, 0.15 µm

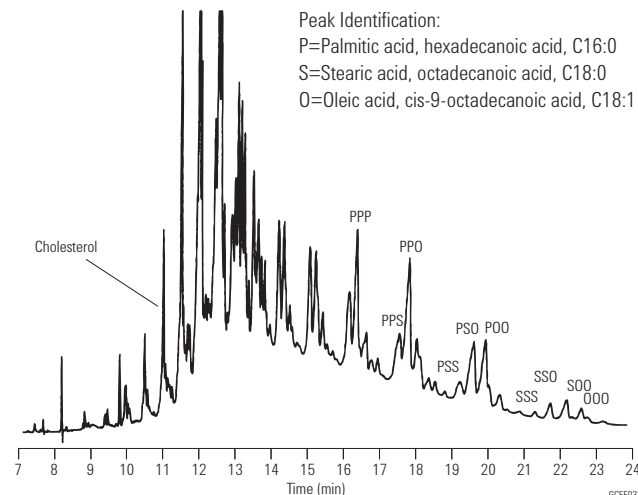
Carrier: Hydrogen at 40 cm/sec

Oven: 250-365 °C at 5 °C/min
365 °C for 1 min

Injection: Cool on-column

Detector: FID, 400 °C
Nitrogen makeup gas at 30 mL/min
Baseline corrected

Sample: 1 µL of 9 µg/µL in toluene
(approx. 1% w/w solution)



Fast screening of FAME isomers in butter

Column: VF-23ms
CP8822
30 m x 0.25 mm, 0.25 µm

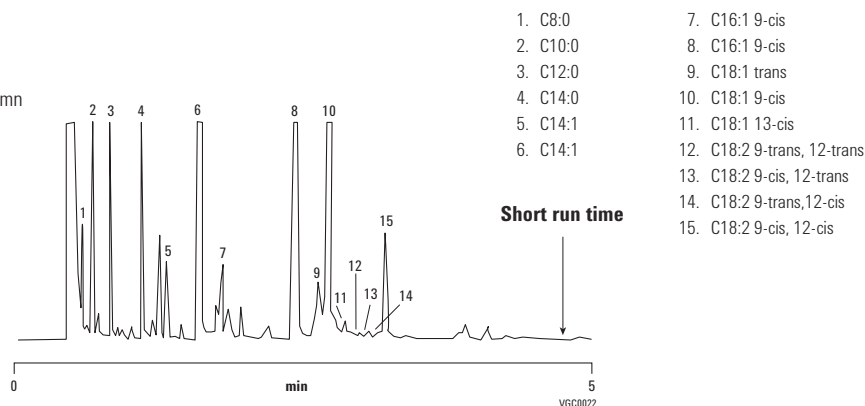
Sample: 0.5 µL ca. 5 ng per component on column

Carrier: Hydrogen, 70 kPa

Oven: 185 °C

Injection: Split, 1:100
T=275 °C

Detector: FID



Pesticides in sunflower oil

Column: VF-5ms
CP8960
60 m x 0.25 mm, 0.25 µm

Sample: 5 µL, splitless

Sample Conc: 40 ppb

Carrier: He, 1.2 mL/min, constant flow

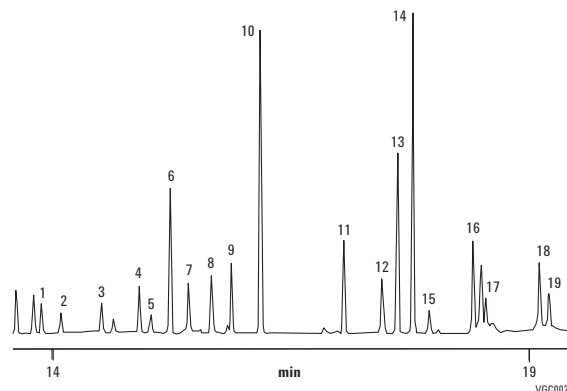
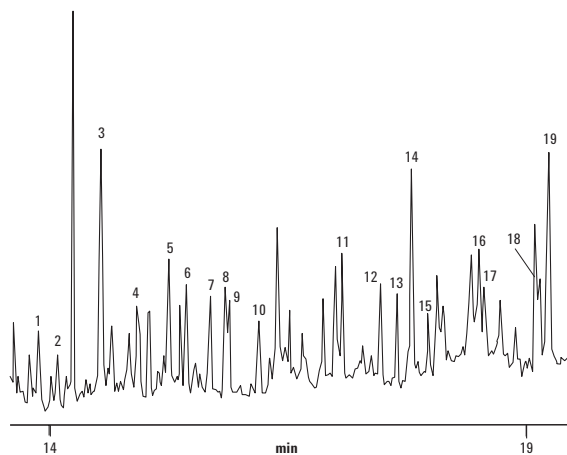
Oven: 70 °C (3.0 min), 25 °C to 190 °C/min (0.0 min)
to 10 °C/min to 320 °C (10 min)

Injection: 1079 with carbofrit liner

Detector: Ion Trap in MS/MS, full scan (left chromatogram)
MS/MS (right chromatogram)

- | | |
|---------------------|------------------------|
| 1. β-HCH | 11. o,p'-DDE |
| 2. γ-HCH | 12. α-Endosulfan |
| 3. δ-HCH | 13. p,p'-DDE |
| 4. + Vinclozolin | 14. o,p'-DDD |
| 5. Pyrimphos methyl | 15. Dieldrin |
| 6. + Malathion | 16. p,p'-DDD |
| 7. Chloropyrifos | 17. b Endosulfan |
| 8. Ethyl parathion | 18. p,p'-DDT |
| 9. Pyrimphos ethyl | 19. Endosulfan sulfate |
| 10. Bromofos | |

- | | |
|---------------------|------------------------|
| 1. β-HCH | 11. o,p'-DDE |
| 2. γ-HCH | 12. α-Endosulfan |
| 3. δ-HCH | 13. p,p'-DDE |
| 4. + Vinclozolin | 14. o,p'-DDD |
| 5. Methyl parathion | 15. Dieldrin |
| 6. Pyrimphos methyl | 16. p,p'-DDD |
| 7. + Fenitrothion | 17. b Endosulfan |
| 8. Chloropyrifos | 18. p,p'-DDT |
| 9. Pyrimphos ethyl | 19. Endosulfan sulfate |
| 10. Promofos | |



Industrial Chemical Applications

Alcohols I

Column: DB-624
125-1334
30 m x 0.53 mm, 3.00 µm

Carrier: Helium at 30 cm/sec,
measured at 40 °C

Oven: 40 °C for 5 min
40-260 °C at 10 °C/min
260 °C for 3 min

Injection: Split, 250 °C
Split ratio 1:10

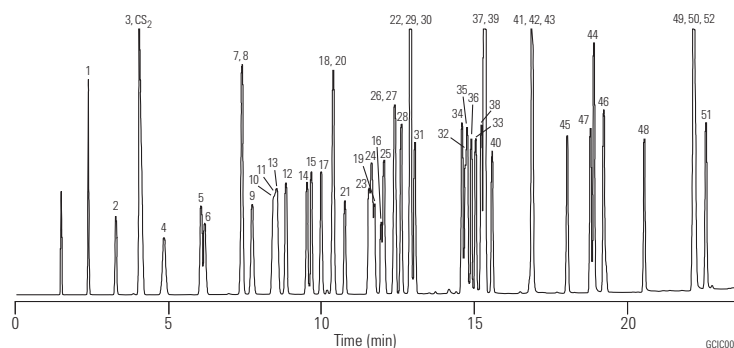
Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL of 0.01-0.05% each solvent in CS₂

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal kit, 5188-5367
Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273

- | | |
|--|--|
| 1. Methanol | 27. 2-Penten-1-ol |
| 2. Ethanol | 28. 3-Methyl-2-buten-1-ol |
| 3. Isopropanol | 29. Cyclopentanol |
| 4. tert-Butanol | 30. 3-Hexanol |
| 5. 2-Propen-1-ol (allyl alcohol) | 31. 2-Hexanol |
| 6. 1-Propanol | 32. 4-Hydroxy-4-methyl-2-pentanone |
| 7. 2-Propyn-1-ol (propargyl alcohol) | 33. Furfuryl alcohol |
| 8. sec-Butanol | 34. cis-3-Hexen-1-ol |
| 9. 2-Methyl-3-buten-2-ol | 35. 1-Hexanol |
| 10. Isobutanol | 36. cis-2-Hexen-1-ol |
| 11. 2-Methoxyethanol (methyl Cellosolve) | 37. Cyclohexanol |
| 12. 3-Buten-1-ol | 38. 3-Heptanol |
| 13. 2-Methyl-2-butanol (tert-amyl alcohol) | 39. 2-Heptanol |
| 14. 1-Butanol | 40. 2-Butoxyethanol (butyl Cellosolve) |
| 15. 2-Buten-1-ol (crotyl alcohol) | 41. cis-4-Hepten-1-ol |
| 16. Ethylene glycol | 42. trans-2-Hepten-1-ol |
| 17. 1-Penten-3-ol | 43. 1-Heptanol |
| 18. 2-Pentanol | 44. Benzyl alcohol |
| 19. Glycidol | 45. 2-Ethyl-1-hexanol |
| 20. 3-Pentanol | 46. a-Methylphenethyl alcohol |
| 21. 2-Ethoxyethanol (Cellosolve) | 47. 1-Octanol |
| 22. Propylene glycol | 48. 1-Nonanol |
| 23. 3-Methyl-1-butanol (isoamyl alcohol) | 49. 2-Phenoxyethanol |
| 24. 2-Methyl-1-butanol (active amyl alcohol) | 50. a-Ethylphenethyl alcohol |
| 25. 4-Methyl-2-pentanol | 51. b-Ethylphenethyl alcohol |
| 26. 1-Pentanol | 52. 1-Decanol |



Halogenated Hydrocarbons I

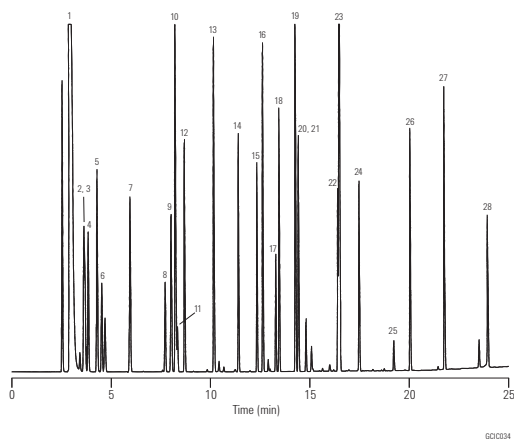
Column: DB-624
123-1334
30 m x 0.32 mm, 1.80 µm

Carrier: Helium at 35 cm/sec

Oven: 35 °C for 5 min
35-245 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:50

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

**Suggested Supplies**

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal kit, 5188-5367

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

- | | |
|---|--|
| 1. Pentane | 15. trans-1,2-Dichloropropene |
| 2. Iodomethane | 16. 1,1,2-Trichloroethane |
| 3. 1,1-Dichloroethene | 17. 1,1,1,2-Tetrachloroethane |
| 4. 1,1,2-Trichlorotrifluoroethane (Freon-113) | 18. 1,2-Dibromoethane (EDB) |
| 5. 3-Chloropropene (allyl chloride) | 19. 1-Chlorohexane |
| 6. Methylene chloride | 20. trans-1,4-Dichloro-2-butene |
| 7. 1,1-Dichloroethane | 21. Iodoform |
| 8. Chloroform | 22. Hexachlorobutadiene |
| 9. 1,1,1-Trichloroethane | 23. 1,2,3-Trichloropropane |
| 10. 1-Chlorobutane | 24. 1,1,2,2-Tetrachloroethane |
| 11. Carbon tetrachloride | 25. Pentachloroethane |
| 12. 1,2-Dichloroethane | 26. 1,2-Dibromo-3-chloropropane (DBCP) |
| 13. 1,2-Dichloropropane | 27. Hexachloroethane |
| 14. cis-1,2-Dichloropropene | 28. Hexachlorocyclopentadiene |

Aromatic Solvents

Column: DB-200
122-2032
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 31 cm/sec

Oven: 50 °C for 5 min
50-160 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:100

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 0.5 µL of 0.5 µg/µL
standard in hexane

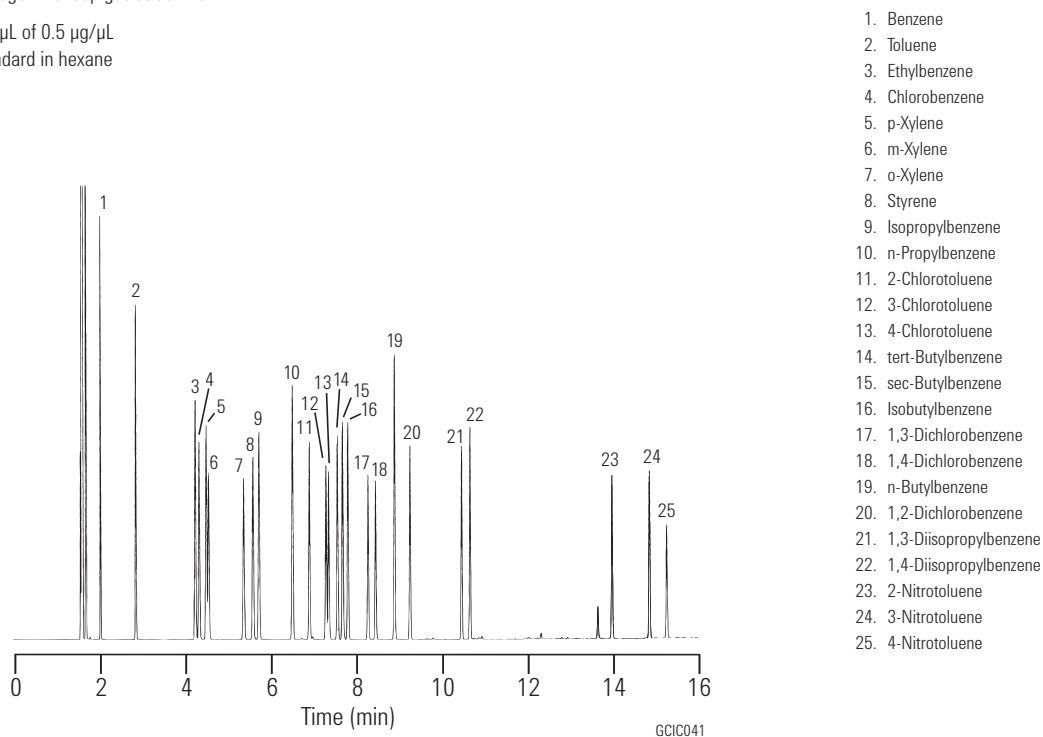
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal kit, 5188-5367

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



1. Benzene
2. Toluene
3. Ethylbenzene
4. Chlorobenzene
5. p-Xylene
6. m-Xylene
7. o-Xylene
8. Styrene
9. Isopropylbenzene
10. n-Propylbenzene
11. 2-Chlorotoluene
12. 3-Chlorotoluene
13. 4-Chlorotoluene
14. tert-Butylbenzene
15. sec-Butylbenzene
16. Isobutylbenzene
17. 1,3-Dichlorobenzene
18. 1,4-Dichlorobenzene
19. n-Butylbenzene
20. 1,2-Dichlorobenzene
21. 1,3-Diisopropylbenzene
22. 1,4-Diisopropylbenzene
23. 2-Nitrotoluene
24. 3-Nitrotoluene
25. 4-Nitrotoluene

Phenols I

Column: HP-5ms
19091S-433
30 m x 0.25 mm, 0.25 µm

Carrier: Helium, 33 cm/sec, constant flow

Oven: 35 °C for 5 min
35-220 °C at 8 °C/min

Injection: Splitless, 250 °C

Detector: FID, 300 °C

Sample: 1 µL
20 µg/mL phenols in methylene chloride

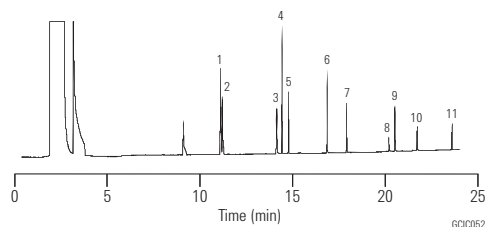
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730

Seal: Gold plated seal kit, 5188-5367

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



1. Phenol
2. 2-Chlorophenol
3. 2-Nitrophenol
4. 2,4-Dimethylphenol
5. 2,4-Dichlorophenol
6. 4-Chloro-3-methylphenol
7. 2,4,6-Trinitrophenol
8. 2,4-Dinitrophenol
9. 4-Nitrophenol
10. 2-Methyl-4,6-dinitrophenol
11. Pentachlorophenol

Inorganic Gases

Column: GS-GasPro
113-4332
30 m x 0.32 mm

Carrier: Helium at 53 cm/sec

Oven: 25 °C for 3 min
25-200 °C at 10 °C/min
200 °C Hold

Injection: Split, 200 °C
Split ratio 1:50

Detector: TCD, 250 °C

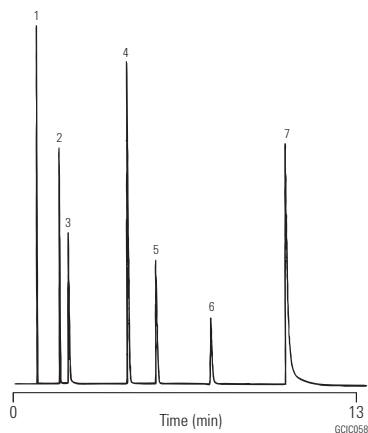
Sample: 50 µL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal kit, 5188-5367



1. Nitrogen
2. CO₂
3. SF₆
4. COS
5. H₂S
6. Ethylene oxide
7. SO₂

Alcohols II

Column: DB-WAXetr
123-7354
50 m x 0.32 mm, 1.00 µm

Carrier: Helium at 50 cm/sec,
measured at 40 °C

Oven: 40 °C for 5 min
40-230 °C at 10 °C/min
230 °C for 5 min

Injection: Split, 250 °C
Split ratio 1:5

Detector: FID, 250 °C
Nitrogen makeup gas at 35 mL/min

Sample: 1 µL of 0.15%
each solvent in CS₂

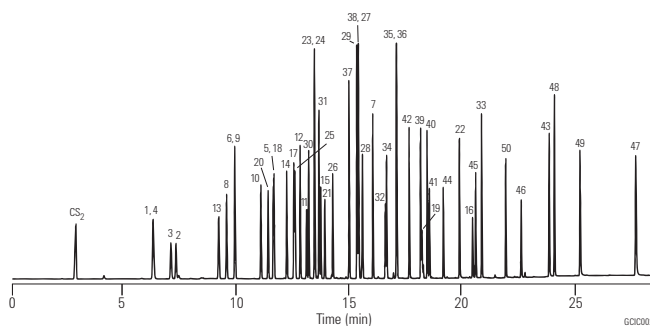
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal kit, 5188-5367

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



- | | |
|--|--|
| 1. Methanol | 26. 1-Pentanol |
| 2. Ethanol | 27. 2-Penten-1-ol |
| 3. Isopropanol | 28. 3-Methyl-2-buten-1-ol |
| 4. tert-Butanol | 29. Cyclopentanol |
| 5. 2-Propen-1-ol (allyl alcohol) | 30. 3-Hexanol |
| 6. 1-Propanol | 31. 2-Hexanol |
| 7. 2-Propyn-1-ol (propargyl alcohol) | 32. 4-Hydroxy-4-methyl-2-pentanone |
| 8. sec-Butanol | 33. Furfuryl alcohol |
| 9. 2-Methyl-3-buten-2-ol | 34. cis-3-Hexen-1-ol |
| 10. Isobutanol | 35. cis-2-Hexen-1-ol |
| 11. 2-Methoxyethanol (methyl Cellosolve) | 36. Cyclohexanol |
| 12. 3-Buten-1-ol | 37. 3-Heptanol |
| 13. 2-Methyl-2-butanol (tert-amyl alcohol) | 38. 2-Heptanol |
| 14. 1-Butanol | 39. 2-Butoxyethanol (butyl Cellosolve) |
| 15. 2-Buten-1-ol (crotyl alcohol) | 40. cis-4-Hepten-1-ol |
| 16. Ethylene glycol | 41. trans-2-Hepten-1-ol |
| 17. 1-Penten-3-ol | 42. 1-Heptanol |
| 18. 2-Pentanol | 43. Benzyl alcohol |
| 19. Glycidol | 44. 2-Ethyl-1-hexanol |
| 20. 3-Pentanol | 45. 1-Octanol |
| 21. 2-Ethoxyethanol (Cellosolve) | 46. 1-Nonanol |
| 22. Propylene glycol | 47. 2-Phenoxyethanol |
| 23. 3-Methyl-1-butanol (isoamyl alcohol) | 48. a-Ethylphenethyl alcohol |
| 24. 2-Methyl-1-butanol (active amyl alcohol) | 49. b-Ethylphenethyl alcohol |
| 25. 4-Methyl-2-pentanol | 50. 1-Decanol |

Alcohols III

Column: HP-InnoWax
19095N-123
30 m x 0.53 mm, 1.00 µm

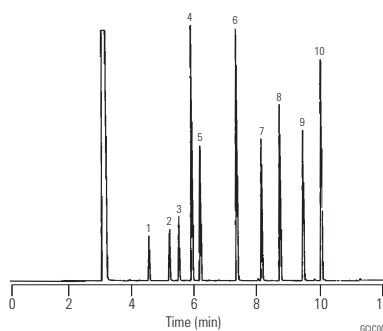
Carrier: Helium, 29 cm/sec, 3.0 psi (45 °C)

Oven: 45 °C for 1 min
45-150 °C at 10 °C/min
4 mL/min constant flow

Injection: Split, 250 °C
Split ratio 25:1

Detector: FID 250 °C

Sample: 1 µL

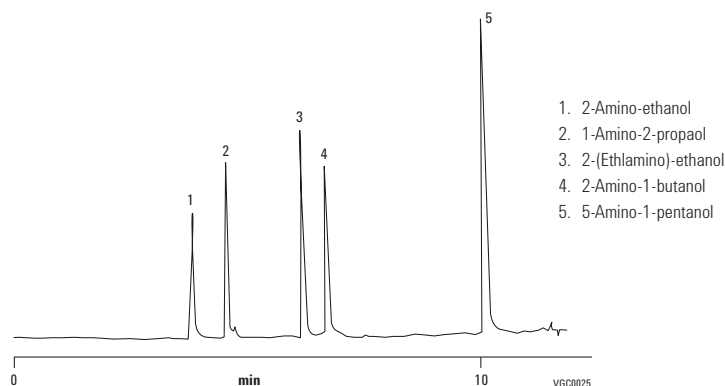


1. 1-Propanol
2. iso-Butanol
3. 3-Methyl-3-pentanol
4. 1-Butanol
5. 4-Methyl-2-pentanol
6. 1-Pentanol
7. 2-Ethyl-1-Butanol
8. 1-Hexanol
9. Cyclohexanol
10. 1-Heptanol

Analysis of Amino Alcohols in Water

Column: CP-Sil 5 CB
CP7640
50 m x 0.53 mm, 2.00 µm

Sample: 0.2 µL
Sample Conc: 1 ppm
Solvent: Water
Carrier: He, 0.7 mL/min, 70 kPa (0.7 bar, 9 psi)
Oven: 65 °C to 100 °C, 10 °C/min
Injection: Splitless
Detector: MS

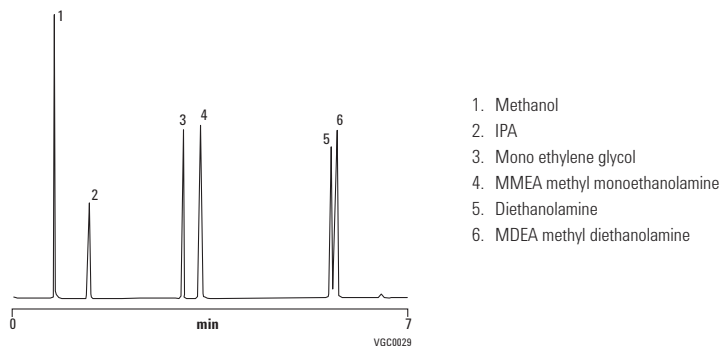


Victor Berezkin and Aleksey B. Lapin, Institute of Petrochemical Synthesis, Russian Academy of Science, Moscow, Russia.

Amines and Alcohols

Column: CP-Volamine
CP7446
15 m x 0.32 mm,

Sample: 0.5 µL
Sample Conc: 1000 ppm, approx. 5 ng per component on the column
Solvent: methanol
Carrier: Helium, 50 kPa, 55 cm/s
Oven: 35 °C (0.5 min) to 240 °C, 30 °C/min
Injection: Split
Detector: MS

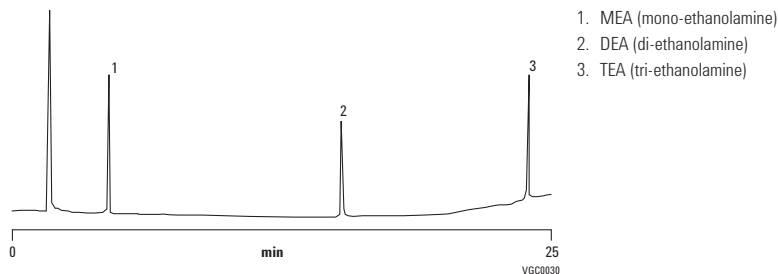


Courtesy of J. Luong, Dow Chemical Canada

Analysis of Ethanolamines

Column: CP-Sil 8 CB for Amines
CP7596
30 m x 0.32 mm, 1.00 µm

Sample Conc: 5-10 ng per component on the column
Solvent: methanol
Carrier: Helium, 50 kPa (0.5 bar, 7 psi)
Oven: 60 °C (5 min) to 220 °C, 6 °C/min
Injection: Split
Detector: FID



Ethoxyethanol

Column: HP-FFAP
19095F-123
30 m x 0.53 mm, 1.00 µm

Carrier: Helium, 10 mL/min

Oven: 60 °C for 1 min
60-100 °C at 5 °C/min
100-210 °C at 10 °C/min

Injection: Split ratio 10:1

Detector: TCD

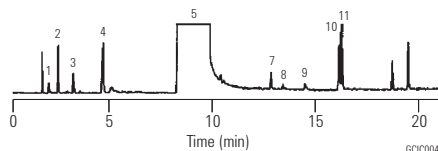
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



- | | |
|--------------------------|---------------------------------|
| 1. Ethylene oxide | 7. Hydroxy acetate |
| 2. Ethyl formate | 8. Acetic acid |
| 3. Ethyl alcohol | 9. Formic acid |
| 4. Water | 10. Ethylene glycol/monoformate |
| 5. 2-Ethoxyethanol | 11. Ethylene glycol/monoacetate |
| 6. 2-Ethoxyethyl acetate | |

Organic Acids

Column: DB-WAXetr
125-7332
30 m x 0.53 mm, 1.00 µm

Carrier: Helium at 37 cm/sec,
measured at 40 °C

Oven: 125 °C for 5 min
125-180 °C at 15 °C/min
180 °C for 12 min

Injection: Split, 250 °C

Detector: FID, 250 °C

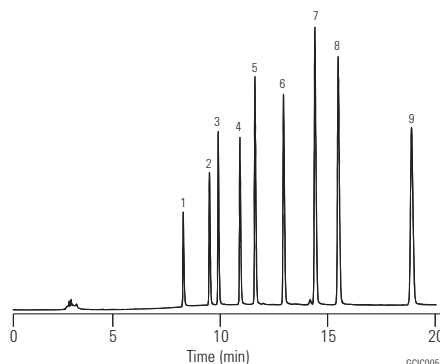
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



- | |
|----------------------------------|
| 1. Acetic acid |
| 2. Propionic acid |
| 3. Isobutyric acid |
| 4. Butyric acid |
| 5. Isovaleric acid |
| 6. Valeric acid (pentanoic acid) |
| 7. Isocaproic acid |
| 8. Caproic acid (hexanoic acid) |
| 9. Heptanoic acid |

Free Organic Acids/C4-C5 Isomers

Column: HP-INNOWax
19091N-133
30 m x 0.25 mm, 0.25 µm

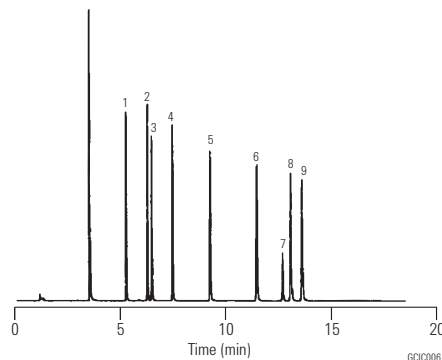
Carrier: Helium 42 cm/sec, 24 psi (120 °C)
1.8 mL/min constant flow

Oven: 110 °C for 1 min
110-133 at 2 °C/min
133-160 °C at 3 °C/min

Injection: Split, 250 °C
Split ratio 40:1

Detector: FID 300 °C

Sample: 1 µL



1. Isobutyric acid
2. Butyric acid
3. Valerolactone
4. 2-Methyl butyric acid
5. Valeric acid
6. 4-Pentenoic acid
7. trans-2-Methyl-2-butenic acid
8. trans-3-Pentenoic acid
9. trans-2-Pentenoic acid

Volatile Amines

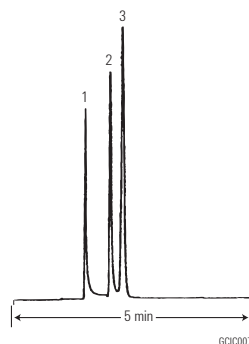
Column: DB-1
125-1035
30 m x 0.53 mm, 5.00 µm

Oven: 30 °C isothermal

Sampler: Headspace

Injection: Split ratio 1:10

Detector: FID
Nitrogen makeup gas at 30 mL/min



1. Methylamine
2. Dimethylamine
3. Trimethylamine

Trace Active Amines, 10 ng on-column

Column: HP-5ms
19091S-213
30 m x 0.32 mm, 1.00 µm

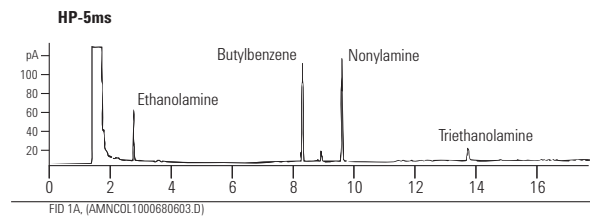
Carrier: Helium, constant pressure 9.79 psi

Oven: 75 °C for 0.5 min
75-250 °C at 10 °C/min
250-320 °C at 25 °C/min
320 °C for 5 min

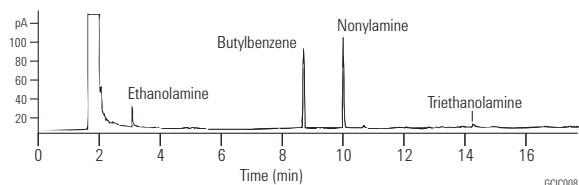
Injection: On-column
Oven tracking mode

Detector: FID 300 °C

Sample: 0.5 µL of each standard in methanol



Another 5% Phenyl Amines Column



Primary Amines

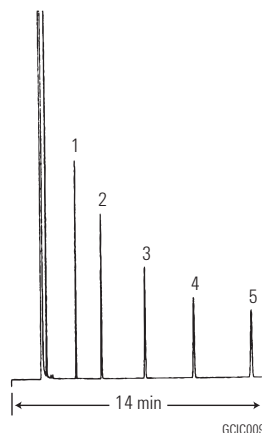
Column: CAM
112-2132
30 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen at 40 cm/sec

Oven: 110 °C isothermal

Injection: Split

Detector: FID
Nitrogen makeup gas at 30 mL/min



1. n-Octylamine
2. n-Nonylamine
3. n-Decylamine
4. Benzylamine
5. Dicyclohexylamine

Polyethyleneamines

Column: DB-5ms
122-5536
30 m x 0.25 mm, 0.50 µm

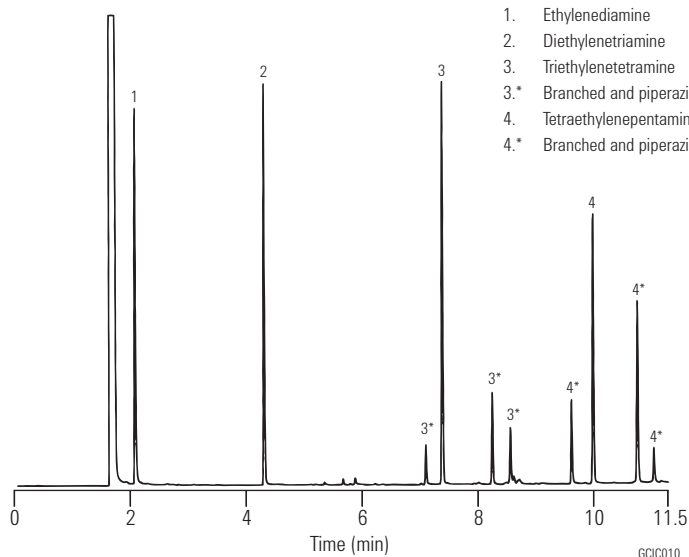
Carrier: Helium at 30 cm/sec, measured at 100 °C

Oven: 100 °C for 1 min
100-320 °C at 20 °C/min

Injection: Split, 250 °C
Split ratio 1:50

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL of 100 ng/µL standard in methanol



1. Ethylenediamine
2. Diethylenetriamine
3. Triethylenetetramine
- 3.* Branched and piperazine analogs of peak #3
4. Tetraethylenepentamine
- 4.* Branched and piperazine analogs of peak #4

Amines and Nitriles

Column: DB-5ms
122-5536
30 m x 0.25 mm, 0.50 μ m

Carrier: Helium at 22 cm/sec, measured at 40 °C

Oven: 40 °C for 1 min
40-260 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:50

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 μ L of 100 ng/ μ L standard in methanol

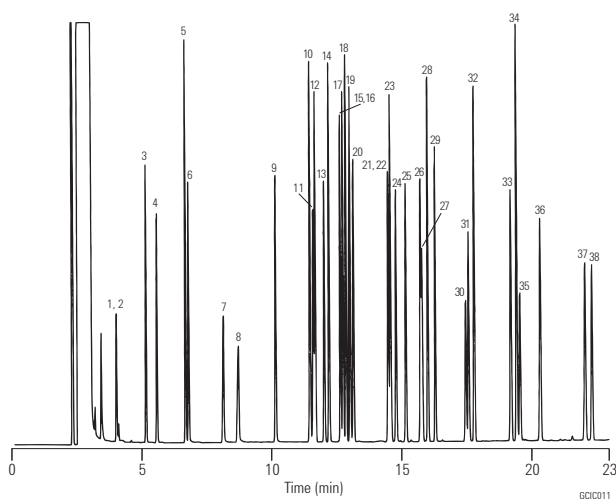
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 μ L tapered, FN 23-26s/42/HP, 5181-1273



- | | |
|-----------------------------|--------------------------|
| 1. Diethylamine | 20. 2-Cyanopyridine |
| 2. Propionitrile | 21. 2-Chloroaniline |
| 3. Diisopropylamine | 22. n-Nonylamine |
| 4. Triethylamine | 23. 2,4-Dimethylaniline |
| 5. Pyridine | 24. 4-Chlorobenzonitrile |
| 6. Pyrimidine | 25. 2,6-Dimethylaniline |
| 7. Pyrazole | 26. 3-Chloroaniline |
| 8. Acrylamide | 27. 4-Chloroaniline |
| 9. Pyridazine | 28. N,N-Diethylaniline |
| 10. Aniline | 29. n-Decylamine |
| 11. 3-Bromopyridine | 30. 4-Bromoaniline |
| 12. Benzonitrile | 31. 3,4-Diaminotoluene |
| 13. 3-Cyanopyridine | 32. 2,6-Diethylaniline |
| 14. Benzylamine | 33. 2-Nitroaniline |
| 15. n-Octylamine | 34. Dicyclohexylamine |
| 16. 1-Methyl-2-pyrrolidine | 35. 3,4-Dichloroaniline |
| 17. N,N-Dimethylbenzylamine | 36. 3-Nitroaniline |
| 18. Phenylethylamine | 37. 4-Nitroaniline |
| 19. N-Benzylmethylamine | 38. Diphenylaniline |

Amines in Water

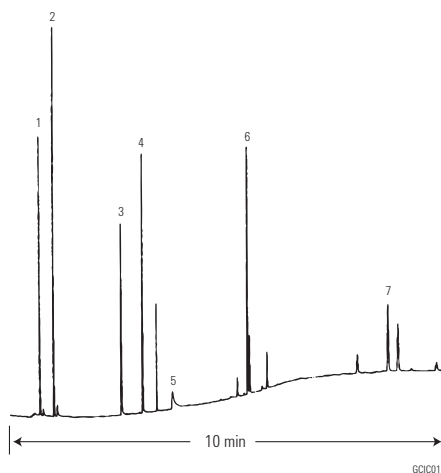
Column: CAM
112-2132
30 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen at 38 cm/sec

Oven: 120-220 °C at 10 °C/min

Injection: Split

Detector: FID
Nitrogen makeup gas at 30 mL/min



1. Ethylenediamine
2. Piperazine
3. Diethylenetriamine
4. N-(2-Aminoethyl) piperazine
5. Aminoethylethanolamine
6. Triethylenetetramine (4 isomers)
7. Tetraethylenepentamine (4 isomers)

Aldehydes and Acids

Column: HP-INNOWax
19091N-213
30 m x 0.32 mm, 0.50 µm

Carrier: Helium, 40 cm/sec, 11.7 psi (60 °C)

Oven: 60 °C for 1 min
60-250 °C at 10 °C/min
2.5 mL/min constant flow

Injection: Split, 250 °C
Split ratio 40:1

Detector: FID 275 °C

Sample: 0.5 µL

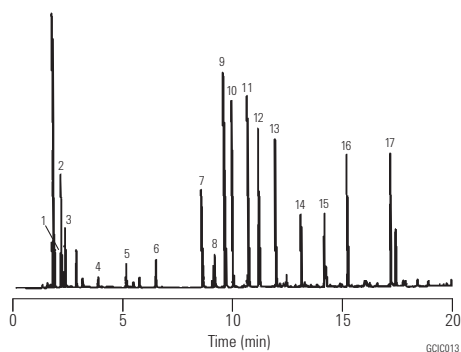
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



- | | |
|---------------------|----------------------|
| 1. Butanal | 10. iso-Butyric acid |
| 2. 2-Methyl butanal | 11. Butyric acid |
| 3. Pentanal | 12. iso-Valeric acid |
| 4. Hexanal | 13. Valeric acid |
| 5. Heptanal | 14. Hexanoic acid |
| 6. Octanal | 15. Heptanoic acid |
| 7. Acetic acid | 16. Octanoic acid |
| 8. Decanal | 17. Decanoic acid |
| 9. Propanoic acid | |

Aldehydes and Ketones

Column: DB-1
123-1034
30 m x 0.32 mm, 3.00 µm

Column: DB-WAX
123-7033
30 m x 0.32 mm, 0.50 µm

Carrier: Helium at 32 cm/sec,
measured at 40 °C

Oven: 40 °C for 5 min
40-210 °C at 10 °C/min 40 °C for 5 min
40-210 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:100

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Suggested Supplies

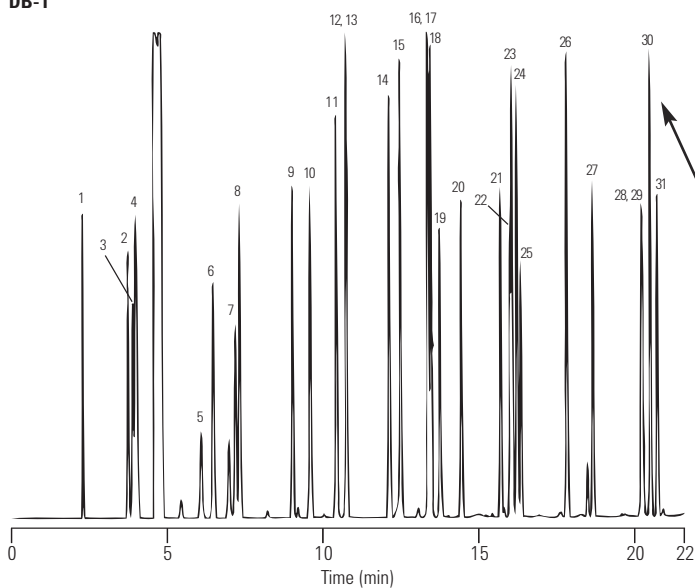
Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

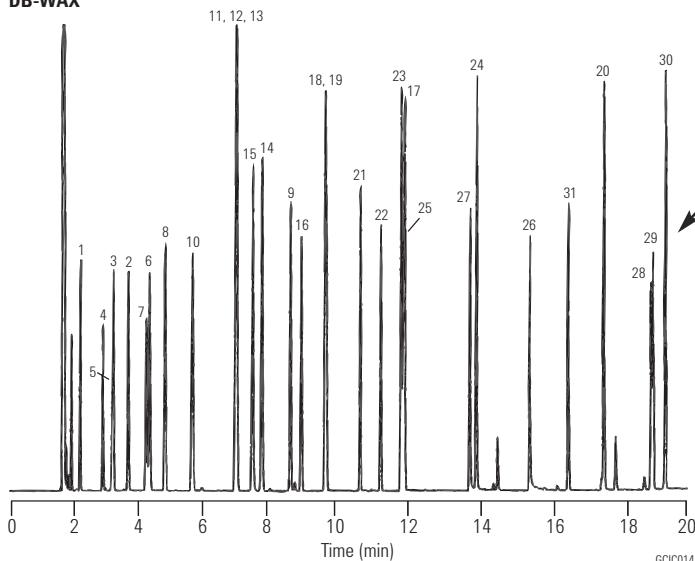
Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273

DB-1



DB-WAX



DB-1 provides the best overall resolution; however, DB-WAX provides better resolution of o- and m-tolualdehyde.

1. Acetaldehyde
2. Acrolein
3. Acetone
4. Propionaldehyde
5. Isobutyraldehyde
6. Methacrolein
7. Butyraldehyde
8. 2-Butanone (MEK)
9. Crotonaldehyde
10. 3-Methyl-2-butanone
11. 2-Pentanone
12. 3-Pentanone
13. Valeraldehyde (pentanal)
14. 4-Methyl-2-pentanone (MIBK)
15. 2-Methyl-3-pentanone
16. 3-Hexanone
17. Cyclopentanone
18. 2-Hexanone
19. Hexanal
20. Furfural
21. 4-Heptanone
22. 3-Heptanone
23. 2-Heptanone
24. Cyclohexanone
25. Heptanal
26. Benzaldehyde
27. Octyl aldehyde
28. o-Tolualdehyde
29. m-Tolualdehyde
30. p-Tolualdehyde
31. Nonyl aldehyde

Formaldehyde Underivatized

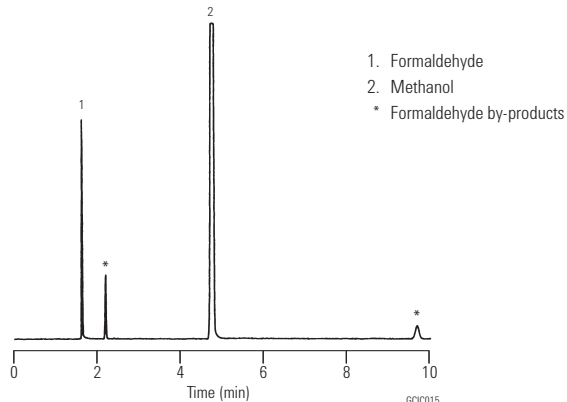
Column: DB-WAX
123-7033
30 m x 0.32 mm, 0.50 µm

Carrier: Helium at 36 cm/sec,
measured at 35 °C

Oven: 35 °C isothermal

Injection: Split, 200 °C
Split ratio 1:100

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

**DNPH Derivative**

Column: DB-1
123-1012
15 m x 0.32 mm, 0.25 µm

Carrier: Helium at 35 cm/sec,
measured at 150 °C

Oven: 150-250 °C at 20 °C/min

Injection: Split, 300 °C
Split ratio 1:100

Detector: ECD, 375 °C
Nitrogen makeup gas at 35 mL/min

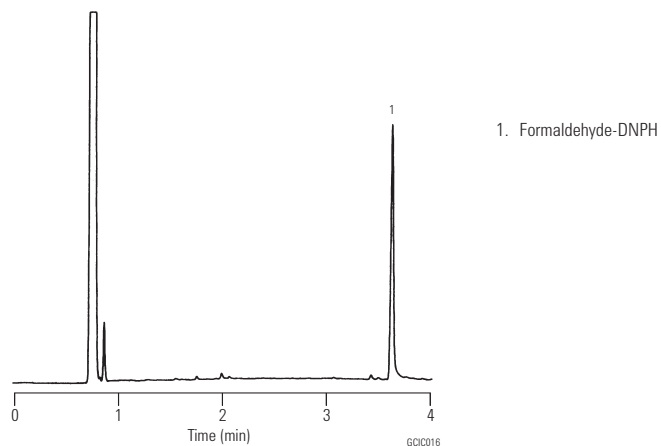
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



PFBHA Derivative

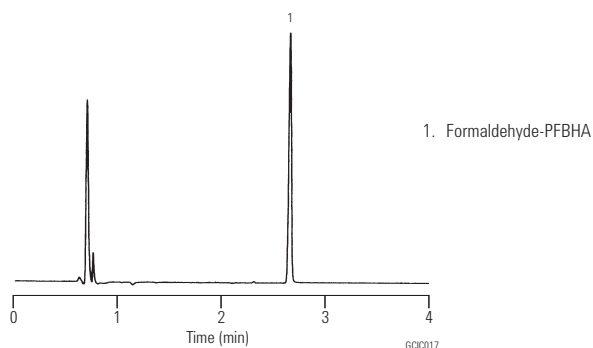
Column: DB-1
123-1012
15 m x 0.32 mm, 0.25 µm

Carrier: Helium at 40 cm/sec,
measured at 60 °C

Oven: 60-100 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:100

Detector: FID, 375 °C
Nitrogen makeup gas at 35 mL/min



Aromatics I

Column: DB-1
125-1034
30 m x 0.53 mm, 3.00 µm

Carrier: Helium at 30 cm/sec,
measured at 40 °C

Oven: 40 °C for 5 min
40-260 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:10

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

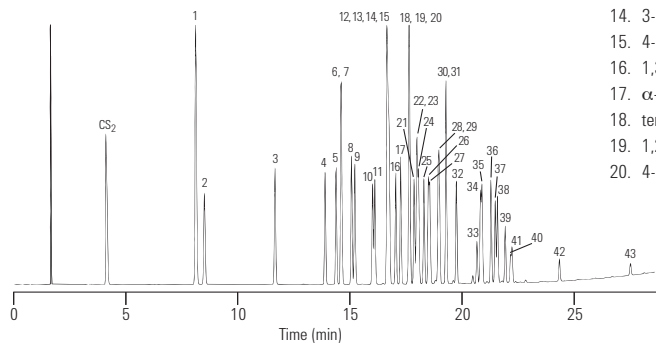
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



1. Benzene
2. Fluorobenzene
3. Toluene
4. Chlorobenzene
5. Ethylbenzene
6. m-Xylene
7. p-Xylene
8. Styrene
9. o-Xylene
10. Isopropylbenzene (cumene)
11. Bromobenzene
12. Propylbenzene
13. 2-Chlorotoluene
14. 3-Chlorotoluene
15. 4-Chlorotoluene
16. 1,3,5-Trimethylbenzene (mesitylene)
17. α-Methylstyrene
18. tert-Butylbenzene
19. 1,2,4-Trimethylbenzene (pseudocumene)
20. 4-Methylstyrene
21. 1,3-Dichlorobenzene
22. 1,4-Dichlorobenzene
23. Isobutylbenzene
24. sec-Butylbenzene
25. 1,2,3-Trimethylbenzene (hemimellitene)
26. 1,2-Dichlorobenzene
27. Iodobenzene
28. Styrene oxide
29. Butylbenzene
30. 4-Chlorostyrene
31. Nitrobenzene
32. 4-tert-Butyltoluene
33. 1,3,5-Trichlorobenzene
34. 2-Nitrotoluene
35. 1,3-Diisopropylbenzene
36. 1,4-Diisopropylbenzene
37. 1,2,4-Trichlorobenzene
38. 3-Nitrotoluene
39. 4-Nitrotoluene
40. 1,2,3-Trichlorobenzene
41. 1-Chloro-4-nitrobenzene
42. 1,2,4,5-Tetrachlorobenzene
43. Pentachlorobenzene

Aromatics II

Column: DB-WAX
125-7032
30 m x 0.53 mm, 1.00 µm

Carrier: Helium at 30 cm/sec, measured at 40 °C

Oven: 40 °C for 5 min
40-230 °C at 10 °C/min
230 °C for 7 min

Injection: Split, 250 °C
Split ratio 1:10

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

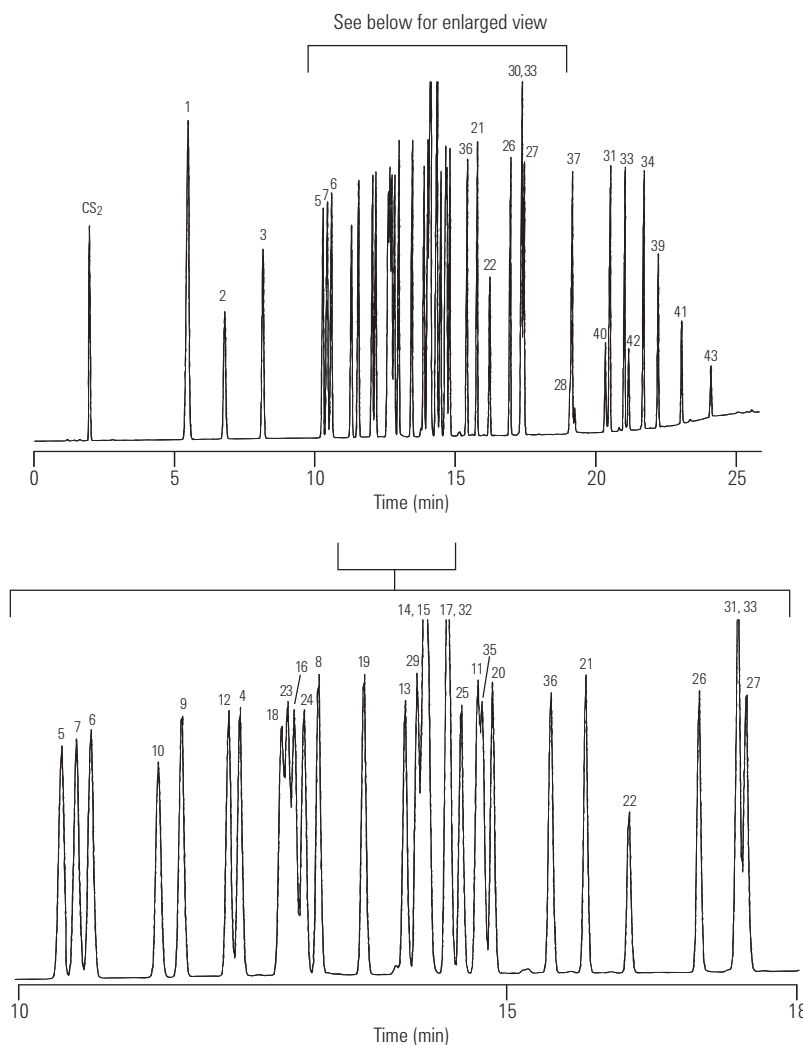
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



1. Benzene
2. Fluorobenzene
3. Toluene
4. Chlorobenzene
5. Ethylbenzene
6. m-Xylene
7. p-Xylene
8. Styrene
9. o-Xylene
10. Isopropylbenzene (cumene)
11. Bromobenzene
12. Propylbenzene
13. 2-Chlorotoluene
14. 3-Chlorotoluene
15. 4-Chlorotoluene
16. 1,3,5-Trimethylbenzene (mesitylene)
17. α-Methylstyrene
18. tert-Butylbenzene
19. 1,2,4-Trimethylbenzene (pseudocumene)
20. 4-Methylstyrene
21. 1,3-Dichlorobenzene
22. 1,4-Dichlorobenzene
23. Isobutylbenzene
24. sec-Butylbenzene
25. 1,2,3-Trimethylbenzene (hemimellitene)
26. 1,2-Dichlorobenzene
27. Iodobenzene
28. Styrene oxide (peak not shown)
29. Butylbenzene
30. 4-Chlorostyrene
31. Nitrobenzene
32. 4-tert-Butyltoluene
33. 1,3,5-Trichlorobenzene
34. 2-Nitrotoluene
35. 1,3-Diisopropylbenzene
36. 1,4-Diisopropylbenzene
37. 1,2,4-Trichlorobenzene
38. 3-Nitrotoluene
39. 4-Nitrotoluene
40. 1,2,3-Trichlorobenzene
41. 1-Chloro-4-nitrobenzene
42. 1,2,4,5-Tetrachlorobenzene
43. Pentachlorobenzene

GCIC019

Impurities in Styrene

Column: DB-WAXetr
123-7363
60 m x 0.32 mm, 0.50 µm

Carrier: Helium at 29.4 cm/sec, measured at 70 °C

Oven: 80 °C isothermal

Injection: Split, 230 °C
Split ratio 1:150

Detector: FID, 240 °C

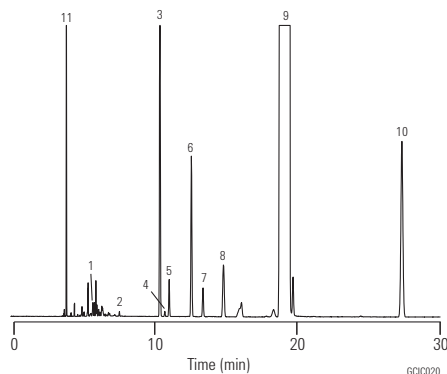
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



1. Benzene
2. Toluene
3. Ethylbenzene
4. p-Xylene
5. m-Xylene
6. Isopropylbenzene
7. o-Xylene
8. n-Propylbenzene
9. Styrene
10. α-Methylstyrene
11. Heptane (IS)

Impurities in Ethylbenzene

Column: HP-INNOWax
19091N-216
60 m x 0.32 mm, 0.50 µm

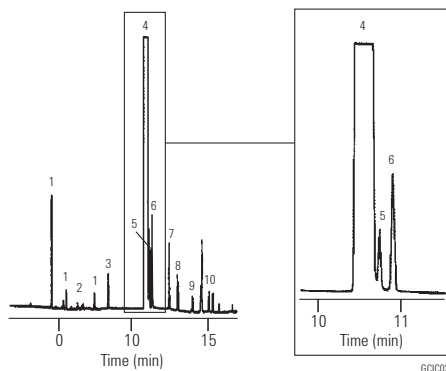
Carrier: Helium, 32 cm/sec, 19.9 psi (60 °C)
2.5 mL/min constant flow

Oven: 60 °C for 1 min
60-92 °C at 4 °C/min
92 °C for 4.5 min
92-220 °C at 20 °C/min

Injection: Split, 220 °C
Split ratio 100:1
ASTM Method D5060

Detector: FID 270 °C

Sample: 0.5 µL
Neat, 99%+



1. Hydrocarbon
2. Benzene
3. Toluene
4. Ethylbenzene
5. p-Xylene
6. m-Xylene
7. Cumene
8. o-Xylene
9. Propylbenzene
10. Styrene

Pyrolysates of Polystyrene

Column: ULTRA 1
19091A-105
50 m x 0.20 mm, 0.33 µm

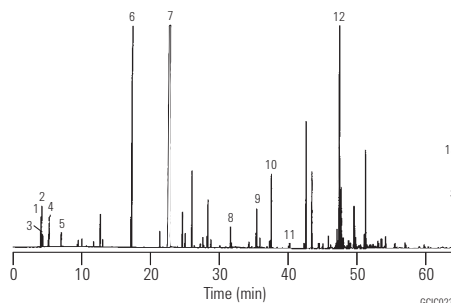
Carrier: Helium, 30 psi, 12 mL/min

Oven: 0-280 at 5 °C/min

Injection: Split, 280 °C
Split ratio 30:1
Pyrolyzer 600 °C

Detector: FID 300 °C

Sample: 100 mg pyrolyzed



1. Propylene
2. Propane
3. 1-Butene
4. Butene
5. Pentane
6. Toluene
7. Styrene
8. $C_2H_5-C(Ph)=CH_2$
9. $C_4H_9-CH_2CH_2-Ph$
10. $C_4H_9-C(Ph)=CH_2$
11. $C_4H_9-CH=C(Ph)CH_3$
12. Styrene dimer
13. Styrene trimer

Esters I

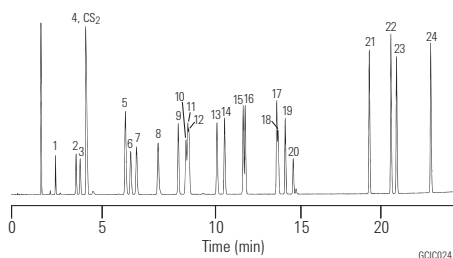
Column: DB-1
125-1034
30 m x 0.53 mm, 3.00 µm

Carrier: Helium at 30 cm/sec,
measured at 40 °C

Oven: 40 °C for 5 min
40-260 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:10

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

**Suggested Supplies**

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

- | | |
|------------------------|---------------------------|
| 1. Methyl formate | 13. sec-Butyl acetate |
| 2. Ethyl formate | 14. Isobutyl acetate |
| 3. Methyl acetate | 15. Propyl propionate |
| 4. Vinyl acetate | 16. Butyl acetate |
| 5. Ethyl acetate | 17. Isoamyl acetate |
| 6. Propyl formate | 18. Amyl acetate |
| 7. Methyl propionate | 19. 2-Ethoxyethyl acetate |
| 8. Isopropyl acetate | 20. 2-Methylbutyl acetate |
| 9. Ethyl acrylate | 21. Methyl benzoate |
| 10. tert-Butyl acetate | 22. Benzyl acetate |
| 11. Ethyl propionate | 23. Ethyl benzoate |
| 12. Propyl acetate | 24. Propyl benzoate |

Esters II

Column: DB-624
125-1334
30 m x 0.53 mm, 3.00 µm

Carrier: Helium at 30 cm/sec,
measured at 40 °C

Oven: 40 °C for 5 min
40-260 °C at 10 °C/min
260 °C for 3 min

Injection: Split, 250 °C
Split ratio 1:10

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

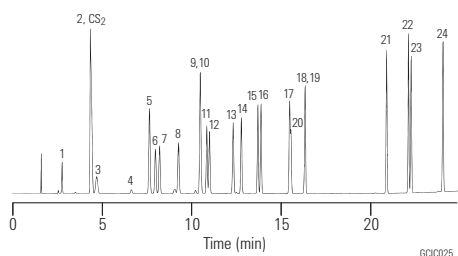
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



- | | |
|------------------------|---------------------------|
| 1. Methyl formate | 13. sec-Butyl acetate |
| 2. Ethyl formate | 14. Isobutyl acetate |
| 3. Methyl acetate | 15. Propyl propionate |
| 4. Vinyl acetate | 16. Butyl acetate |
| 5. Ethyl acetate | 17. Isoamyl acetate |
| 6. Propyl formate | 18. Amyl acetate |
| 7. Methyl propionate | 19. 2-Ethoxyethyl acetate |
| 8. Isopropyl acetate | 20. 2-Methylbutyl acetate |
| 9. Ethyl acrylate | 21. Methyl benzoate |
| 10. tert-Butyl acetate | 22. Benzyl acetate |
| 11. Ethyl propionate | 23. Ethyl benzoate |
| 12. Propyl acetate | 24. Propyl benzoate |

Esters III

Column: HP-InnoWax
19095N-123
30 m x 0.53 mm, 1.00 µm

Carrier: Helium 29 cm/sec, 3.0 psi (45 °C)
4 mL/min constant flow

Oven: 45 °C for 1 min
45-200 °C at 5 °C/min

Injection: Split, 250 °C
Split ratio 25:1

Detector: FID 250 °C

Sample: 1 µL

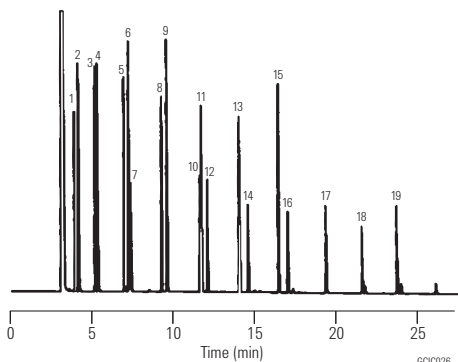
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



- | | |
|----------------------|---------------------------|
| 1. Ethyl propionate | 11. Propyl caproate |
| 2. Propyl acetate | 12. Methyl decanoate |
| 3. Ethyl butyrate | 13. Butyl caproate |
| 4. Propyl propionate | 14. Methyl dodecanoate |
| 5. Propyl butyrate | 15. Butyl heptanoate |
| 6. Ethyl valerate | 16. Methyl tetradecanoate |
| 7. Butyl propionate | 17. Methyl hexadecanoate |
| 8. Propyl valerate | 18. Methyl octadecanoate |
| 9. Ethyl caproate | 19. Methyl eicosanoate |
| 10. Butyl valerate | |

Ethers

Column: DB-624
125-1334
30 m x 0.53 mm, 3.00 µm

Carrier: Helium at 30 cm/sec,
measured at 40 °C

Oven: 40 °C for 5 min
40-260 °C at 10 °C/min
260 °C for 3 min

Injection: Split, 250 °C
Split ratio 1:10

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

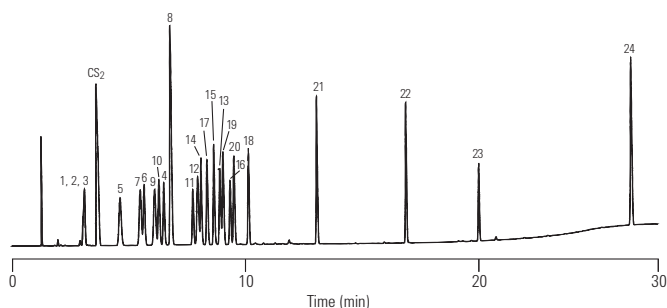
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



GCIC027

- | | |
|---|--|
| 1. Furan | 13. Diglyme (diethylene glycol dimethyl ether) |
| 2. Ethyl vinyl ether | 14. Propyl ether |
| 3. Ethyl ether | 15. Allyl ether |
| 4. 1,3-Dioxalane | 16. 1,4-Dioxane |
| 5. Methyl-tert-butyl ether (MTBE) | 17. Butyl ethyl ether |
| 6. Allyl ethyl ether | 18. Epichlorohydrin |
| 7. Isopropyl ether | 19. Tetrahydropyran |
| 8. Tetrahydrofuran (THF) | 20. Acetal (acetaldehyde diethyl acetal) |
| 9. tert-Amyl methyl ether | 21. Butyl ether |
| 10. Butyl methyl ether | 22. Pentyl ether |
| 11. Glyme (propylene glycol dimethyl ether) | 23. Triglyme (triethylene glycol dimethyl ether) |
| 12. tert-Amyl methyl ether | 24. Benzyl ether |

Glycols I

Column: DB-WAX
124-7032
30 m x 0.45 mm, 0.85 µm

Carrier: Helium at 35 cm/sec,
measured at 50 °C

Oven: 50 °C for 2 min
50-220 °C at 10 °C/min

Injection: Megabore Direct, 250 °C

Detector: FID, 280 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL

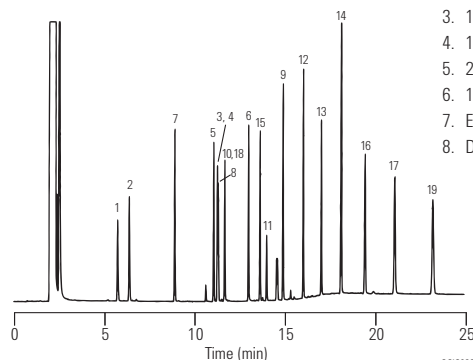
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



GCIC028

- | | |
|---------------------------------------|---------------------------------------|
| 1. Ethylene glycol monomethyl ether | 9. 1,4-Butanediol |
| 2. Ethylene glycol monoethyl ether | 10. Diethylene glycol monoethyl ether |
| 3. 1,3-Propanediol | 11. Dipropylene glycol |
| 4. 1,2-Propanediol (propylene glycol) | 12. 1,5-Pentanediol |
| 5. 2,3-Butanediol | 13. 1,6-Hexanediol |
| 6. 1,3-Butanediol | 14. 1,7-Heptanediol |
| 7. Ethylene glycol monobutyl ether | 15. Diethylene glycol monobutyl ether |
| 8. Diethylene glycol monomethyl ether | 16. 1,8-Octanediol |
| | 17. 1,9-Nonanediol |
| | 18. Ethylene glycol |
| | 19. 1,10-Decanediol |

Glycols II

Column: DB-624
125-1334
30 m x 0.53 mm, 3.00 µm

Carrier: Helium at 30 cm/sec,
measured at 40 °C

Oven: 40 °C for 5 min
40-260 °C at 10 °C/min
260 °C for 3 min

Injection: Split, 250 °C
Split ratio 1:10

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

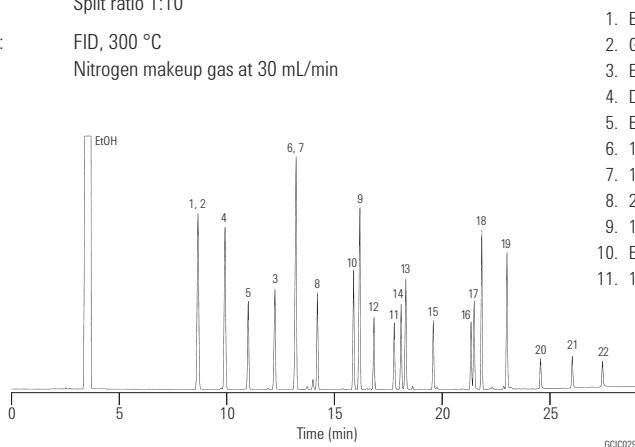
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, dual taper, deactivated, 4 mm id, G1544-80700

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



- | | |
|---------------------------------------|--|
| 1. Ethylene glycol monomethyl ether | 12. Diethylene glycol monomethyl ether |
| 2. Glyme | 13. Diethylene glycol |
| 3. Ethylene glycol | 14. Diethylene glycol monoethyl ether |
| 4. Diglyme | 15. 1,5-Pentanediol |
| 5. Ethylene glycol monoethyl ether | 16. 1,6-Hexanediol |
| 6. 1,3-Propanediol | 17. Diethylene glycol monobutyl ether |
| 7. 1,2-Propanediol (propylene glycol) | 18. Triglyme |
| 8. 2,3-Butanediol | 19. 1,7-Heptanediol |
| 9. 1,3-Butanediol | 20. 1,8-Octanediol |
| 10. Ethylene glycol monobutyl ether | 21. 1,9-Nonanediol |
| 11. 1,4-Butanediol | 22. 1,10-Decanediol |

Glycols III

Column: DB-1
124-1032
30 m x 0.45 mm, 1.27 µm

Carrier: Helium at 35 cm/sec,
measured at 50 °C

Oven: 50 °C for 2 min
50-260 °C at 10 °C/min

Injection: Split, 250 °C

Detector: FID, 280 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL

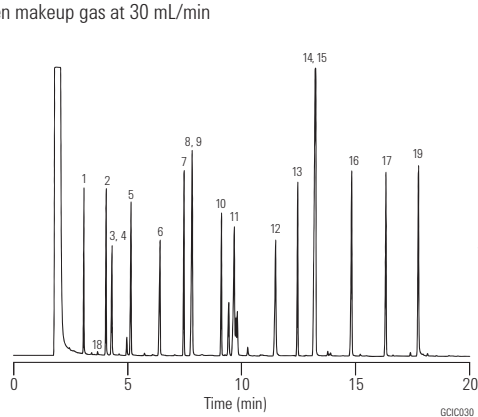
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, dual taper, deactivated, 4 mm id, G1544-80700

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



- | | |
|---------------------------------------|---------------------------------------|
| 1. Ethylene glycol monomethyl ether | 11. Dipropylene glycol |
| 2. Ethylene glycol monoethyl ether | 12. 1,5-Pentanediol |
| 3. 1,3-Propanediol | 13. 1,6-Hexanediol |
| 4. 1,2-Propanediol | 14. 1,7-Heptanediol |
| 5. 2,3-Butanediol | 15. Diethylene glycol monobutyl ether |
| 6. 1,3-Butanediol | 16. 1,8-Octanediol |
| 7. Ethylene glycol monobutyl ether | 17. 1,9-Nonanediol |
| 8. Diethylene glycol monomethyl ether | 18. Ethylene glycol |
| 9. 1,4-Butanediol | 19. 1,10-Decanediol |
| 10. Diethylene glycol monoethyl ether | |

Triethylene Glycol and Impurities

Column: DB-1
124-1032
30 m x 0.45 mm, 1.27 µm

Carrier: Helium at 35 cm/sec,
measured at 50 °C

Oven: 170 °C isothermal

Injection: Split, 250 °C
Split ratio 1:50

Detector: FID, 280 °C
Nitrogen makeup gas at 30 mL/min

Sample: 0.5 µL

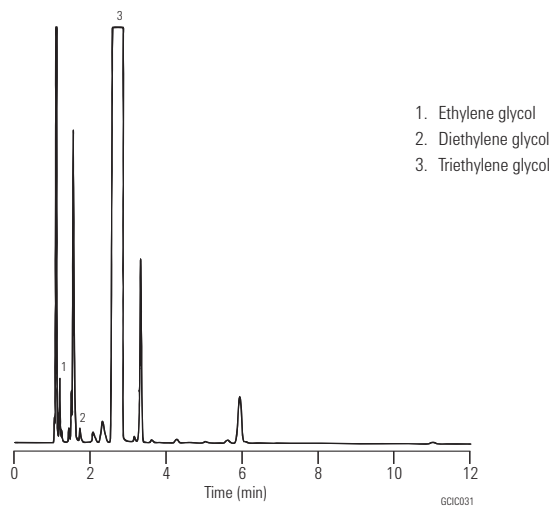
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273

**Ethylene Glycol Mixture**

Column: ULTRA 1
19091A-101
12 m x 0.20 mm, 0.33 µm

Carrier: Helium, 25 cm/sec

Oven: 100 °C for 0.5 min
100-200 °C at 20 °C/min

Injection: Split, 250 °C
Split ratio 100:1

Detector: FID

Sample: 1 µL

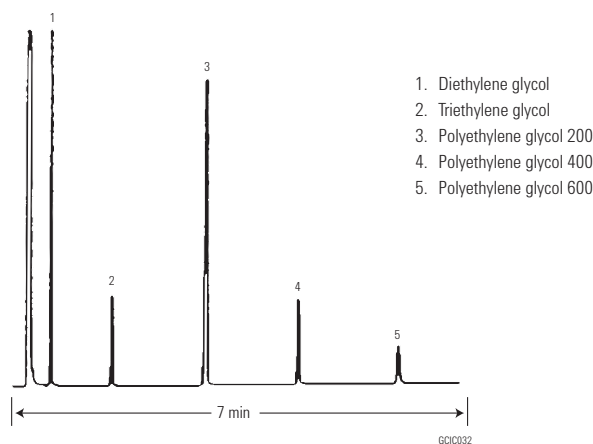
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Liner, splitless, single-taper, glass wool, deactivated, 5062-3587

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



Glycols/Diols

Column: HP-1
19095Z-023
30 m x 0.53 mm, 0.88 µm

Carrier: Helium

Oven: 50 °C for 3 min
50-180 °C at 8 °C/min

Injection: On-column

Detector: FID 250 °C

Sample: 1 µL



1. Ethylene glycol
2. 1,3-Butanediol
3. Ethylene glycol phenyl ether
4. 1,7-Hepatanediol
5. 1,9-Nonanediol
6. 1,10-Decanediol

Halogenated Hydrocarbons II

Column: DB-1
123-1034
30 m x 0.32 mm, 3.00 µm

Carrier: Helium at 35 cm/sec, measured at 35 °C

Oven: 35 °C for 5 min
35-245 °C at 10 °C/min
245 °C for 2 min

Injection: Split, 250 °C
Split ratio 1:100

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: In pentane

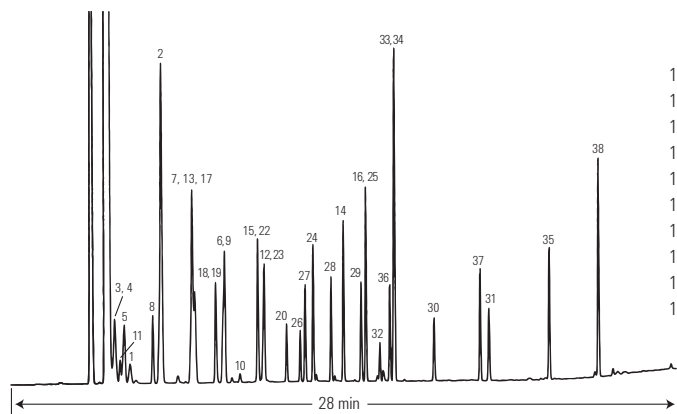
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



- | | |
|---|--|
| 1. 1,1,2-Trichlorotrifluoroethane (Freon-113) | 20. Iodoform |
| 2. 1,1-Dichloroethene | 21. cis-1,3-Dichloropropene |
| 3. Bromoethane (ethyl bromide) | 22. Dibromomethane |
| 4. Iodomethane | 23. Bromodichloromethane |
| 5. 3-Chloropropene (allyl chloride) | 24. 1,3-Dichloropropene |
| 6. 1-Chlorobutane | 25. 1,1-Dichloropropene |
| 7. 2,2-Dichloropropane | 26. trans-1,3-Dichloropropene |
| 8. trans-1,2-Dichloroethene | 27. 1,1,2-Trichloroethane |
| 9. 1,1,1-Trichloroethane | 28. 1,2-Dibromoethane (EDB) |
| 10. Carbon tetrachloride | 29. 1,1,1,2-Tetrachloroethane |
| 11. Methylene chloride | 30. Pentachloroethane |
| 12. Trichloroethene | 31. Hexachloroethane |
| 13. Chloroform | 32. Bromoform |
| 14. Tetrachloroethene | 33. trans-1,4-Dichloro-2-butene |
| 15. 1,2-Dichloropropane | 34. 1,2,3-Trichloropropene |
| 16. 1-Chlorohexane | 35. Hexachlorobutadiene |
| 17. Bromochloromethane | 36. 1,1,2,2-Tetrachloroethane |
| 18. 1,1-Dichloroethane | 37. 1,2-Dibromo-3-chloropropene (DBCP) |
| 19. 1,2-Dichloroethane | 38. Hexachlorocyclopentadiene |

Chlorinated Isooctane

Column: HP-INNOWax
19091N-136
60 m x 0.25 mm, 0.25 µm

Carrier: Helium, 33 cm/sec, 35.7 psi (80 °C) 2 mL/min

Oven: 80 °C isothermal

Injection: Split, 250 °C
Split ratio 150:1

Detector: FID 300 °C

Sample: Monochloro isomers, 0.5 µL

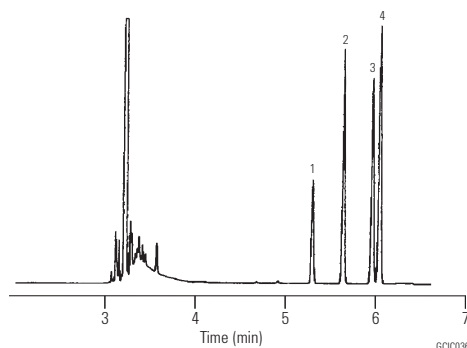
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



1. 1-Chloro isooctane
2. 4-Chloromethyl 2,2'-dimethyl pentane
3. 3-Chloro isooctane
4. 4-Chloro isooctane

Solvents I

Column: DB-WAXetr
125-7332
30 m x 0.53 mm, 1.00 µm

Carrier: Helium at 30 cm/sec,
measured at 40 °C

Oven: 40 °C for 5 min
40-140 °C at 5 °C/min

Injection: Split, 250 °C

Detector: FID, 250 °C

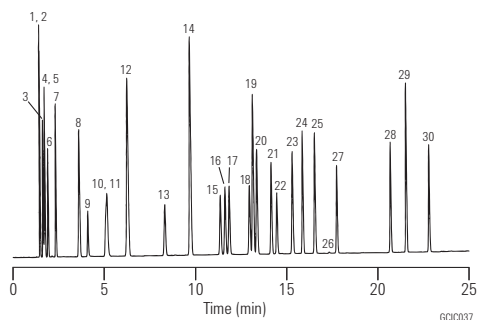
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



- | | |
|-----------------------------------|----------------------------|
| 1. 3-Methylpentane | 16. p-Xylene |
| 2. Hexane | 17. m-Xylene |
| 3. Isooctane | 18. Cumene |
| 4. Methyl-tert-butyl ether (MTBE) | 19. Dodecane |
| 5. Heptane | 20. o-Xylene |
| 6. Cyclohexane | 21. Propylbenzene |
| 7. Octane | 22. Chlorobenzene |
| 8. Nonane | 23. Mesitylene |
| 9. Methanol | 24. Styrene |
| 10. Ethanol | 25. 1,2,4-Trimethylbenzene |
| 11. Benzene | 26. Naphthalene |
| 12. Decane | 27. 4-Chlorotoluene |
| 13. Toluene | 28. 1,3-Dichlorobenzene |
| 14. Undecane | 29. 1,4-Dichlorobenzene |
| 15. Ethylbenzene | 30. 1,2-Dichlorobenzene |

Solvents II

Column: DB-WAXetr
123-7354
50 m x 0.32 mm, 1.00 µm

Carrier: Helium at 41 cm/sec, measured at 50 °C

Oven: 50 °C for 5 min
50-170 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:100

Detector: FID, 280 °C
Nitrogen makeup gas at 30 mL/min

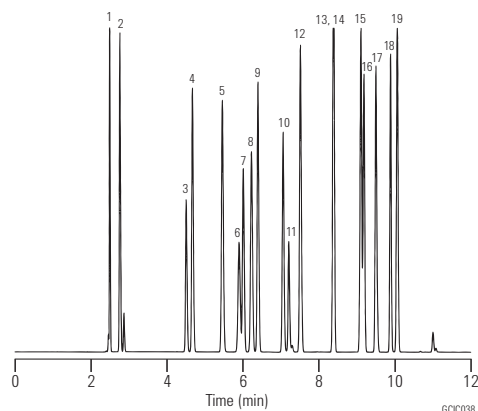
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



1. Hexane
2. Isooctane
3. Acetone
4. Ethyl formate
5. Tetrahydrofuran
6. Trichloroethane
7. Ethyl acetate
8. Isopropyl acetate
9. Methyl ethyl ketone
10. Isopropyl alcohol
11. Methylene chloride
12. Benzene
13. 2-Pentanone
14. Methyl isobutyl ketone
15. Isobutyl acetate
16. Chloroform
17. sec-Butyl alcohol
18. Toluene
19. n-Propanol

Solvents III

Column: DB-200
122-2033
30 m x 0.25 mm, 0.50 µm

Carrier: Helium at 31 cm/sec

Oven: 45 °C for 7 min
45-145 °C at 20 °C/min

Injection: Split, 250 °C
Split ratio 1:100

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 0.5 µL of 0.5-1.0 µg/µL
standard in water

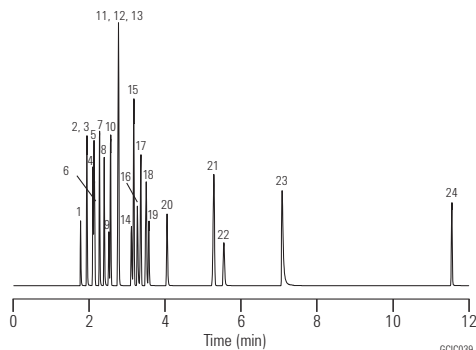
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



- | | |
|-----------------------|-------------------------------|
| 1. Methanol | 13. Acetone |
| 2. Ethanol | 14. Acetonitrile |
| 3. Ethyl ether | 15. Benzene |
| 4. Isopropanol | 16. Tetrahydrofuran (THF) |
| 5. n-Hexane | 17. Trichloroethylene |
| 6. Methylene chloride | 18. n-Butanol |
| 7. tert-Butanol | 19. Ethyl acetate |
| 8. n-Propanol | 20. Methyl ethyl ketone (MEK) |
| 9. Chloroform | 21. Toluene |
| 10. Cyclohexane | 22. 1,4-Dioxane |
| 11. sec-Butanol | 23. Pyridine |
| 12. n-Heptane | 24. Dimethylformamide (DMF) |

Solvents IV

Column: HP-1
19091Z-205
50 m x 0.20 mm, 0.50 μ m

Carrier: Helium, 30 psi

Oven: 70-200 °C at 5 °C/min
200 °C for 2 min

Injection: Split

Detector: TCD

Sample: 1 μ L

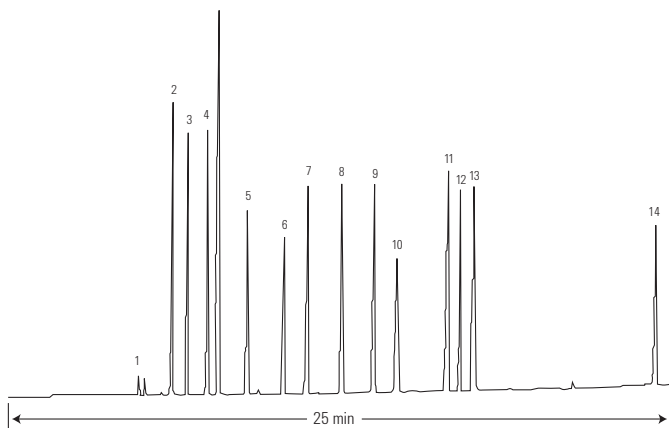
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 μ L tapered, FN 23-26s/42/HP, 5181-1273



GCIC040

1. Isopropanol
2. Methyl ethyl ketone
3. Ethyl acetate
4. n-Butyl alcohol
5. Ethyl cellosolve
6. Methyl isobutyl ketone
7. Toluene
8. n-Butyl acetate
9. Diacetone alcohol
10. p-Xylene
11. Cellosolve acetate
12. o-Xylene
13. Butyl cellosolve
14. Butyl cellosolve acetate

Common Industrial Solvents

Column: HP-1
19091Z-212
25 m x 0.32 mm, 1.05 μ m

Carrier: Helium, 35 kPa

Oven: 30-140 °C at 10 °C/min

Injection: Split ratio 200:1

Detector: IRD, 200 °C

Sample: 1 μ L

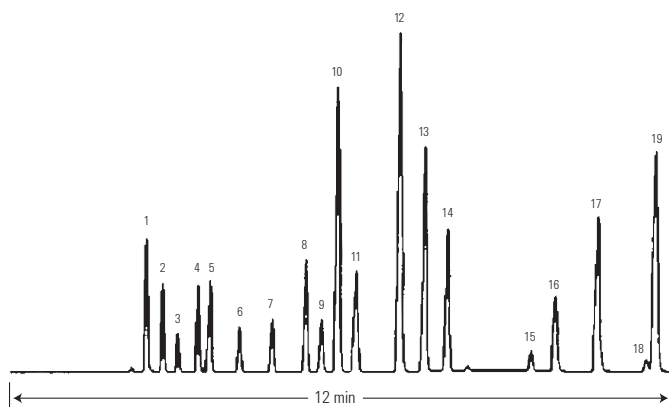
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 μ L tapered, FN 23-26s/42/HP, 5181-1273



GCIC042

1. Methanol
2. Methyl formate
3. Ethanol
4. Acetone
5. Isopropanol
6. Dichloromethane
7. n-Propanol
8. Methyl ethyl ketone
9. sec-Butanol
10. Ethyl acetate
11. Isobutanol
12. Isopropyl acetate
13. Nitropropane
14. 1,4-Dioxane
15. Toluene
16. Mesityl oxide
17. Diacetone-alcohol
18. m-Xylene
19. Cyclohexanone

Analysis of Solvents

Column: PoraBOND Q
CP7354
25 m x 0.53 mm, 10.00 µm

Sample: 5 µL

Sample Conc: 0.1% per compound

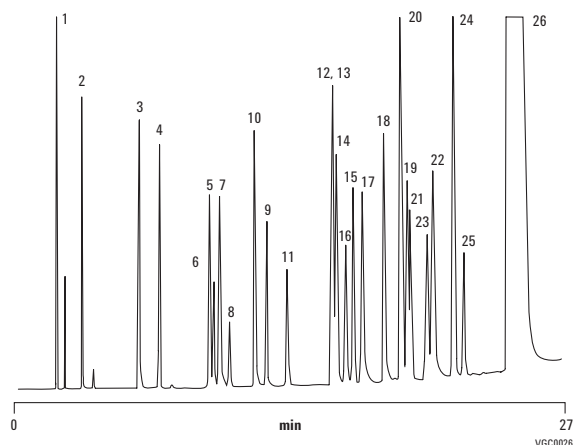
Solvent: DMSO

Carrier: He, 25 kPa (0.25 bar, 3.5 psi)

Oven: 100 °C (2 min) to 300 °C, 5 °C/min

Injection: Split, T=250 °C

Detector: FID, T=250 °C



1. Methane
2. Methanol
3. Ethanol
4. Acetonitrile
5. Acetone
6. Dichloromethane
7. 2-Propanol
8. Dimethyl sulfide
9. Diethyl ether
10. 1-propanol
11. Pentane
12. 2-Butanone
13. Trichloromethane
14. Tetrahydrofuran
15. Ethyl acetate
16. 2-Methoxyethanol
17. Isobutanol
18. Butanol
19. Hexane
20. Benzene
21. Trichloroethylene
22. Cyclohexane
23. 1,4-Dioxane
24. Pyridine
25. N,N-dimethylformamide
26. Dimethyl sulfoxide

Nitrogen Based Solvents I

Column: DB-1
125-1034
30 m x 0.53 mm, 3.00 µm

Carrier: Helium at 30 cm/sec,
measured at 40 °C

Oven: 40 °C for 5 min
40-260 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:10

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

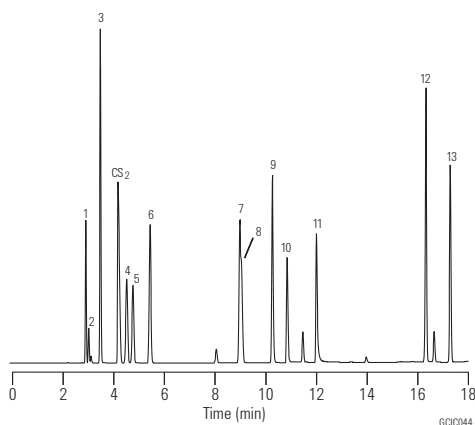
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



1. Acetonitrile
2. Acrolein
3. Acrylonitrile
4. Propionitrile
5. Methacrolein
6. Methacrylonitrile
7. Triethylamine
8. Ethyl acrylate
9. Pyridine
10. DMF (dimethylformamide)
11. DMSO (dimethyl sulfoxide)
12. Benzonitrile
13. 1-Methyl-2-pyrrolidinone

Nitrogen Based Solvents II

Column: DB-624
125-1334
30 m x 0.53 mm, 3.00 µm

Carrier: Helium at 30 cm/sec,
measured at 40 °C

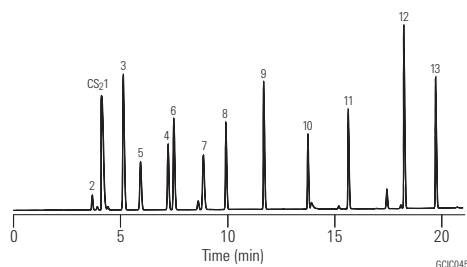
Oven: 40 °C for 5 min
40-260 °C at 10 °C/min
260 °C for 3 min

Injection: Split, 250 °C
Split ratio 1:10

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



1. Acetonitrile
2. Acrolein
3. Acrylonitrile
4. Propionitrile
5. Methacrolein
6. Methacrylonitrile
7. Triethylamine
8. Ethyl acrylate
9. Pyridine
10. DMF (dimethylformamide)
11. DMSO (dimethyl sulfoxide)
12. Benzonitrile
13. 1-Methyl-2-pyrrolidinone

Acrylate Impurities I

Column: DB-200
125-2032
30 m x 0.53 mm, 1.00 µm

Carrier: Helium at 34.5 cm/sec
measured at 35 °C

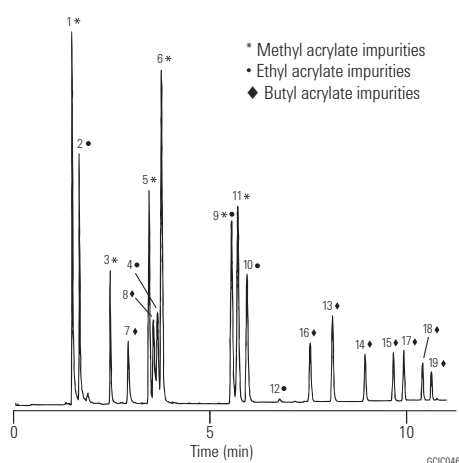
Oven: 35 °C for 5 min,
35-200 °C at 10 °C/min

Injection: Split, 230 °C
Split ratio 1:10

Detector: FID, 250 °C

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



1. Methanol
2. Ethanol
3. Methyl acetate
4. Ethyl acetate
5. Methyl acrylate
6. Methyl propionate
7. Isobutanol
8. Butanol
9. Ethyl acrylate
10. Ethyl propionate
11. Methyl methacrylate
12. Isopropyl acrylate
13. Isobutyl acetate
14. Butyl acetate
15. Isobutyl acrylate
16. Dibutyl ether
17. Isobutyl propionate
18. Butyl acrylate
19. Butyl propionate

Acrylate Impurities II

Column: DB-1701
125-0732
30 m x 0.53 mm, 1.00 µm

Carrier: Helium at 36.8 cm/sec
measured at 35 °C

Oven: 35 °C for 5 min,
35-200 °C at 10 °C/min

Injection: Split, 230 °C
Split ratio 1:10

Detector: FID, 250 °C

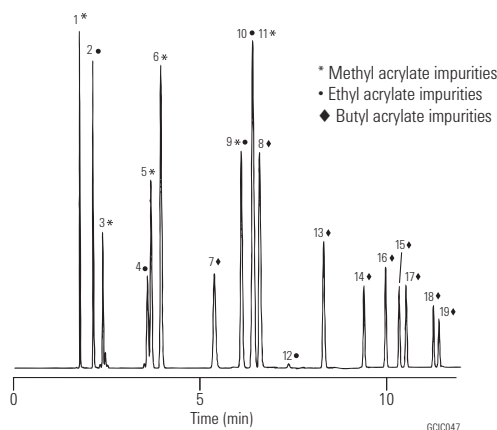
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



1. Methanol
2. Ethanol
3. Methyl acetate
4. Ethyl acetate
5. Methyl acrylate
6. Methyl propionate
7. Isobutanol
8. Butanol
9. Ethyl acrylate
10. Ethyl propionate
11. Methyl methacrylate
12. Isopropyl acrylate
13. Isobutyl acetate
14. Butyl acetate
15. Isobutyl acrylate
16. Dibutyl ether
17. Isobutyl propionate
18. Butyl acrylate
19. Butyl propionate

Acrylates

Column: HP-FFAP
19095F-121
10 m x 0.53 mm, 1.00 µm

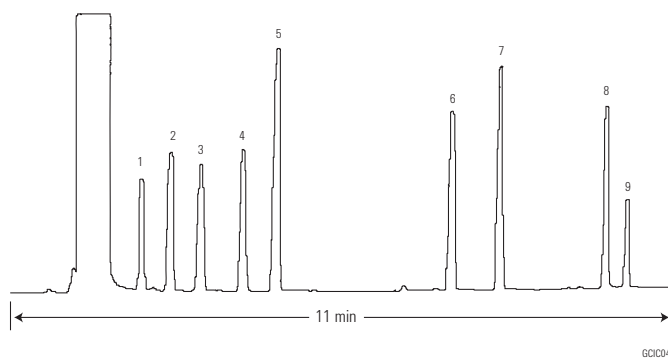
Carrier: Hydrogen

Oven: 35 °C for 1 min
35-60 °C at 10 °C/min
60-160 °C at 15 °C/min

Injection: On-column

Detector: FID

Sample: 1 µL



1. Methyl methacrylate
2. Ethyl methacrylate
3. sec-Butyl methacrylate
4. Allyl acrylate
5. n-Butyl acrylate
6. Hexyl methacrylate
7. Cyclohexyl methacrylate
8. Hydroxypropyl acrylate
9. Unknown

Anilines

Column: DB-35ms
128-3822
25 m x 0.20 mm, 0.33 µm

Carrier: Helium at 35 cm/sec,
measured at 50 °C

Oven: 50 °C for 2 min
50-340 °C at 20 °C/min
340 °C for 10 min

Injection: Splitless, 280 °C
0.50 min purge activation time

Detector: FID, 320 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL of 5 ng
on-column per component

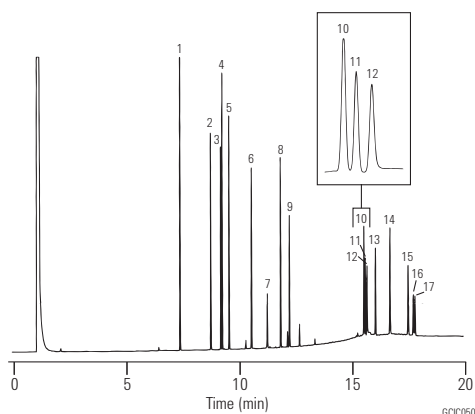
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



1. o-Toluidine
2. 4-Chloroaniline
3. 2-Methoxy-5-methylaniline
4. 2,4,5-Trimethylaniline
5. 4-Chloro-2-methylaniline
6. 2,4-Diaminotoluene
7. 2,4-Diaminoanisole
8. 2-Aminonaphthalene
9. 2-Methyl-5-nitroaniline
10. 4,4'-Oxydianiline
11. 4,4'-Methylenedianiline
12. Benzidine
13. 2-Aminoazotoluene
14. o-Tolidine
15. 4,4'-Thiodianiline
16. 3,3'-Dimethoxybenzidine
17. 3,3'-Dichlorobenzidine

Substituted Anilines

Column: DB-5ms
122-5536
30 m x 0.25 mm, 0.50 µm

Carrier: Helium at 33.3 cm/sec,
measured at 150 °C

Oven: 40 °C for 5 min
40-290 °C at 12 °C/min
290 °C for 10 min

Injection: Splitless, 250 °C
30 sec purge activation time

Detector: MSD, 325 °C transfer line

Sample: 1 µL of 25 ng/µL standard

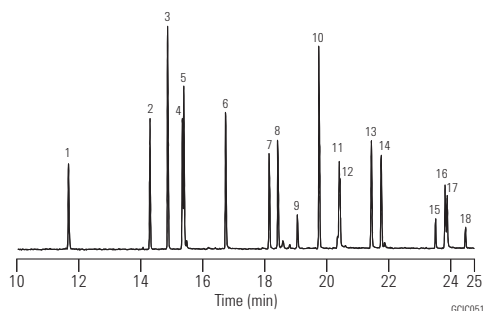
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



- | | m/z |
|---------------------------------|-----|
| 1. Aniline | 93 |
| 2. 2-Chloroaniline | 127 |
| 3. 2,6-Dimethylaniline | 121 |
| 4. 3-Chloroaniline | 127 |
| 5. 4-Chloroaniline | 127 |
| 6. 4-Bromoaniline | 171 |
| 7. 2-Nitroaniline | 138 |
| 8. 3,4-Dichloroaniline | 161 |
| 9. 3-Nitroaniline | 65 |
| 10. 2,4,5-Trichloroaniline | 195 |
| 11. 4-Chloro-2-nitroaniline | 172 |
| 12. 4-Nitroaniline | 138 |
| 13. 2-Chloro-4-nitroaniline | 172 |
| 14. 2,6-Dichloro-4-nitroaniline | 176 |
| 15. 2-Chloro-4,6-dinitroaniline | 217 |
| 16. 2,6-Dibromo-4-nitroaniline | 266 |
| 17. 2,4-Dinitroaniline | 183 |
| 18. 2-Bromo-4,6-dinitroaniline | 261 |

Phenols II

Column: DB-5ms
122-5536
30 m x 0.25 mm, 0.50 μ m

Carrier: Helium at 22 cm/sec,
measured at 100 °C

Oven: 100 °C for 1 min
100-270 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:50

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 μ L of 50 ng/ μ L standard
in toluene/p-xylene

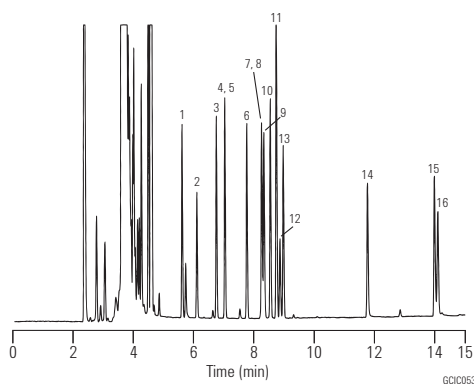
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730

Seal: Gold plated seal, 18740-20885

Syringe: 10 μ L tapered, FN 23-26s/42/HP, 5181-1267



1. Phenol
2. 2-Chlorophenol
3. o-Cresol
4. m-Cresol
5. p-Cresol
6. 2,6-Xylenol
7. 2,4-Xylenol
8. 2,5-Xylenol
9. 2-Nitrophenol
10. 3,5-Xylenol
11. 2,3-Xylenol
12. 2,4-Dichlorophenol
13. 3,4-Xylenol
14. 2,4,6-Trichlorophenol
15. 2,4-Dinitrophenol
16. 1-Naphthol

Phenols III

Column: DB-WAX
122-7032
30 m x 0.25 mm, 0.25 μ m

Carrier: Hydrogen at 43 cm/sec

Oven: 165 °C isothermal

Injection: Split, 250 °C
Split ratio 1:50

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

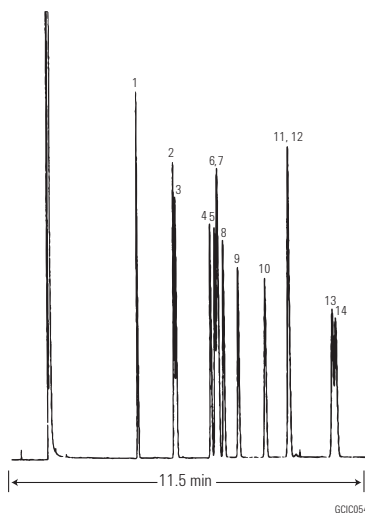
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 μ L tapered, FN 23-26s/42/HP, 5181-1273



1. 2,6-Xylenol
2. 2-Cresol
3. Phenol
4. 2-Ethylphenol
5. 2,5-Xylenol
6. 4-Cresol
7. 2,4-Xylenol
8. 3-Cresol
9. 2-Isopropylphenol
10. 2,3-Xylenol
11. 3,5-Xylenol
12. 4-Ethylphenol
13. 3,4-Xylenol
14. 2,3,5-Trimethylphenol

Halocarbons

Column: GS-GasPro
113-4332
30 m x 0.32 mm

Carrier: Helium at 30 cm/sec

Oven: 130 °C for 4 min
130-225 °C at 10 °C/min
225 °C Hold

Injection: Split, 250 °C
Split ratio 1:67

Detector: FID, 250 °C

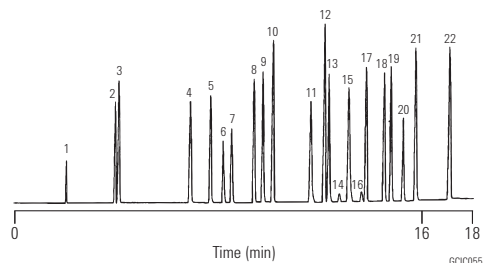
Sample: 1 µL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



- | | |
|---|---|
| 1. CH ₄ | 12. cis-ClCH=CHCl |
| 2. CHClF ₂ (Freon 22) | 13. CHCl ₃ |
| 3. CCl ₂ F ₂ (Freon 12) | 14. ? from CCl ₄ |
| 4. ClCF ₂ CF ₂ Cl (Freon 114) | 15. CCl ₄ |
| 5. CHCl ₂ F (Freon 21) | 16. ? from CCl ₄ |
| 6. CCl ₃ F (Freon 11) | 17. CH ₃ CH ₂ I |
| 7. CF ₂ Br ₂ (Freon 12B2) | 18. CH ₂ Br ₂ |
| 8. CH ₃ I | 19. CHCl ₂ Br |
| 9. CH ₂ Cl ₂ | 20. C ₄ F ₉ I |
| 10. trans-ClCH=CHCl | 21. CHClBr ₂ |
| 11. CF ₃ CCl ₃ (Freon 113) | 22. CH ₃ CH ₂ CH ₂ I |

Ethylene Oxide

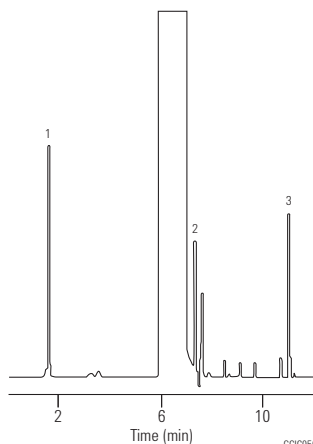
Column: DB-WAX
122-7032
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 1 mL/min

Oven: 60 °C for 2 min
60-180 °C at 16 °C/min

Injection: Split, 250 °C
Split ratio 1:50

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min



1. Ethylene oxide
2. 2-Chloroethanol
3. Ethylene glycol (solvent: Dimethylformamide)

(Courtesy of J. Chromatogr. Sci., 28:97 [1990])

Impurities in Mixed Xylenes

Column: DB-WAXetr
123-7362
60 m x 0.32 mm, 0.25 µm

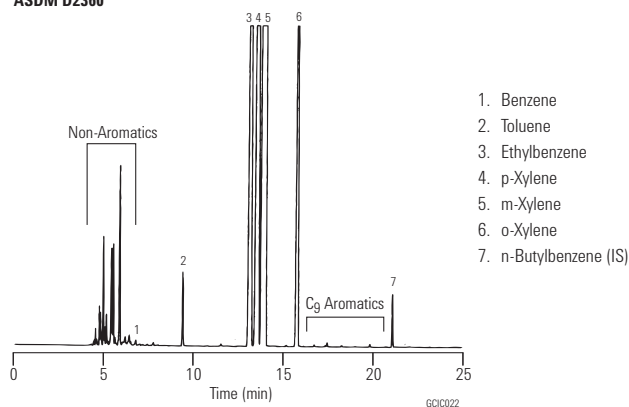
Carrier: Helium at 20 cm/sec,
measured at 145 °C

Oven: 60 °C for 10 min
60-150 °C at 5 °C/min
150 °C for 10 min

Injection: Split, 230 °C
Split ratio 1:150

Detector: FID, 240 °C

ASDM D2360

**High Resolution Separation of Xylene Isomers**

Column: CP-Chirasil-Dex CB
CP7502
25 m x 0.25 mm, 0.25 µm

Sample: 0.5 µL

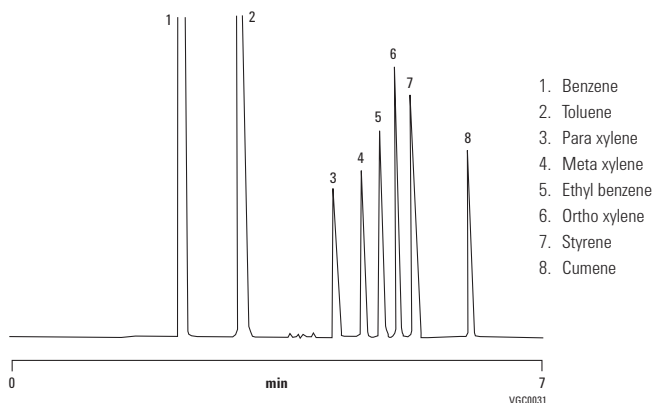
Sample Conc: 10-20%

Carrier: Helium, 40 kPa, 6 psi

Oven: 80 °C, (6 min) to 130 °C, 25 °C/min

Injection: Split, T = 210 °C, 1:20

Detector: FID, T=230 °C

**Halothane**

Column: GS-GasPro
113-4312
15 m x 0.32 mm,

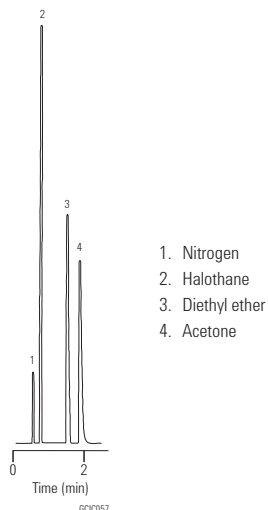
Carrier: Helium at 45 cm/sec

Oven: 240 °C, isothermal

Injection: Split, 200 °C
Split ratio 1:100

Detector: FID, 200 °C

Sample: 0.2 µL

**Suggested Supplies**

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

Inorganic Hydride Gases

Column: HP-1
19091Z-205
50 m x 0.20 mm, 0.50 μ m

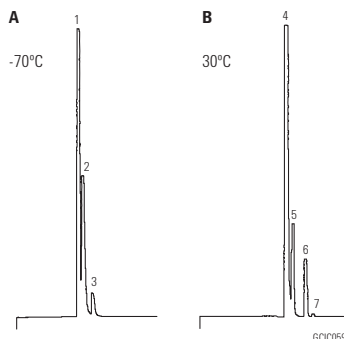
Carrier: Helium, 35 cm/sec

Oven: A: -70 °C isothermal
B: 30 °C isothermal

Injection: Split ratio 25:1

Detector: FPD, 535 μ m filter

Sample: 1 μ L



1. Arsine 0.1%
2. Phosphine 0.1%
3. Selenide 0.1%
4. Diborane 0.10 ppm
5. Tetraborane 0.10 ppm
6. Pentaborane 0.10 ppm
7. Dihdropentaborane 0.60 ppm

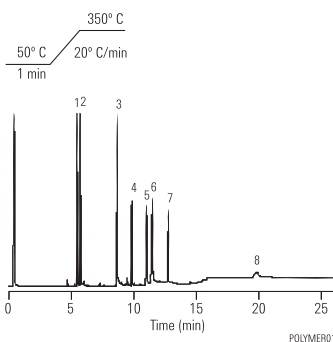
Polymer Additives

Column: HP-35 (use only 10 meters)
19091G-013
30 m x 0.32 mm, 0.15 μ m

Carrier: Helium, 6 psi (4 mL/min at 50 °C) hold for 5 min.
ramp to 50 psi (21 mL/min at 350 °C) at 5 psi/min.

Injection: EPC on-column, oven track 0.5 μ L injection

Detector: FID



1. BHT
2. BHEB
3. Tinuvin P
4. Isonox 129
5. Irgafos 168
6. Irganox 1076
7. MD 1024
8. Irganox 1010

Fast Separation of Silanes

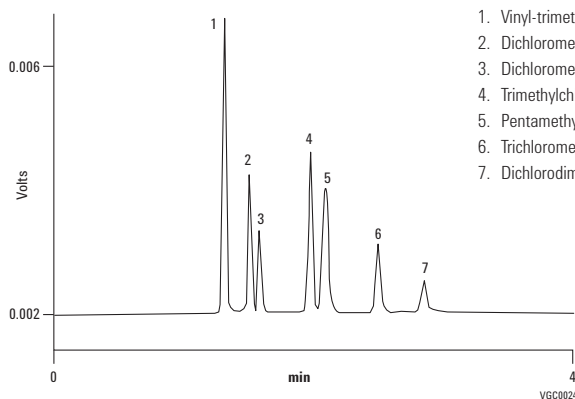
Column: VF-200ms
CP8860
30 m x 0.25 mm, 1.00 μ m

Carrier: Hydrogen, ca 1.0 mL/min, 60 kPa

Oven: 50 °C

Injection: Split/splitless, in split mode, 1:100

Detector: FID



1. Vinyl-trimethyl silane
2. Dichloromethyl silane
3. Dichloromethane
4. Trimethylchloro silane
5. Pentamethyl disiloxane
6. Trichloromethyl silane
7. Dichlorodimethyl silane

Sulfur Gases

Column: PoraPLOT U
CP7584
25 m x 0.53 mm, 20.00 μ m

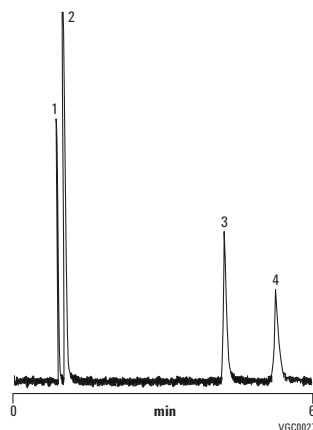
Sample: ± 100 ppm

Carrier: H_2

Oven: 50 $^{\circ}C$

Injection: 100 mL/min

Detector: FPD



1. Hydrogen sulfide
2. Carbonyl sulfide
3. Sulfur dioxide
4. Methyl sulfide

Analysis of Acetylenes Mixture

Column: Select AI203
CP7432
50 m x 0.53 mm,

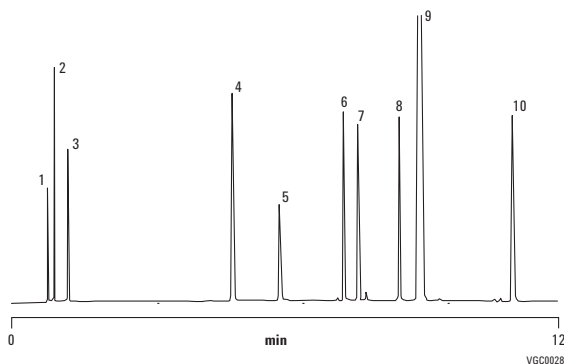
Sample Conc: Approx 100 ppm in nitrogen, synthetic standard

Carrier: Helium, 4 psig, 4 min to 11 psig, 0.5 psig/min, 2 min

Oven: 40 $^{\circ}C$, 5 min to 160 $^{\circ}C$, 10 $^{\circ}C$ /min to 200 $^{\circ}C$,
20 $^{\circ}C$ /min, hold 1 min

Injection: Split 60 mL/min

Detector: FID



1. Methane
2. Ethane
3. Ethylene
4. n-Butane
5. Propadiene
6. 1-Butene
7. Iso-butene
8. 1,2-Butadiene
9. 1,3-Butadiene
10. Ethyl acetylene

Courtesy of J. Luong, Dow Chemical Canada.

Life Science Applications

DB-Select 624 UI for Mega Bore Early Eluting Peaks

Column: DB-Select 624 UI for <467>
125-0334UI
30 m x 0.53 mm x 3.0 μ m

Carrier: Helium 44 cm/s (approx. 6 mL/min) set at 40 °C,
EPC-Constant Flow

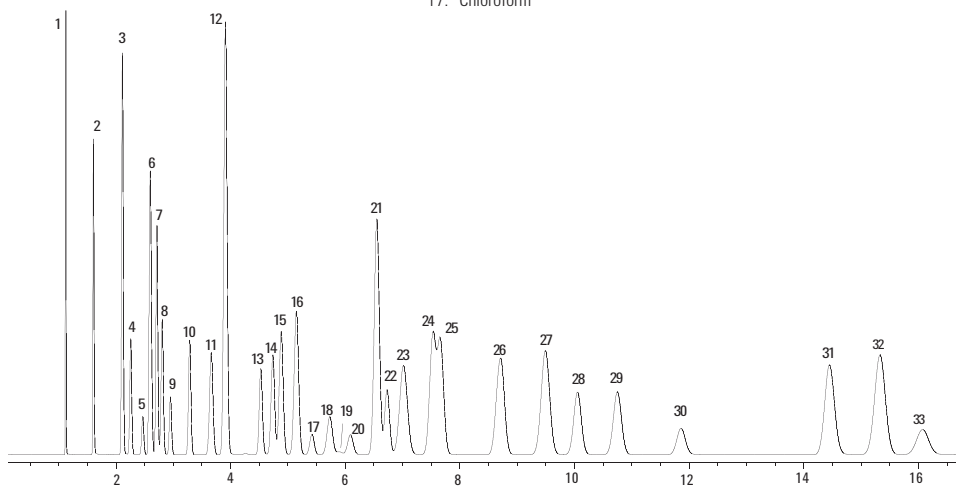
Oven: 40 °C 20 min hold, then 10°/min to 170 °C

Injection: 20 Hz

Detector: FID at 240 °C, H2 at 30 mL/min
Air at 400 mL/min
N2 makeup at 35 mL/min
(constant column + makeup)

Sample: FIDSignal

- | | |
|--------------------------------|--|
| 1. Methane | 18. 1,1,1-Trichloroethane |
| 2. Methanol | 19. Cyclohexane |
| 3. Ethanol | 20. Carbon tetrachloride |
| 4. Diethyl ether | 21. Benzene |
| 5. 1,1-Dichloroethylene | 22. 1,2-Dichloroethane |
| 6. 2-Propanol | 23. Isooctane (2,2,4-Trimethylpentane) |
| 7. Acetonitrile | 24. 3-Methyl-2-butanone |
| 8. Methyl acetate | 25. n-Heptane |
| 9. Dichloromethane | 26. Trichloroethylene |
| 10. trans-1,2-Dichloroethylene | 27. Methycyclohexane |
| 11. n-Hexane | 28. 1,4-Dioxane |
| 12. 1-Propanol | 29. Propy acetate |
| 13. Nitromethane | 30. 2-Ethoxyethanol |
| 14. cis-1,2-Dichloroethylene | 31. Pyridine excellent peak shape |
| 15. Ethyl acetate | 32. Toluene |
| 16. 2-Butanol | 33. 3-Methyl-1-butanol |
| 17. Chloroform | |



Benzodiazepines I

Column: DB-5ms Ultra Inert
122-5532UI
30 m x 0.25 mm, 0.25 µm

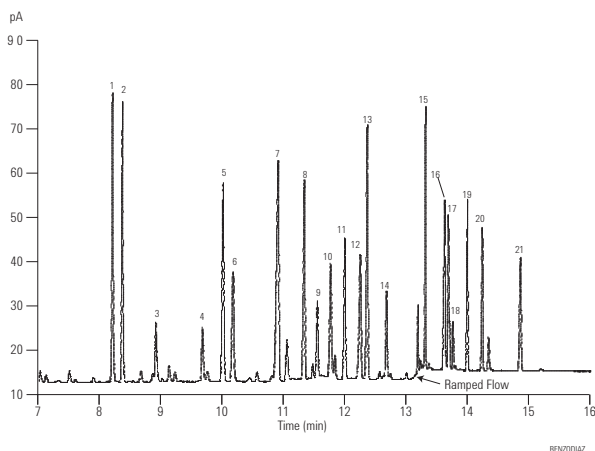
Carrier: Hydrogen, 53 cm/sec, constant flow
1.6 for 11 min
1.6 to 2.4 at 60 mL/min hold 2 min
2.4 to 5.0 at 50 mL/min hold 9 min

Oven: 170 °C for 3.2 min
170-250 °C at 24.7 °C/min, hold 5.3 min
250-280 °C at 18.6 °C/min, hold 4.0 min
280-325 °C at 50.0 °C/min, hold 4.0 min

Injection: Pulsed splitless, 280 °C
20 psi pulse pressure for 0.38 min
50 mL/min purge at 0.40 min
Direct connect liner G1544-80730

Detector: FID, 350 °C

Sample: 1 µL of 5-10 ppm



1. Medazepam
2. Halazepam
3. Oxazepam
4. Lorazepam
5. Diazepam
6. Desalkyl Aurazepam
7. Nordazepam
8. Clonazam
9. Oxazepam
10. Temazepam
11. Flunitrazepam
12. Bromazepam
13. Prazepam
14. Lormetazepam
15. Nitrazepam
16. Chlordiazepoxide
17. Clonazepam
18. Demoxepam
19. Estazolam
20. Alprazolam
21. Triazolam

Analysis of benzodiazepines and other drugs is particularly challenging because of their high level of activity. For this reason, all aspects of the sample path – particularly the GC Column – must be as inert as possible.

Amphetamines and Precursors – TMS Derivatives

Column: DB-5
121-5023
20 m x 0.18 mm, 0.40 µm

Carrier: Helium at 39 cm/sec, measured at 100 °C

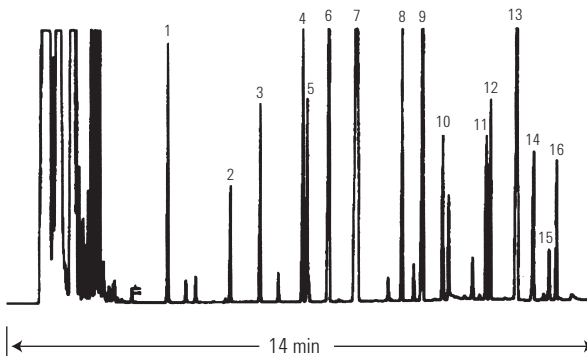
Oven: 100-240 °C at 10 °/min

Injection: Split, 250 °C
Split ratio 1:100

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL of 2 µg/µL each in pyridine

- | | |
|------------------------|---|
| 1. Phenylacetone | 9. Phenacetin |
| 2. Dimethylamphetamine | 10. 3,4-Methylenedioxyamphetamine (MDA) |
| 3. Amphetamine | 11. 3,4-Methylenedioxymethylamphetamine |
| 4. Phentermine | 12. 4-Methyl-2,5-dimethoxyamphetamine (STP) |
| 5. Methamphetamine | 13. Phenyl ephedrine |
| 6. Methyl ephedrine | 14. 3,4-Methylenedioxyethylamphetamine (MDE; Eve) |
| 7. Nicotinamine | 15. Caffeine |
| 8. Ephedrine | 16. Benzphetamine |



GCLS004

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Barbiturates

Column: DB-35ms
122-3832
30 m x 0.25 mm, 0.25 μ m

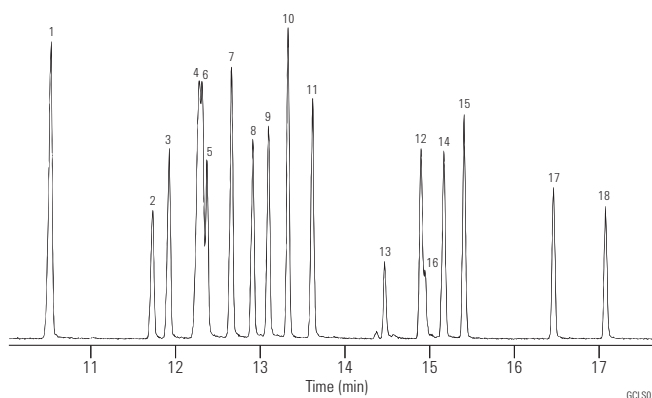
Carrier: Helium at 31 cm/sec, measured at 50 °C

Oven: 50 °C for 0.5 min
50-150 °C at 25 °C/min
150-300 °C at 10 °C/min

Injection: Splitless, 250 °C
30 sec purge activation time

Detector: MSD, 280 °C transfer line
full scan at m/z 40-270

- | | |
|------------------|-------------------------|
| 1. Barbital | 10. Methohexital |
| 2. Allobarbitol | 11. Secobarbital |
| 3. Aprobarbital | 12. Hexobarbital |
| 4. Butabarbital | 13. Thiopental |
| 5. Butethal | 14. Cyclopentylbarbital |
| 6. Butalbital | 15. Mephobarbital |
| 7. Amobarbital | 16. Thiamylal |
| 8. Talbutal | 17. Phenobarbital |
| 9. Pentobarbital | 18. Alphenal |

**Suggested Supplies**

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316
Seal: Gold plated seal, 18740-20885
Syringe: 10 μ L tapered, FN 23-26s/42/HP, 5181-1267

Narcotics

Column: DB-5ms
122-5532
30 m x 0.25 mm, 0.25 μ m

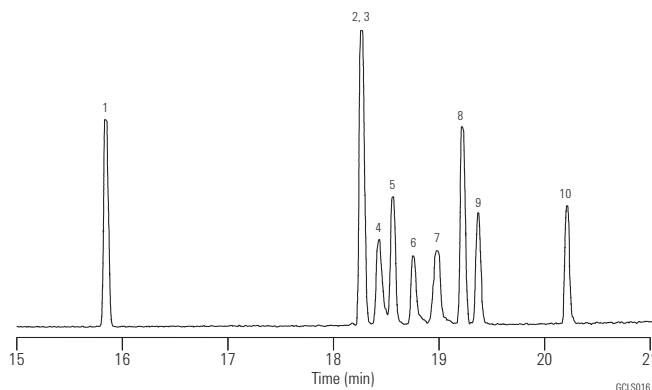
Carrier: Helium at 31 cm/sec, measured at 50 °C

Oven: 50 °C for 0.5 min
50-150 °C at 25 °C/min
150-325 °C at 10 °C/min

Injection: Splitless, 250 °C
30 sec purge activation time

Detector: MSD, 300 °C transfer line
full scan at m/z 40-380

- | | |
|---------------------|-------------------------|
| 1. Dextromethorphan | 6. Morphine |
| 2. Codeine | 7. Normorphine |
| 3. Dihydrocodeine | 8. 6-Acetylcodeine |
| 4. Norcodeine | 9. 6-Monoacetylmorphine |
| 5. Ethylmorphine | 10. Heroin |

**Suggested Supplies**

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730
Seal: Gold plated seal, 18740-20885
Syringe: 10 μ L tapered, FN 23-26s/42/HP, 5181-1267

Blood Alcohols I (Static Headspace/Split)

Column: DB-ALC1
125-9134
30 m x 0.53 mm, 3.00 µm

Carrier: Helium at 80 cm/sec,
measured at 40 °C

Oven: 40 °C Isothermal

Sampler: Headspace

Injection: Split, 250 °C
Split ratio 1:10

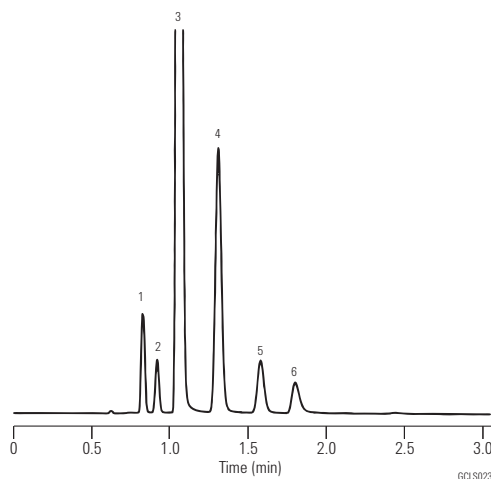
Detector: FID, 300 °C
Nitrogen makeup gas
at 23 mL/min

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1. Methanol
2. Acetaldehyde
3. Ethanol
4. Isopropanol
5. Acetone
6. 1-Propanol

Blood Alcohols II (Static Headspace/Split)

Column: DB-ALC2
125-9234
30 m x 0.53 mm, 2.00 µm

Carrier: Helium at 80 cm/sec,
measured at 40 °C

Oven: 40 °C Isothermal

Sampler: Headspace

Oven: 70 °C
Loop: 80 °C
Transfer line: 90 °C
Vial equil. time: 10 min
Pressurization time: 0.20 min
Loop fill time: 0.20 min
Loop equil. time: 0.05 min
Inject time: 0.1 - 0.2 min
Sample loop size: 1.0 mL

Injection: Split, 250 °C
Split ratio 1:10

Detector: FID, 300 °C
Nitrogen makeup gas
at 23 mL/min

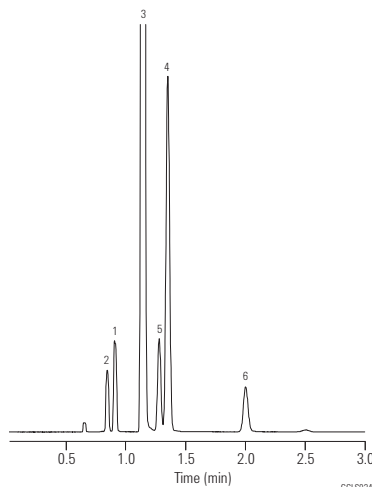
Sample: 0.1% Ethanol,
0.001% Others

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1. Methanol
2. Acetaldehyde
3. Ethanol
4. Isopropanol
5. Acetone
6. 1-Propanol

Residual Solvents, DMI Diluent

Column: DB-624
123-1364
60 m x 0.32 mm, 1.80 µm

Oven: 50-60 °C, 1 °C/min
60-115 °C, 9.2 °C/min
115-220 °C, 35 °C/min
220 °C – hold 6 min

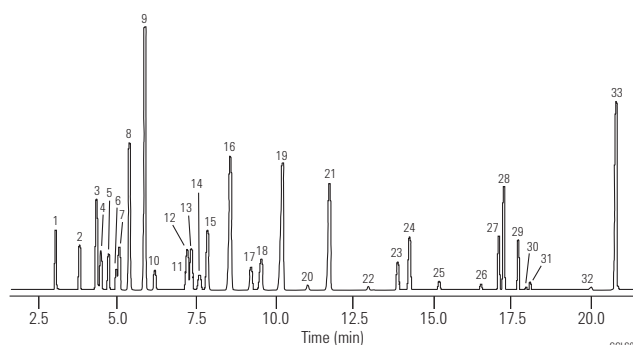
Sampler: Headspace
Platen 140 °C
Transfer line, valve 250 °C
Sample loop 2 mL

Injection: Split, 250 °C
Split ratio 1:18

Detector: FID, 270 °C
Nitrogen makeup

Sample: 5,000 ppm standard

- | | | |
|---------------------------------------|--------------------------|--|
| 1. Methanol | 12. 2-Butanone (MEK) | 23. MIBK (2-Pentanone) |
| 2. Ethanol | 13. Ethyl acetate | 24. Toluene |
| 3. Acetone | 14. 2-Butanol | 25. 1-Pentanol |
| 4. 2-Propanol | 15. Tetrahydrofuran | 26. n,n-Dimethylformamide (DMF) |
| 5. Acetonitrile | 16. Cyclohexane | 27. Ethyl benzene |
| 6. Methylene chloride | 17. Isopropyl acetate | 28. m,p-Xylene |
| 7. 2-Methyl-2-propanol (tert-butanol) | 18. 1,2-Dimethoxyethane | 29. o-Xylene |
| 8. MTBE | 19. Heptane | 30. Dimethyl sulfoxide (DMSO) |
| 9. Hexane | 20. 1-Methoxy-2-propanol | 31. n,n-Dimethylacetamide |
| 10. 1-Propanol | 21. Methylcyclohexane | 32. n-Methylpyrrolidone |
| 11. DMI impurity | 22. 2-Ethoxyethanol | 33. 1,3-Dimethyl-2-imidazolidinone (DMI) |



Special thanks to Julie Kancler, Brian Wallace, Teledyne.

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

Underivatized Drugs of Abuse – Agilent Fast Toxicology Analyzer

Column: DB-35 ms Ultra Inert
122-3812UI
15 m x 0.25 mm, 0.25 µm

Carrier: Helium fixed pressure 35.0 psi

Injection: Splitless 1 µL 280 °C, total flow 56.4 mL/min,
3 mL/min switched septum purge, gas saver off,
50 mL/min after 0.4 min

Liner: Splitless, dual taper, deactivated, 4 mm id, 5181-3315

Sample: Agilent GC/MS Toxicology Checkout Mixture
(P/N 5190-0471)

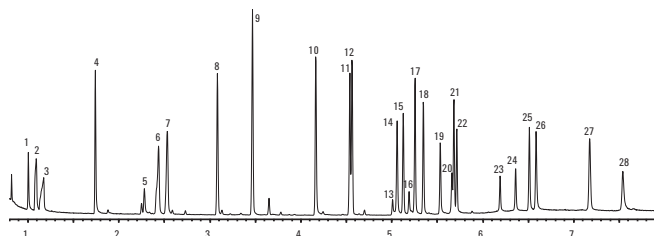
Backflush: Post run: 1 min 1 psi inlet, 75 psi aux EPC

Oven: 100 °C (0.25 min) to 345 °C
(40 °C/min, 2.25 min hold)

Detector: MSD: Transfer line 300 °C, source 300 °C,
quadrapole 180 °C scan mode
NPD: Blos bead 300 °C H₂ 3 mL/min, 60 mL/min air,
11 mL/min makeup and col flow

CFT Device: 2-Way splitter with solvent venting between MSD and NPD

- | | | |
|---|-----------------------------|----------------------|
| 1. Amphetamine | 10. Methadone | 19. Oxycodone |
| 2. Phentermine | 11. Cocaine | 20. Temazepam |
| 3. Methamphetamine | 12. SKF-525a (RTL Compound) | 21. Diacetylmorphine |
| 4. Nicotine | 13. Oxazepam | 22. Flunitrazepam |
| 5. Methylenedioxyamphetamine (MDA) | 14. Tetrahydrocannabinol | 23. Nitrazepam |
| 6. Methylenedioxymethamphetamine (MDMA) | 15. Codeine | 24. Clonazepam |
| 7. Methylenedioxyethylamphetamine | 16. Lorazepam | 25. Alprazolam |
| 8. Meperidine | 17. Diazepam | 26. Verapamil |
| 9. Phencyclidine | 18. Hydrocodone | 27. Strychnine |
| | | 28. Trazodone |



Example NPD chromatogram of underivatized drugs of abuse 5 ng/component on an Agilent J&W DB-35ms UI column. Component number 12 is used for retention time locking in the deconvolution reporting software database.

Benzodiazepines II

Column: DB-35ms
122-3832
30 m x 0.25 mm, 0.25 µm

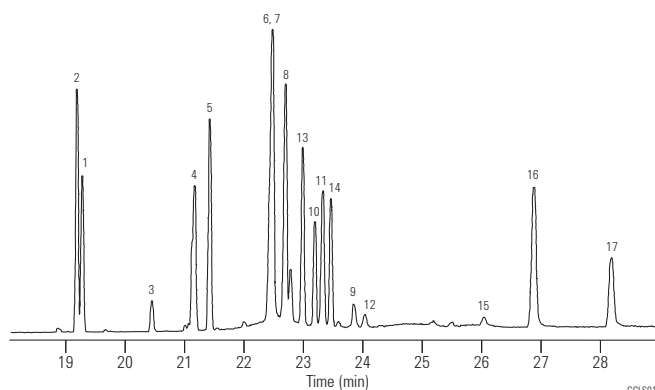
Carrier: Helium at 31 cm/sec, measured at 50 °C

Oven: 50 °C for 0.5 min
50-150 °C at 25 °C/min
150-340 °C at 10 °C/min
340 °C for 6 min

Injection: Splitless, 250 °C
30 sec purge activation time

Detector: MSD, 280 °C transfer line
full scan at m/z 40-400

- | | |
|----------------------|-------------------|
| 1. Medazepam | 10. Flunitrazepam |
| 2. Halazepam | 11. Delorazepam |
| 3. Oxazepam | 12. Bromazepam |
| 4. Lorazepam | 13. Prazepam |
| 5. Diazepam | 14. Flurazepam |
| 6. Demoxepam | 15. Clonazepam |
| 7. Desmethyldiazepam | 16. Alprazolam |
| 8. Clobazam | 17. Triazolam |
| 9. Temazepam | |

**Suggested Supplies**

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Drug Screen

Column: DB-1ms
122-0132
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 40 cm/sec,
measured at 50 °C

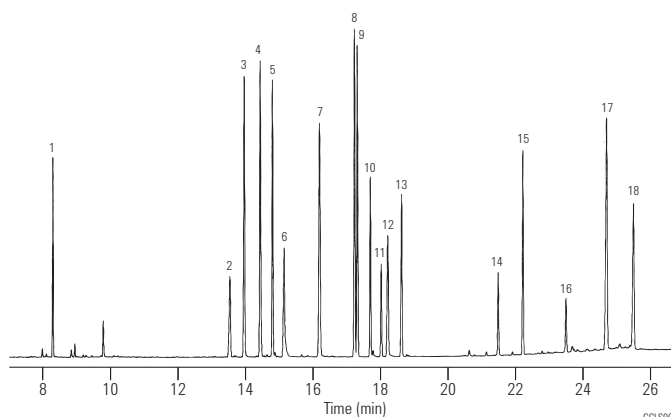
Oven: 50 °C for 1.0 min
50-125 °C at 25 °C/min
125-325 °C at 10 °C/min
325 °C for 5 min

Injection: Cold Splitless
Optic II injector, 50-250 °C at 10 °C/sec
45 sec purge activation time

Detector: FID, 300 °C

Sample: 1 µL injection of 50-150 ppm standard

- | | |
|---------------------------------|------------------|
| 1. Nicotine | 10. Cocaine |
| 2. Caffeine | 11. Desipramine |
| 3. Glutethimide | 12. Carbazepine |
| 4. Lidocaine | 13. Trimipramine |
| 5. PCP | 14. Heroin |
| 6. Phenobarbital | 15. Fentanyl |
| 7. Methadone primary metabolite | 16. Ibogaine |
| 8. Methaqualone | 17. Triazolam |
| 9. Methadone | 18. LSD |



Common Drug Screen

Column: DB-5
122-5032
30 m x 0.25 mm, 0.25 µm

Column: DB-17
122-1732
30 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen at 41 cm/sec,
measured at 80 °C

Oven: 80 °C for 1 min
80-280 °C at 10 °C/min
280 °C for 9 min

Injection: Split, 250 °C
Split ratio 1:40

Detector: FID, 300 °C

	DB-17 Time	DB-5 Time		DB-17 Time	DB-5 Time
1. Nicotine	9.87	8.57	18. Hexobarbital	17.52	15.22
2. Phenmetrazine	11.8	9.95	19. Doxylamine	17.69	15.87
3. Ibuprofen	12.06	10.64	20. Caffeine	18.05	13.11
4. Procaine	13.48	14.82	21. Chlorpheniramine	18.47	16.35
5. Allobarbitol	13.91	12.02	22. Methapyrilene	18.72	16.68
6. Aprobital	14.14	12.27	23. Thenyldiamine	18.87	16.85
7. Butabarbital	14.56	12.76	24. Phenobarbital	19.11	16.29
8. Secobarbital	14.87	14.31	25. Bromopheniramine	19.71	17.39
9. Pentobarbital	15.41	13.73	26. Chlorcyclizine	20.75	19.13
10. Phenacetin	15.72	12.94	27. Cocaine	21.32	18.88
11. Amobarbital	15.87	13.43	28. Pyrrobutamine	22.79	20.89
12. Benzphetamine	16.14	14.96	29. Codeine	24.27	20.66
13. Acetaminophen	16.34	11.12	30. Diazepam	25.27	21.13
14. Hydroxyphenamate	16.47	15.31	31. Morphine	25.36	21.12
15. Dimenhydrinate	16.93	13.79	32. Hydrocodone	25.98	21.26
16. Meprobamate	17.12	14.44	33. Oxymorphone	28.27	22.21
17. Benactyzine	17.26	14.71	34. Heroin	29.32	23.14

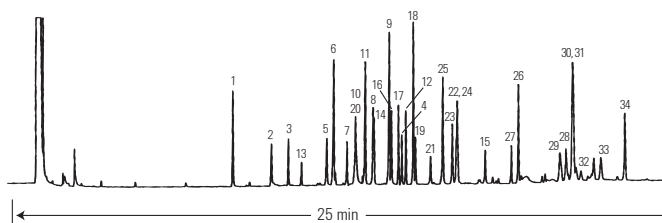
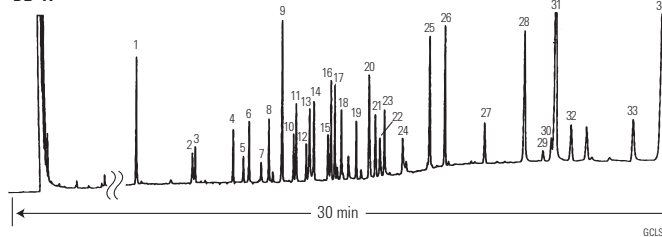
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper,
glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

DB-5**DB-17**

GCL5001

Urine Drug Screen

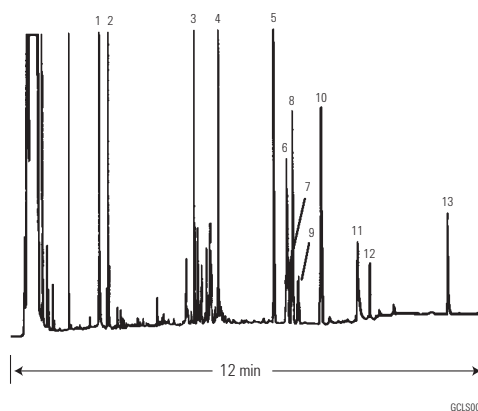
Column: ULTRA 2
19091B-115
50 m x 0.32 mm, 0.52 μ m

Carrier: Hydrogen 80 cm/sec

Oven: 45 °C for 1.5 min
45-300 °C at 6 °C/min

Injection: Splitless

Detector: FID



1. Amphetamine
2. Methamphetamine
3. Meperidine
4. Phencyclidine (PCP)
5. Methadone
6. Propoxyphene
7. Amitriptyline
8. Cocaine
9. Imipramine
10. Cyheptamide (ISTD)
11. Codeine
12. Diazepam
13. Flurazepam

Analysis of Drugs of Abuse in Urine via GC/MS

Column: VF-DA
CP8964
12 m x 0.20 mm, Optimized μ m

Sample: 1 μ L

Solvent: Methanol

Carrier: He, ca 1.0 mL/min

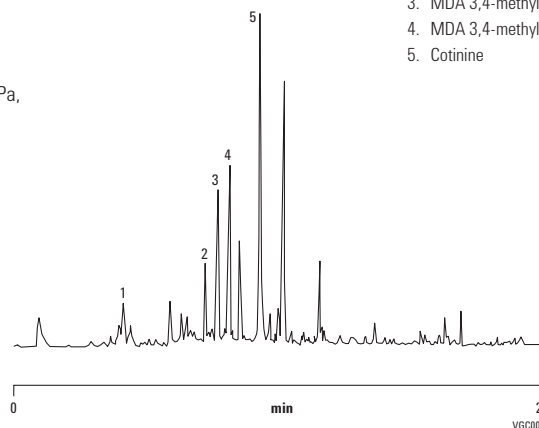
Oven: 70 °C, 1.2 min to 200 °C, 20 °C/min to 270 °C,
7 °C/min to 320 °C, 20 °C/min

Pressure: 58.7 kPa, 2.2 min to 97 kPa, 58 kPa/min to 132 kPa,
3 kPa/min to 180 kPa, 12 kPa/min

Injection: Splitless

Detector: MS

Derivatization: Acetic acid anhydride to form acetates



1. Amphetamine
2. MDA 3,4-methylenedioxyamphetamine
3. MDA 3,4-methylenedioxymethamphetamine
4. MDA 3,4-methylenedioxy-ethylamphetamine
5. Cotinine

Anesthetics

Column: DB-5ms EVDX
128-8522
25 m x 0.20 mm, 0.33 μ m

Carrier: Helium at 35 cm/sec,
measured at 55 °C

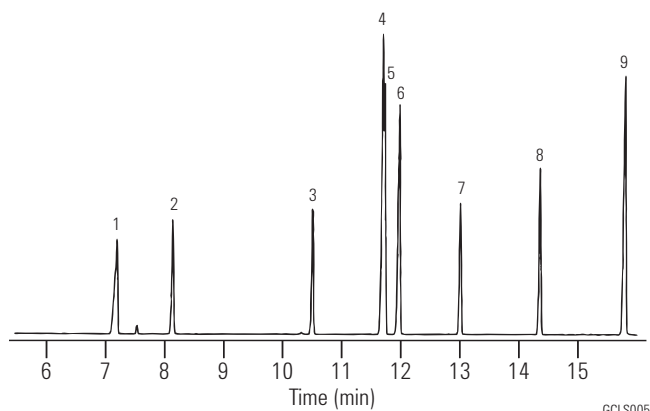
Oven: 55 °C for 1 min
55-130 °C at 25 °C/min
130-325 °C at 15 °C/min

Injection: Splitless, 250 °C
45 sec purge activation time

Detector: MSD, 280 °C transfer line
full scan at m/z 35-400

Sample: 1 μ L of 50-100 ng/ μ L
standard in methanol

- | | |
|-----------------|----------------|
| 1. Salicylamide | 6. Mepivacaine |
| 2. Benzocaine | 7. Tetracaine |
| 3. Lidocaine | 8. Butacaine |
| 4. Procaine | 9. Dibucaine |
| 5. Nefopam | |

**Suggested Supplies**

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316
Seal: Gold plated seal, 18740-20885
Syringe: 10 μ L tapered, FN 23-26s/42/HP, 5181-1267

Anticonvulsants

Column: DB-1
125-1032
30 m x 0.53 mm, 1.50 μ m

Carrier: Helium at 8 mL/min

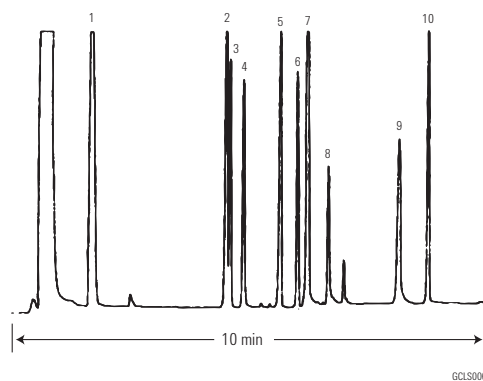
Oven: 160 °C for 2 min
160-275 °C at 15 °C/min

Injection: Megabore Direct, 250 °C

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 μ L of 100 ng/ μ L in methanol

- | | |
|-----------------------------|--------------------------------|
| 1. Ethosuximide | 6. Phenobarbital |
| 2. Methsuximide | 7. Primidone |
| 3. Phensuximide | 8. Carbamazepine |
| 4. N-Desmethyl methsuximide | 9. Phenytoin |
| 5. Phenylethylmalonamide | 10. 5-Methyl-5-phenylhydantoin |

**Suggested Supplies**

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730
Seal: Gold plated seal, 18740-20885
Syringe: 10 μ L tapered, FN 23-26s/42/HP, 5181-1267

Antihistamines

Column: DB-5
123-5032
30 m x 0.32 mm, 0.25 µm

Carrier: Helium at 40 cm/sec, measured at 55 °C

Oven: 55 °C for 1 min
55-175 °C at 30 °C/min
175-320 °C at 10 °C/min
320 °C for 1 min

Injection: Splitless, 250 °C
30 sec purge activation time

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL of 50 ng/µL each in methanol

- | | |
|----------------------|--------------------|
| 1. Pheniramine | 13. Thonzylamine |
| 2. Dimenhydrinate | 14. Chlorcyclizine |
| 3. Diphenhydramine | 15. Pyrilamine |
| 4. Doxylamine | 16. Triprolidine |
| 5. Phenyltoloxamine | 17. Promethazine |
| 6. Tripeleminamine | 18. Antazoline |
| 7. Methapyrilene | 19. Clemizole |
| 8. Chlorpheniramine | 20. Hydroxyzine |
| 9. Cyclizine | 21. Meclizine |
| 10. Carbinoxamine | 22. Cinnanzine |
| 11. Diphenylpyraline | 23. Buclizine |
| 12. Bromopheniramine | |

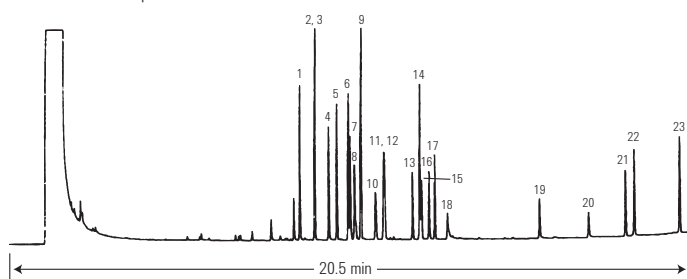
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



GCL5007

Antiepileptic Drugs

Column: ULTRA 2
19091B-012
25 m x 0.32 mm, 0.17 µm

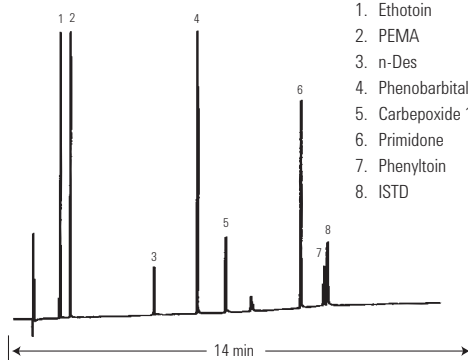
Carrier: Helium, 14 psi

Oven: 100-230 °C at 15 °C/min

Injection: Split ratio 35:1

Detector: NPD

- | |
|----------------------|
| 1. Ethotoin |
| 2. PEMA |
| 3. n-Des |
| 4. Phenobarbital |
| 5. Carbepoxide 10/11 |
| 6. Primidone |
| 7. Phenytoin |
| 8. ISTD |



GCL5008

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Tricyclic Antipsychotics

Column: ULTRA 2
19091B-101
12 m x 0.20 mm, 0.33 µm

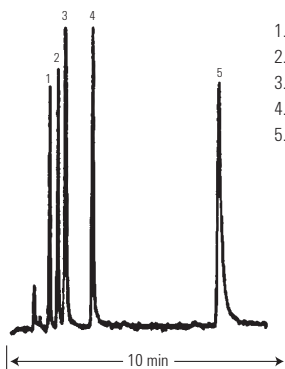
Carrier: Hydrogen, 106 cm/sec

Oven: 250 °C for 3 min
250-290 °C at 10 °C/min
290 °C for 10 min

Injection: Split ratio 75:1

Detector: FPD

- | |
|--------------------|
| 1. Triflupromazine |
| 2. Promethazine |
| 3. Promazine |
| 4. Chlorpothixene |
| 5. Thioridazine |



GCL5009

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Fentanyls

Column: DB-1701
125-0732
30 m x 0.53 mm, 1.00 μ m

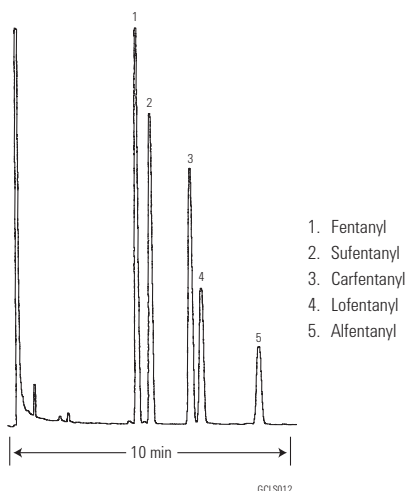
Carrier: Hydrogen at 15 mL/min

Oven: 270 °C isothermal

Injection: Split, 250 °C
Split ratio 1:5

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 0.8 μ L

**Suggested Supplies**

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 μ L tapered, FN 23-26s/42/HP, 5181-1273

Tocopherols

Column: DB-17ms
122-4732
30 m x 0.25 mm, 0.25 μ m

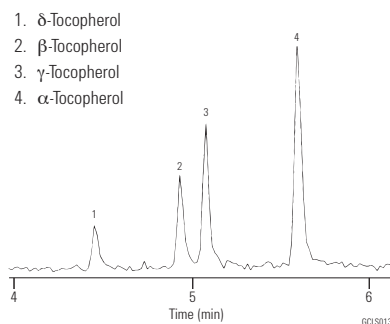
Carrier: Helium at 40 cm/sec, measured at 150 °C

Oven: 300 °C for 1 min
300-320 °C at 25 °C/min
320 °C for 4 min

Injection: Split, 310 °C
Split ratio 1:25

Detector: MSD, 310 °C transfer line
full scan at m/z 45-550

Sample: 1 μ L of 1-10 ng/ μ L in isooctane

**Suggested Supplies**

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 μ L tapered, FN 23-26s/42/HP, 5181-1273

Hallucinogens

Column: DB-17ms
122-4732
30 m x 0.25 mm, 0.25 μ m

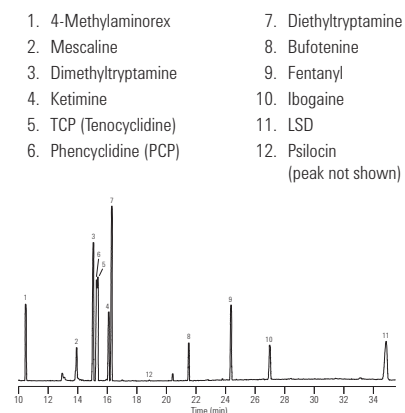
Carrier: Helium at 30 cm/sec, measured at 50 °C

Oven: 50 °C for 0.5 min
50-125 °C at 25 °C/min
125-255 °C at 10 °C/min
255-320 °C at 25 °C/min
320 °C for 16 min

Injection: Splitless, 250 °C
30 sec purge activation time

Detector: MSD, 300 °C transfer line
full scan at m/z 40-350

Sample: 1 μ L of 10-50 ng/ μ L standard in methanol

**Suggested Supplies**

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730

Seal: Gold plated seal, 18740-20885

Syringe: 10 μ L tapered, FN 23-26s/42/HP, 5181-1267

Sedative Hypnotics

Column: DB-5ms EVDX
128-8522
25 m x 0.20 mm, 0.33 µm

Carrier: Helium at 35 cm/sec, measured at 55 °C

Oven: 55 °C for 1 min
55-130 °C at 25 °C/min
130-325 °C at 15 °C/min
325 °C for 4 min

Injection: Splitless, 250 °C
45 sec purge activation time

Detector: MSD, 280 °C transfer line
full scan at m/z 35-400

Sample: 1 µL of 50-100 ng/µL standard in methanol

1. Ethchlorvynol
2. Ethinamate
3. Pyridylidione
4. Talbutal
5. Meprobamate
6. Glutethimide
7. Methaqualone
8. Propiomazine
9. Haloperidol
10. Sulpiride
11. Droperidol

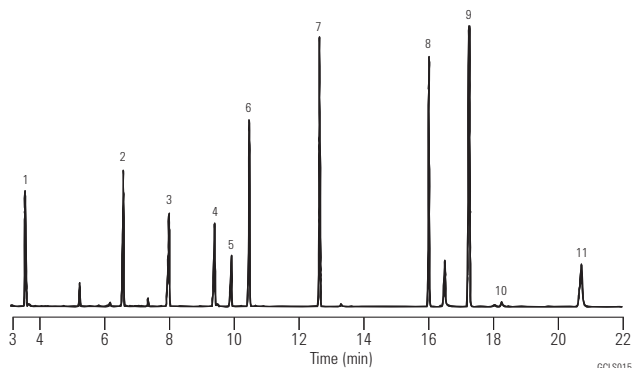
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



GCLS015

Narcotics and Adulterants

Column: DB-5
123-5032
30 m x 0.32 mm, 0.25 µm

Carrier: Helium at 40 cm/sec, measured at 140 °C

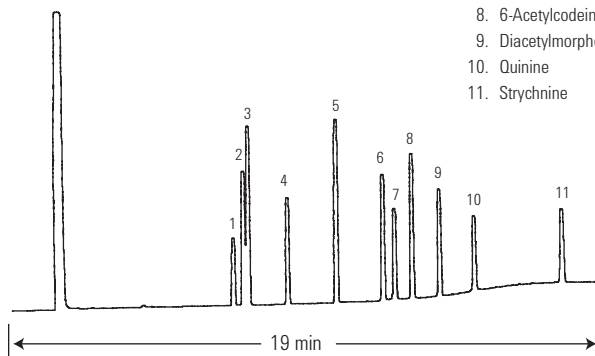
Oven: 140-320 °C at 12 °C/min
320 °C for 4 min

Injection: Split, 250 °C
Split ratio 1:75

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL of 0.5 µg/µL each in methanol

1. Caffeine
2. Ketamine
3. Lidocaine
4. Procaine
5. Cocaine
6. Codeine
7. Morphine
8. 6-Acetylcodeine
9. Diacetylmorphine (Heroin)
10. Quinine
11. Strychnine



GCLS017

Over-the-Counter Pain Killers – TMS Derivatives

Column: DB-5
121-5023
20 m x 0.18 mm, 0.40 µm

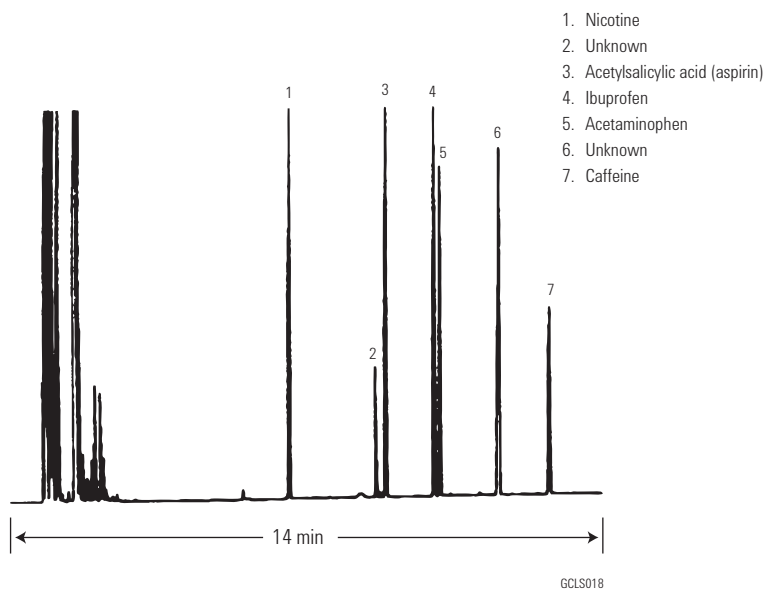
Carrier: Helium at 39 cm/sec, measured at 100 °C

Oven: 100-240 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:100

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL of 2 µg/µL each in pyridine



Aspirin and Ibuprofen in Methanol

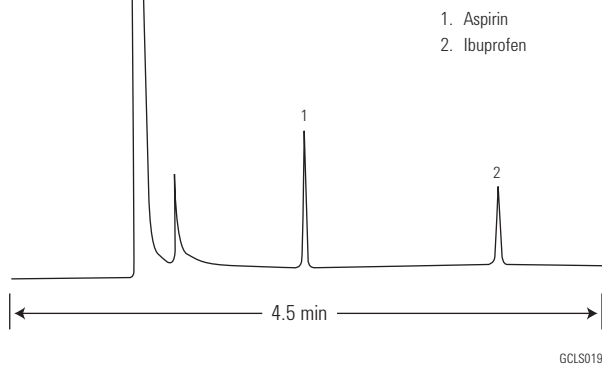
Column: DB-FFAP
122-3232
30 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen at 24 cm/sec, measured at 180 °C

Oven: 180 °C isothermal

Injection: Split, 250 °C
Split ratio 1:50

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min



Free Steroids

Column: DB-17
122-1731
30 m x 0.25 mm, 0.15 μ m

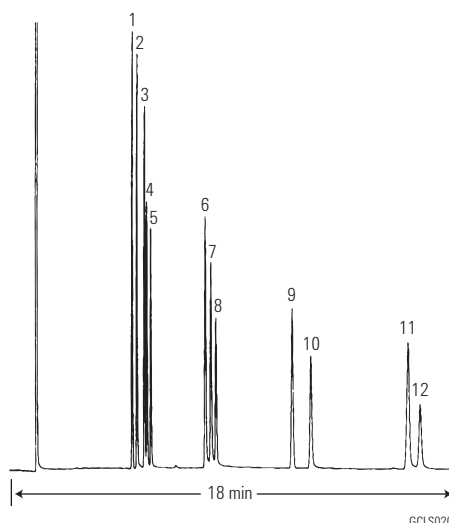
Carrier: Hydrogen at 44 cm/sec

Oven: 260 °C isothermal

Injection: Split, 250 °C
Split ratio 1:100

Detector: FID, 300 °C
Nitrogen makeup gas at
30 mL/min

Sample: 1 μ L



1. Coprostan (5- β -cholestane)
2. 5- β -Androsterone
3. 5- α -Cholestane
4. Androsterone
5. Epiandrosterone (trans-androsterone)
6. 17- α -Estradiol
7. β -Estradiol
8. Estrone
9. Progesterone
10. Cholesterol
11. Estriol
12. Stigmastrol

Anabolic Steroids

Column: DB-1
122-1031
30 m x 0.25 mm, 0.10 μ m

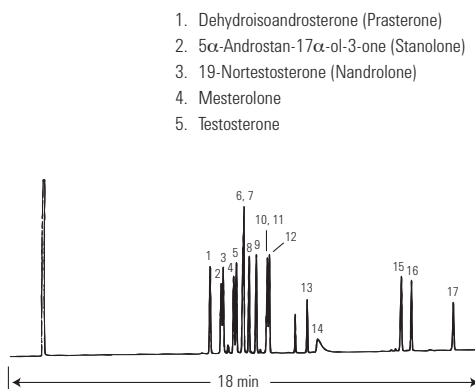
Carrier: Helium at 40 cm/sec, measured at 180 °C

Oven: 180-320 °C at 10 °C/min
320 °C for 4 min

Injection: Split ratio 1:40

Detector: FID, Nitrogen makeup gas at 30 mL/min

Sample: 2 μ L of 0.125 μ g/ μ L each in methanol



1. Dehydroisoandrosterone (Prasterone)
2. 5 α -Androstan-17 α -ol-3-one (Stanolone)
3. 19-Nortestosterone (Nandrolone)
4. Mesterolone
5. Testosterone
6. 1-Dehydrotestosterone (Boldenone)
7. 17 α -Methyltestosterone
8. 1-Dehydro-17 α -methyltestosterone (Methandrostenolone)
9. Norethandrolone
10. 1-Dehydrotestosterone acetate
11. Oxymetholone
12. 19-Nortestosterone-17-propionate
13. 4-Chlortestosterone-17-acetate (Clostebol)
14. Stanozolol
15. 1-Dehydrotestosterone benzoate
16. 19-Nortestosterone-17-decanoate
17. 1-Dehydrotestosterone undecylenate

Marijuana (Δ 9-THC) and Major Metabolites – TMS Derivatives

Column: DB-5
123-5032
30 m x 0.32 mm, 0.25 μ m

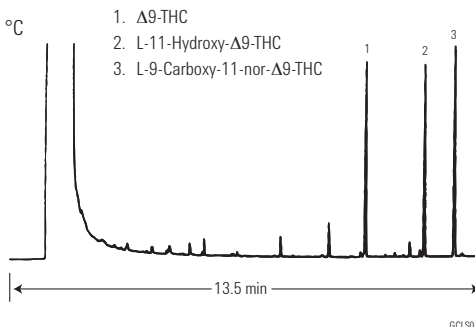
Carrier: Helium at 40 cm/sec, measured at 100 °C

Oven: 100 °C for 1 min
100-175 °C at 30 °C/min
175-295 °C at 12 °C/min

Injection: Splitless, 250 °C
30 sec purge activation time

Detector: FID, 300 °C
Nitrogen makeup
gas at 30 mL/min

Sample: 1 μ L of 0.1 μ g/ μ L each in pyridine



1. Δ 9-THC
2. L-11-Hydroxy- Δ 9-THC
3. L-9-Carboxy-11-nor- Δ 9-THC

Suggested Supplies

- Septum:** 11 mm Advanced Green septa, 5183-4759
- Liner:** Direct connect, single taper, deactivated, 4 mm id, G1544-80730
- Seal:** Gold plated seal, 18740-20885
- Syringe:** 10 μ L tapered, FN 23-26s/42/HP, 5181-1267

Blood Pollutants I

Column: HP-Blood Alcohol
125-9134
30 m x 0.53 mm, 3.00 µm

Carrier: Helium, 36 cm/sec, measured at 40 °C

Oven: 40 °C for 5 min
40-210 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:10

Detector: FID, 300 °C

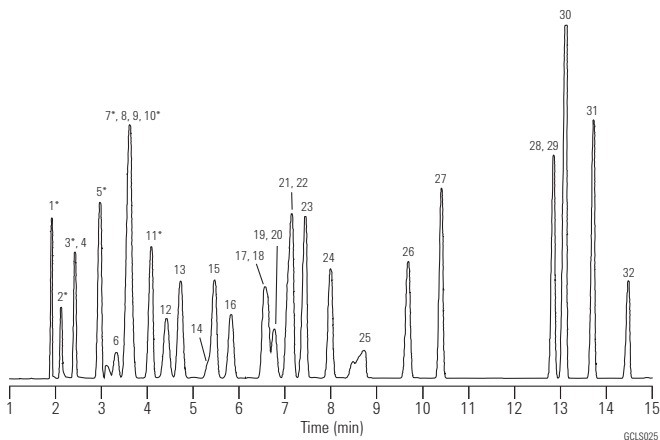
- | | | |
|-----------------------|--------------------------|---------------------------------|
| 1. Methanol* | 12. MTBE | 23. 1-Butanol |
| 2. Acetaldehyde* | 13. Hexane | 24. Heptane |
| 3. Ethanol* | 14. Chloroform | 25. Ethylene glycol |
| 4. Diethyl ether | 15. sec-Butyl alcohol | 26. soamyl alcohol |
| 5. Isopropyl alcohol* | 16. 2-Chlorobutane | 27. Toluene |
| 6. Methylene Chloride | 17. MEK (2-Butanone) | 28. Isopropyl amine (not shown) |
| 7. Acetone* | 18. Ethyl acetate | 29. Ethylbenzene |
| 8. Acetonitrile | 19. 1,1-Trichloroethane | 30. m,p-Xylene |
| 9. Ethyl formate | 20. Carbon tetrachloride | 31. o-Xylene |
| 10. t-Butyl alcohol* | 21. 1-Chlorobutane | 32. DMSO |
| 11. 1-Propanol | 22. Benzene | |

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

**Blood Pollutants II**

Column: HP-Blood Alcohol
125-9234
30 m x 0.53 mm, 2.00 µm

Carrier: Helium, 36 cm/sec, measured at 40 °C

Oven: 40 °C for 5 min
40-210 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:10

Detector: FID, 300 °C

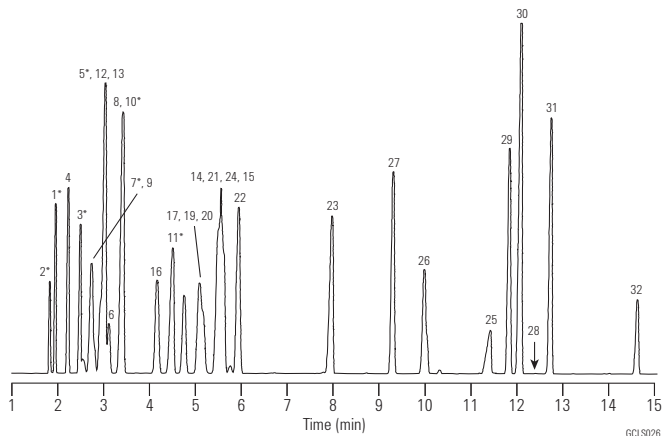
- | | | |
|-----------------------|--------------------------|---------------------------------|
| 1. Methanol* | 12. MTBE | 23. 1-Butanol |
| 2. Acetaldehyde* | 13. Hexane | 24. Heptane |
| 3. Ethanol* | 14. Chloroform | 25. Ethylene glycol |
| 4. Diethyl ether | 15. sec-Butyl alcohol | 26. soamyl alcohol |
| 5. Isopropyl alcohol* | 16. 2-Chlorobutane | 27. Toluene |
| 6. Methylene Chloride | 17. MEK (2-Butanone) | 28. Isopropyl amine (not shown) |
| 7. Acetone* | 18. Ethyl acetate | 29. Ethylbenzene |
| 8. Acetonitrile | 19. 1,1-Trichloroethane | 30. m,p-Xylene |
| 9. Ethyl formate | 20. Carbon tetrachloride | 31. o-Xylene |
| 10. t-Butyl alcohol* | 21. 1-Chlorobutane | 32. DMSO |
| 11. 1-Propanol | 22. Benzene | |

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

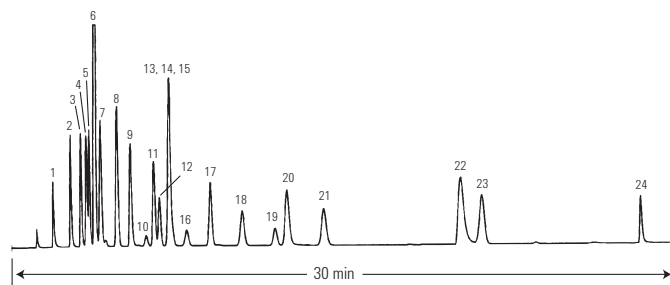
Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



Residual Solvents, USP 467**Column:** DB-624**125-1334****30 m x 0.53 mm, 3.00 µm****Carrier:** Helium at 35 cm/sec, measured at 40 °C**Oven:** 40 °C for 20 min
40-90 °C at 5 °C/min**Injection:** Megabore Direct, 250 °C
5 m phenylmethylsilane deactivated
retention gap**Detector:** FID, 300 °C
Nitrogen makeup gas at
30 mL/min

- | | | |
|-----------------------|-------------------------------|-----------------------------|
| 1. Methanol | 9. n-Hexane | 17. Benzene |
| 2. Ethanol | 10. n-Propanol | 18. n-Heptane |
| 3. Ethyl ether | 11. Methyl ethyl ketone (MEK) | 19. Trichloroethylene |
| 4. Acetone | 12. Ethyl acetate | 20. n-Butanol |
| 5. Isopropanol | 13. Tetrahydrofuran (THF) | 21. 1,4-Dioxane |
| 6. Acetonitrile | 14. Chloroform | 22. Pyridine |
| 7. Methylene chloride | 15. sec-Butanol | 23. Toluene |
| 8. tert-Butanol | 16. Cyclohexane | 24. Dimethylformamide (DMF) |



GCLSD27

Residual Solvents

Column: DB-624
123-1364
60 m x 0.32 mm, 1.80 µm

Carrier: Helium, 35-40 cm/sec, set to yield same RT for Hexane on all columns.

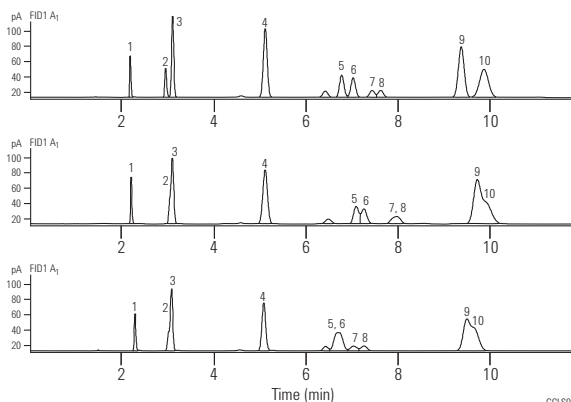
Oven: 40 °C Isothermal

Sampler: Ambient Headspace

Injection: Split ratio 1:8

Detector: FID, 240 °C

Sample: 4 µL



1. Methanol
2. Ethanol
3. Diethyl ether
4. Hexane
5. Ethyl Acetate
6. 2-Butanone
7. 2-Butanol
8. Chloroform
9. Benzene
10. Isooctane

Peak Numbers	Critical Pair	% Resolution*		
		DB-624	Manufacturer A's 624	Manufacturer B's 624
2,3	ethanol and diethyl ether	100%	0%	0%
5,6	ethyl acetate and 2-butanone	95%	38%	0%
7,8	2-butanol and chloroform	60%	0%	60%
9,10	benzene and isooctane	100%	0%	0%

*Resolution calculated as follows: %R = 100% x valley height/average of peak height 1 + peak height 2

The three chromatograms above show how widely different the two other manufacturer's columns are compared to the DB-624, the original USP G-43 stationary phase column recommended for the analysis of these common organic volatile impurities in pharmaceutical samples.

Top Chromatogram: DB-624

Middle Chromatogram: Manufacturer A's "-624"

Bottom Chromatogram: Manufacturer B's "-624"

TIPS & TOOLS

For the latest residual solvent application for USP 467, request publication number 5989-8085EN.



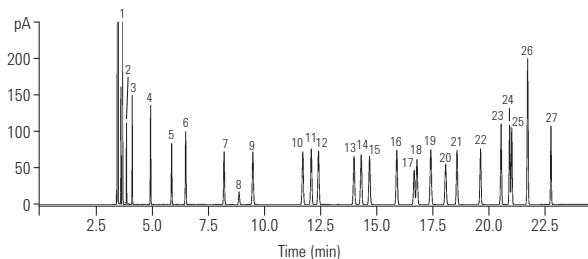
Energy and Fuels Applications

Fast Analysis of Aromatic Solvent

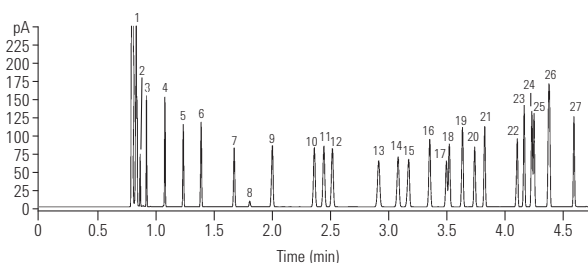
Column: HP-INNOWax
19091N-577
20 m x 0.18 mm, 0.18 µm

Carrier: Helium at 33 psi constant pressure mode
Oven: 70 °C (3 min); 45 °C/min to 145 °C (1 min)
Injection: Split/splitless at 250 °C
100:1 to 600:1 split ratio
Detector: FID at 250 °C
Sample: 0.2 to 1.0 µL

Unified aromatic solvent method



Optimized unified aromatic solvent method



GCHE003

1. Heptane
2. Cyclohexane
3. Octane
4. Nonane
5. Benzene
6. Decane
7. Toluene
8. 1,4-Dioxan
9. Undecane
10. Ethylbenzene
11. p-Xylene
12. m-Xylene
13. Cumene
14. Dodecane
15. o-Xylene
16. Propylbenzene
17. p-Ethyltoluene
18. m-Ethyltoluene
19. t-Butylbenzene
20. s-Butylbenzene
21. Styrene
22. Tridecane
23. 1,3-Diethylbenzene
24. 1,2-Diethylbenzene
25. n-Butylbenzene
26. a-Methylstyrene
27. Phenylacetylene

This application showcases the practicality using High Efficiency GC columns in daily aromatic solvent analysis. The result: a three-fold reduction in run time (compared to a 0.32 mm id column) with no compromise in resolution.

Refinery Gas I

Column: HP PLOT Q
19095P-Q04
30 m x 0.53 mm, 40.00 µm

Carrier: Helium p=9.0 psi at 60 °C

Oven: 60 °C for 5 min
60-200 °C at 20 °C/min
200 °C for 1 min

Injection: Split, 250 °C
Split flow 100 mL/min
0.25 cc valve

Detector: TCD, 250 °C

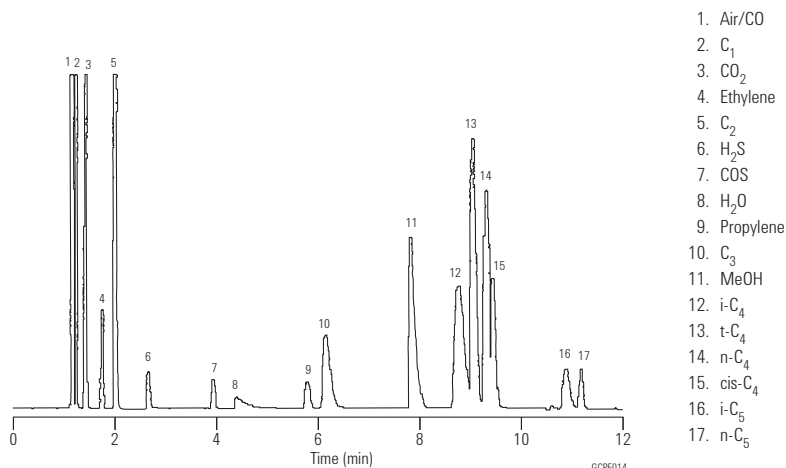
Sample: Refinery gas and others

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

**Unleaded Gasoline**

Column: DB-Petro
122-10A6
100 m x 0.25 mm, 0.50 µm

Carrier: Helium at 25.6 cm/sec

Oven: 0 °C for 15 min
0-50 °C at 1 °C/min
50-130 °C at 2 °C/min
130-180 °C at 4 °C/min
180 °C for 20 min

Injection: Split, 200 °C
Split ratio 1:300

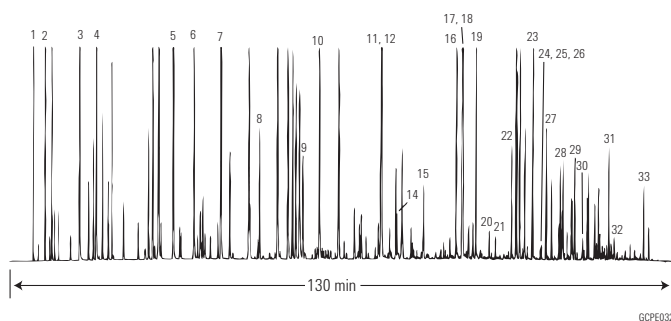
Detector: FID, 250 °C
Nitrogen makeup gas
at 30 mL/min

Sample: 1 µL of neat sample

- | | | |
|-----------------------|----------------------------|--------------------------------|
| 1. Methane | 12. 2,3,3-Trimethylpentane | 23. 1,2,4-Trimethylbenzene |
| 2. n-Butane | 13. 2-Methylheptane | 24. Isobutylbenzene |
| 3. Isopentane | 14. 4-Methylheptane | 25. sec-Butylbenzene |
| 4. n-Pentane | 15. n-Octane | 26. n-Decane |
| 5. n-Hexane | 16. Ethylbenzene | 27. 1,2,3-Trimethylbenzene |
| 6. Methylcyclopentane | 17. m-Xylene ** | 28. Butylbenzene |
| 7. Benzene | 18. p-Xylene | 29. n-Undecane |
| 8. Cyclohexane | 19. o-Xylene | 30. 1,2,4,5-Tetramethylbenzene |
| 9. Isooctane | 20. n-Nonane | 31. Naphthalene |
| 10. n-Heptane | 21. Isopropylbenzene | 32. Dodecane |
| 11. Toluene * | 22. Propylbenzene | 33. Tridecane |

*Valley point with 12 = 78%

**Valley point with 18 = 87%



n-Paraffin Standard

Column: DB-HT SimDis
145-1001
5 m x 0.53 mm, 0.15 µm

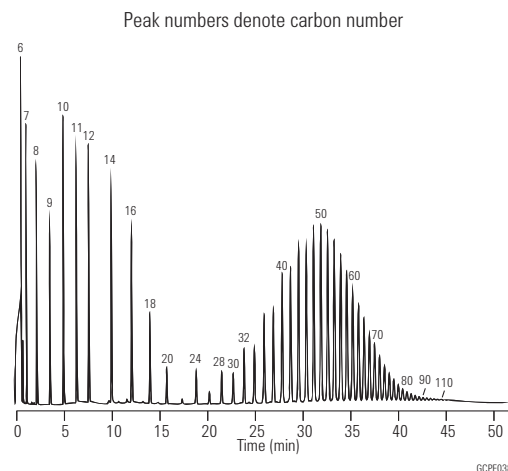
Carrier: Helium at 18 mL/min, measured at 35 °C

Oven: -30-430 °C at 10 °C/min

Injection: OPTIC PTV
55-450 °C at 2 °C/sec

Detector: FID, 450 °C
Nitrogen makeup gas at 15 mL/min

Sample: 0.5 µL of about 2% n-paraffins in CS₂

**Volatile Sulfur Compounds**

Column: DB-1
123-1035
30 m x 0.32 mm, 5.00 µm

Carrier: Helium at 23 cm/sec (H₂S at 50 °C)

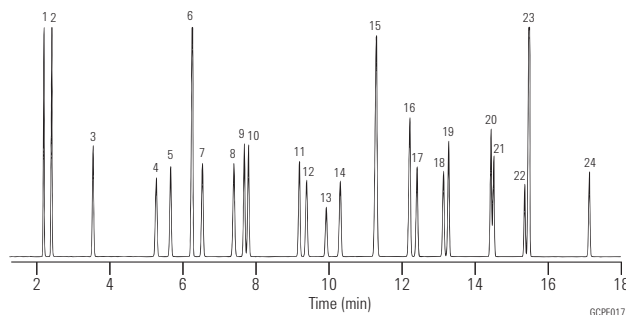
Oven: 50 °C for 4 min, 50-120 °C at 20 °C/min,
120 °C for 4 min, 120-220 °C at
25 °C/min, 220 °C for 2.5 min

Injection: Split, 200 °C
Split ratio 1:10

Detector: PFPD (OI Analytical), 220 °C

Sample: 600 µL of sulfur gas standard
3 ppmV each component

- | | |
|-----------------------------|---------------------------|
| 1. Hydrogen sulfide | 13. Diethyl sulfide |
| 2. Carbonyl sulfide | 14. 1-Butanethiol |
| 3. Methyl mercaptan | 15. Methyl disulfide |
| 4. Ethyl mercaptan | 16. 2-Methylthiophene |
| 5. Dimethyl sulfide | 17. 3-Methylthiophene |
| 6. Carbon disulfide | 18. Tetrahydrothiophene |
| 7. 2-Propanethiol | 19. 1-Pentanethiol |
| 8. 2-Methyl-2-propanethiol | 20. 2-Ethylthiophene |
| 9. 1-Propanethiol | 21. 2,5-Dimethylthiophene |
| 10. Ethyl methyl sulfide | 22. 1-Hexanethiol |
| 11. Thiophene | 23. Ethyl disulfide |
| 12. 2-Methyl-1-propanethiol | 24. 1-Heptanethiol |



Agilent wishes to thank Air Toxics, Ltd. (Folsom, CA) for providing the standard mixture shown in this chromatogram.

Sulfur Compounds in Propylene (1 ppm)

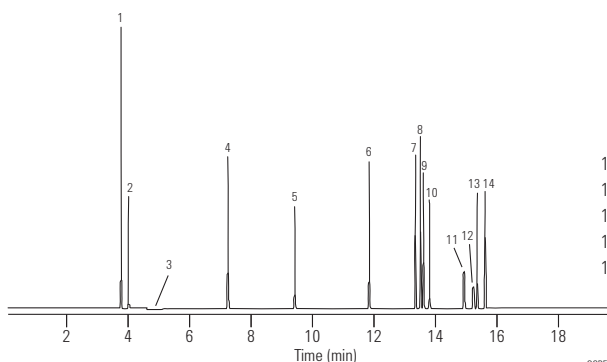
Column: GS-GasPro
113-4332
30 m x 0.32 mm

Oven: 60 °C for 2.5 min
60-250 °C at 10 °C/min

Injection: OI Analytical Volatiles Inlet
Split ratio 5:1
200 µL gas sampling valve

Detector: OI Analytical Model 5380 PFPD

Sample: 1 ppm Sulfur compounds in Propylene



1. COS
2. H₂S
3. Propylene
4. CS₂
5. Methyl mercaptan
6. Ethyl mercaptan
7. Thiophene
8. Dimethyl sulfide
9. 2-Propanethiol
10. 1-Propanethiol
11. 2-Methyl-2-propanethiol
12. 2-Methyl-1-propanethiol
13. 1-Methyl-1-propanethiol
14. 1-Butanethiol

Chromatogram courtesy of OI Analytical.

GCPE020

Sulfur Impurities in Propylene

Column: Select Low Sulfur
CP8575
60 m x 0.32 mm

Oven: 65 °C for 4 min, 30 °C/min to 120 °C for 5 min

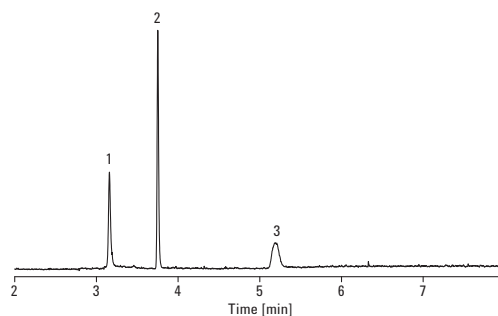
Carrier: Helium, constant flow, 2.0 mL/min

Injection: Gas sampling valve
220 °C, split 1:10

Detector: SCD, 200 °C

Sample: Polypropylene matrix containing ~300 ppb H₂S
and CH₃SH, ~500 ppb COS

Injection Volume: 1 mL



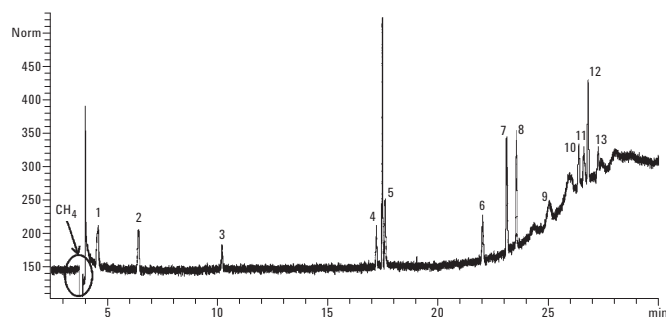
1. H₂S
2. COS
3. CH₃SH

Trace Sulfur Compounds in Methane (50 ppbv)

Column: Select Low Sulfur
CP8575
60 m x 0.32 mm

Oven: 40 °C (6 min), to 120 °C at 6 °C/min,
to 180 °C (5 min) at 10 °C/min

Sample: 1 mL, split ratio: 3:1



Compound	Signal/noise
1. Hydrogen sulfide	3.8
2. Carbonyl sulfide	4.0
3. Methylmercaptan	2.2
4. Ethylmercaptan	3.8
5. Dimethyl sulfide	6.3
6. 2-Propanethiol	4.3
7. Methyl ethyl sulfide	11
8. Thiophene	11
9. Tert-Butyl mercaptan	2.1
10. 2-Butanethiol	4.5
11. 2-Methyl-1 propanethiol	3.7
12. Diethylsulfide	9.8
13. 1-Butanethiol	2.4

Trace Oxygenates in Light Hydrocarbon Matrices

Column: DB-1
125-102J
25 m x 0.53 mm, 1.00 µm

Column: GS-OxyPLOT
115-4912
10 m x 0.53 mm,

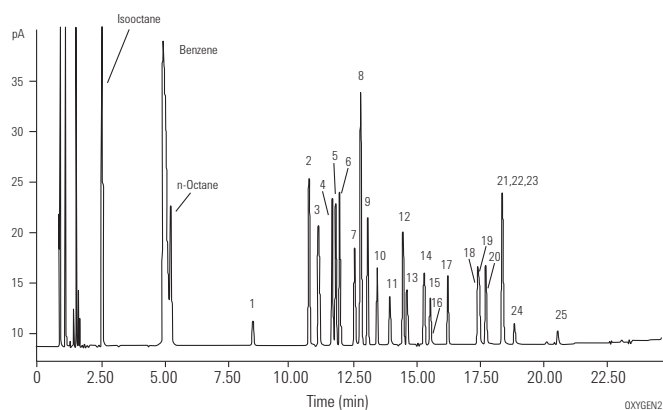
Carrier: Helium (tm = 0.96 min at 50 °C)

Oven: 50 °C for 5 min
50 °C to 240 °C

Injection: Split

Detector: FID

- | | |
|---------------------------|-------------------------|
| 1. Dimethyl ether | 13. Acetone |
| 2. Diethyl ether | 14. Isovaleraldehyde |
| 3. Acetaldehyde | 15. Valeraldehyde |
| 4. Ethyl t-butyl ether | 16. Methyl ethyl ketone |
| 5. Methyl t-butyl ether | 17. Ethanol |
| 6. Diisopropyl ether | 18. n-Propanol |
| 7. Propionaldehyde | 19. Isopropanol |
| 8. Tert-amyl methyl ether | 20. Allyl alcohol |
| 9. Propyl ether | 21. Isobutanol |
| 10. Isobutylaldehyde | 22. t-Butyl alcohol |
| 11. Butylaldehyde | 23. s-Butyl alcohol |
| 12. Methanol | 24. n-Butyl alcohol |
| | 25. 2-methyl-2 pentanol |



Selected Oxygenates

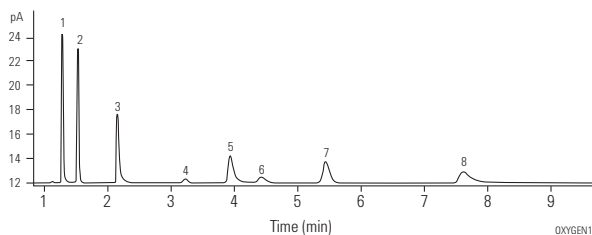
Column: GS-OxyPLOT
115-4912
10 m x 0.53 mm,

Carrier: Helium at 41 cm/s

Oven: 150 °C Isothermal

Injection: Split, 1:40, 250 °C

Detector: FID, 290 °C



1. n-Dodecane
2. Methyl t-butyl ether
3. n-Tridecane
4. Iso-Buteraldehyde
5. n-Tetradecane
6. Methanol
7. Acetone
8. n-Pentadecane

Noble Gases

Column: HP PLOT
19095P-MS0
30 m x 0.53 mm, 50.00 µm

Carrier: Helium, 4 mL/min

Oven: 35 °C for 3 min
35-120 °C at 25 °C/min
120 °C for 5 min

Injection: Split ratio 50:1

Detector: TCD

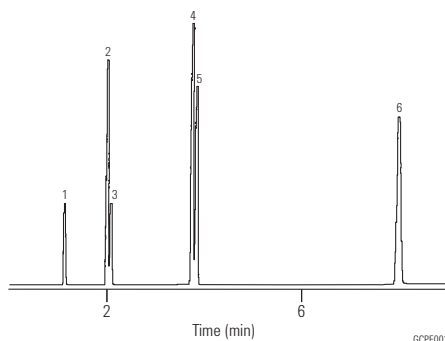
Sample: 250 µL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1. Neon
2. Argon
3. Oxygen
4. Nitrogen
5. Krypton
6. Xenon

Permanent Gases

Column: HP PLOT Molesieve
19091P-MS4
30 m x 0.32 mm, 12.00 µm

Carrier: Helium, 2 mL/min

Oven: 40 °C Isothermal

Injection: Split ratio 75:1

Detector: TCD

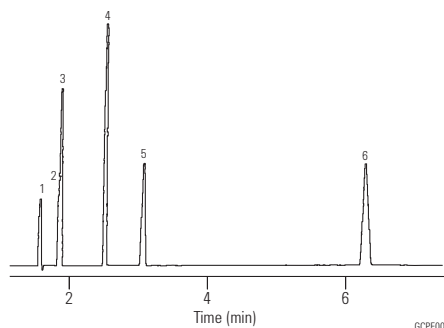
Sample: 250 µL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1. Neon
2. Argon
3. Oxygen
4. Nitrogen
5. Methane
6. Carbon monoxide

Baseline Resolution of Air/CO, CO₂, and Methane in a Natural Gas Sample

Column: HP PLOT Q
19095P-Q04
30 m x 0.53 mm, 40.00 µm

Carrier: Helium (8.6 mL/min @ 60 °C)

Oven: 60 °C for 2 min
60-240 °C at 30 °C/min
240 °C for 1 min

Injection: Split ratio 12:1

Detector: TCD, 250 °C

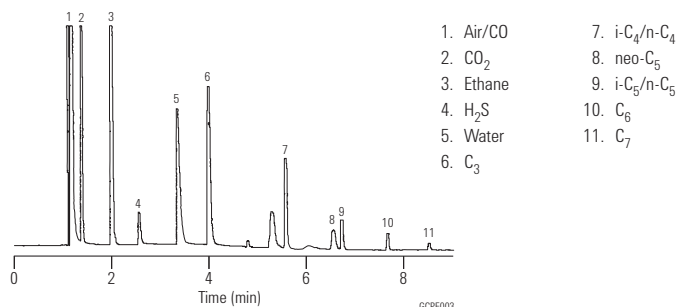
Sample: 0.25 cc natural gas sample, Methane, 80%+

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

**Natural Gas**

Column: HP PLOT Al₂O₃ S
19095P-S21
15 m x 0.53 mm, 15.00 µm

Carrier: Helium, 50 cm/sec (100 °C), 6 mL/min

Oven: 100 °C for 1.5 min
100-180 °C at 30 °C/min

Injection: Split, 250 °C
Split ratio 50:1

Detector: FID, 250 °C

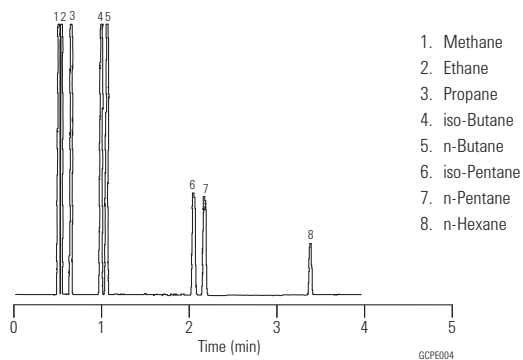
Sample: 5 µL
Natural Gas P/N 5080-8756

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



Ethylene

Column: HP PLOT Al_2O_3 S
19095P-S25
50 m x 0.53 mm, 15.00 μm

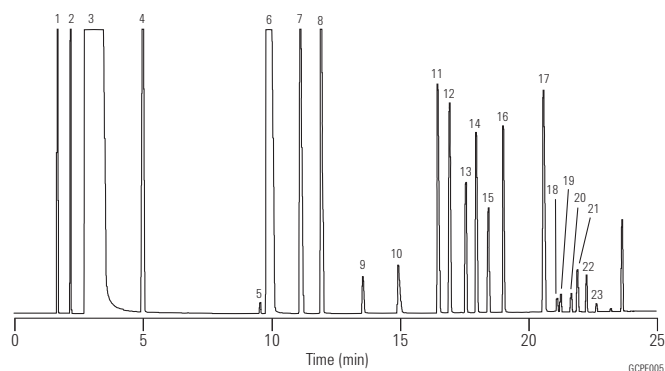
Carrier: Helium, 50 cm/sec (35 °C),
7 mL/min constant flow

Oven: 35 °C for 2 min
35-100 °C at 5 °C/min

Injection: Split, 250 °C
Split ratio 65:1

Detector: FID, 250 °C

Sample: 5 μL
Ethylene 98.4%



1. Methane
2. Ethane
3. Ethylene
4. Propane
5. Cyclopropane
6. Propylene
7. Isobutane
8. n-Butane
9. Propadiene
10. Acetylene
11. trans-2-Butene
12. Butene-1
13. Isobutylene
14. cis-2-Butene
15. Isopentane
16. n-Pentane
17. 1,3-Butadiene
18. Propyne
19. trans-2-Pentene
20. 2-Methyl-2-butene
21. Pentene-1
22. cis-2-Pentene
23. n-Hexane

Impurities in Ethylene

Column: GS-Alumina KCl
115-3352
50 m x 0.53 mm,

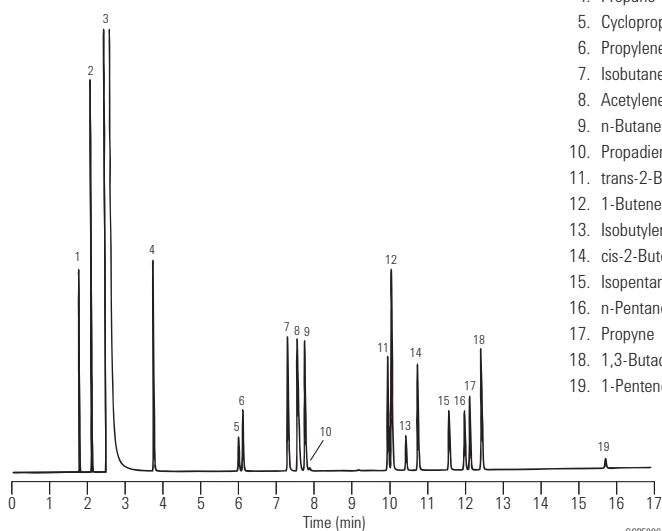
Carrier: Helium at 8 mL/min, measured at 35 °C

Oven: 35 °C for 2 min
35-190 °C at 10 °C/min
190 °C for 3 min

Injection: Split, 200 °C
Split ratio 1:40

Detector: FID, 200 °C
Nitrogen makeup gas at 20 mL/min

Sample: 0.2 mL of trace hydrocarbons
in ethylene



1. Methane
2. Ethane
3. Ethylene
4. Propane
5. Cyclopropane
6. Propylene
7. Isobutane
8. Acetylene
9. n-Butane
10. Propadiene
11. trans-2-Butene
12. 1-Butene
13. Isobutylene
14. cis-2-Butene
15. Isopentane
16. n-Pentane
17. Propyne
18. 1,3-Butadiene
19. 1-Pentene

Impurities in Propylene

Column: GS-Alumina KCl
115-3352
50 m x 0.53 mm,

Carrier: Helium at 10 mL/min,
measured at 35 °C

Oven: 35 °C for 2 min
35-190 °C at 10 °C/min
190 °C for 3 min

Injection: Split, 200 °C
Split ratio 1:30

Detector: FID, 200 °C
Nitrogen makeup gas
at 20 mL/min

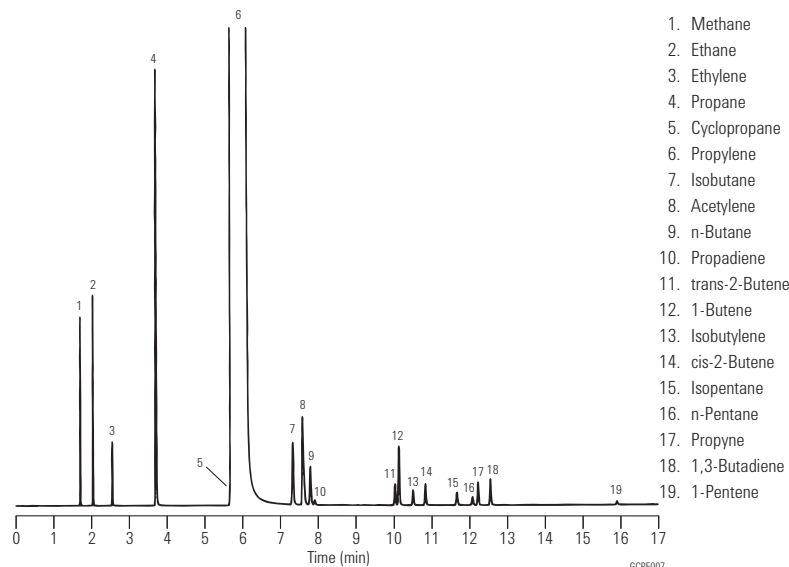
Sample: 0.2 mL of trace
hydrocarbons in propylene

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

**Propylene**

Column: GS-Alumina
115-3552
50 m x 0.53 mm

Carrier: Helium at 10 mL/min,
measured at 35 °C

Oven: 35 °C for 2 min
35-190 °C at 10 °C/min
190 °C for 3 min

Injection: Split, 200 °C
Split ratio 1:30

Detector: FID, 200 °C
Nitrogen makeup gas
at 20 mL/min

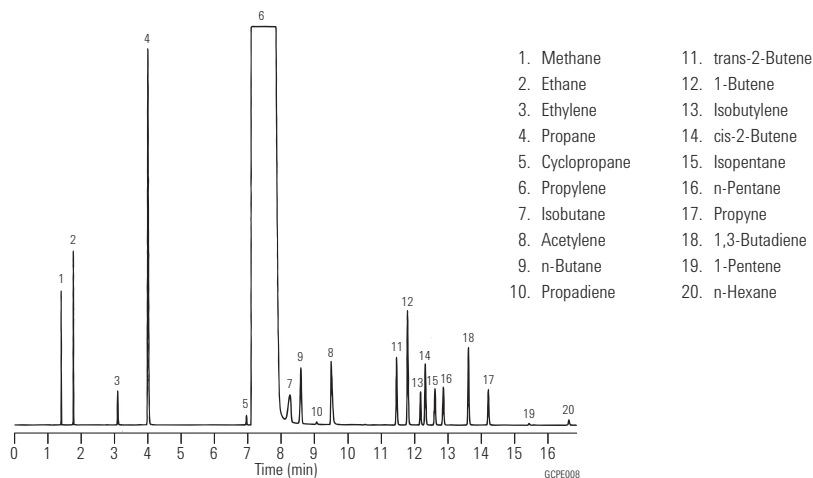
Sample: 0.2 mL of trace
hydrocarbons in propylene

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1,3-Butadiene

Column: DB-624
128-1324
25 m x 0.20 mm, 1.12 µm

Carrier: Helium at 1.0 mL/min

Oven: -20 °C for 3 min
-20 °C-20 °C at 4 °C/min
20 °C-200 °C at 8 °C/min
200 °C for 10 min

Injection: Split, 250 °C
Split ratio 1:150

Detector: FID, 250 °C

Sample: 0.5 µL

Suggested Supplies

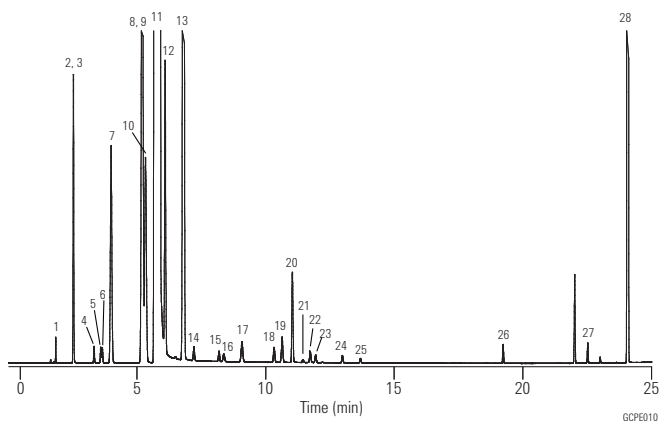
Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

**Refined Butadiene
Standard Component****Gravimetric
concentration (PPM)**

1. Acetylene	20.7
2. Propane	19.8
3. Propylene	296
4. Propadiene (allene)	21.1
5. Propyne (methylacetylene)	21
6. Cyclopropane	20
7. Isobutane	506
8. Butene-1	999
9. Isobutylene	495
10. n-Butane	494
11. 1,3-Butadiene	balance
12. trans-2-Butene	442
13. cis-2-Butene	1946
14. 1-Butyne (ethylacetylene)	20.2
15. 1,2-Butadiene	28.9
16. 3-Methyl-1-butene	19.8
17. Isopentane	50.1
18. Pentene-1	29.8
19. n-Pentane	50.1
20. 2-Butyne (dimethylacetylene)	150
21. trans-2-Pentene	5.57
22. Isoprene	20
23. cis-2-Pentene	13.9
24. trans-1,3-Pentadiene	13.8
25. cis-1,3-Pentadiene	7.73
26. Benzene	20.3
27. Toluene	20.2
28. Dimer (4-vinylcyclohexene-1)	



Agilent Technologies wishes to
thank DCG Industries (Pearland, TX)
for providing this chromatogram.

1,3-Butadiene Purity

Column: GS-Alumina
115-3552
50 m x 0.53 mm

Carrier: Helium, 6.0 mL/min
(constant flow mode)

Oven: 45 °C for 3 min
6 °C/min to 195 °C
195 °C for 15 min

Injection: Split, 250 °C
Split ratio 1:50

Detector: FID, 250 °C

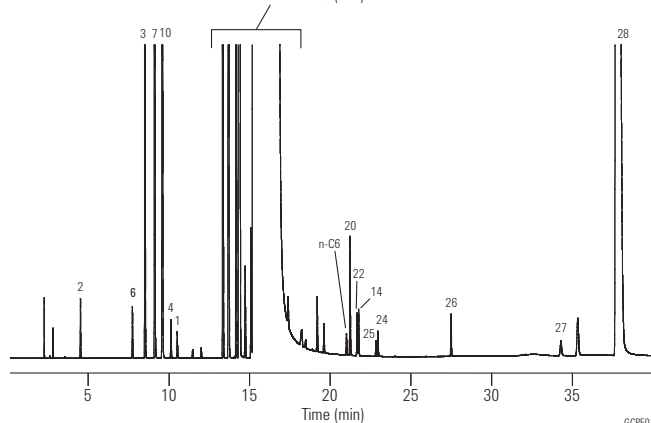
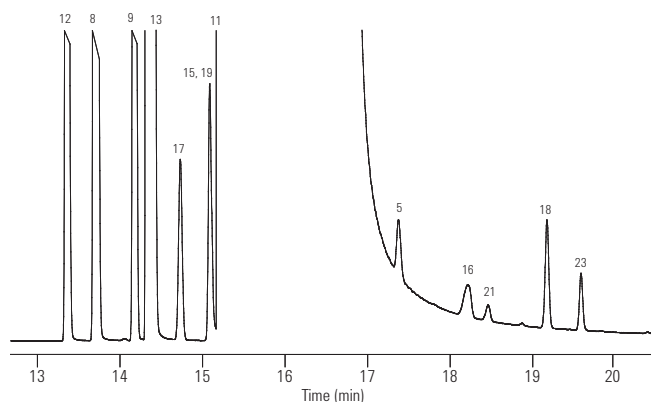
Sample: 0.5 µL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

**Refined Butadiene
Standard Component****Gravimetric
concentration (PPM)**

1. Acetylene	20.7
2. Propane	19.8
3. Propylene	296
4. Propadiene (allene)	21.1
5. Propyne (methylacetylene)	21
6. Cyclopropane	20
7. Isobutane	506
8. Butene-1	999
9. Isobutylene	495
10. n-Butane	494
11. 1,3-Butadiene	balance
12. trans-2-Butene	442
13. cis-2-Butene	1946
14. 1-Butyne (ethylacetylene)	20.2
15. 1,2-Butadiene	28.9
16. 3-Methyl-1-butene	19.8
17. Isopentane	50.1
18. Pentene-1	29.8
19. n-Pentane	50.1
20. 2-Butyne (dimethylacetylene)	150
21. trans-2-Pentene	5.57
22. Isoprene	20
23. cis-2-Pentene	13.9
24. trans-1,3-Pentadiene	13.8
25. cis-1,3-Pentadiene	7.73
26. Benzene	20.3
27. Toluene	20.2
28. Dimer (4-vinylcyclohexene-1)	

Extended Hydrocarbon Analysis I

Column: GS-Alumina
115-3532
30 m x 0.53 mm

Carrier: Helium at 52 cm/sec (6.7 mL/min),
measured at 100 °C

Oven: 100 °C for 1 min
100-140 °C at 8 °C/min
140 °C for 0.5 min
140-200 °C at 30 °C/min

Injection: Split, 250 °C
Split ratio 1:8

Detector: FID, 275 °C
Nitrogen makeup gas at 29 mL/min

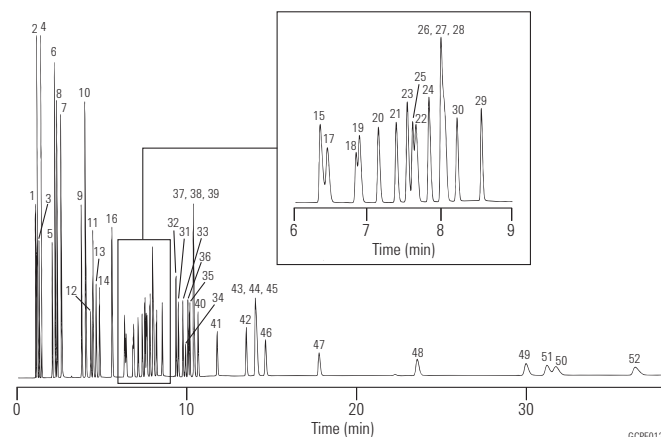
Sample: 300 µL injection of 100 ppm V
SUMMA cannister mixture

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



- | | |
|------------------------|--|
| 1. Methane | 27. 2-Methylpentane |
| 2. Ethane | 28. 3-Methylpentane |
| 3. Ethylene | 29. Isoprene |
| 4. Propane | 30. n-Hexane |
| 5. Propylene | 31. 4-Methyl-1-pentene |
| 6. Isobutane | 32. trans-2-Hexene |
| 7. Acetylene | 33. 2-Methyl-1-pentene |
| 8. n-Butane | 34. cis-2-Hexene |
| 9. trans-2-Butene | 35. 2,4-Dimethylpentane |
| 10. 1-Butene | 36. Methylcyclohexane |
| 11. cis-2-Butene | 37. 2,3-Dimethylpentane |
| 12. Cyclopentane | 38. 2-Methylhexane |
| 13. Isopentane | 39. 3-Methylhexane |
| 14. n-Pentane | 40. n-Heptane |
| 15. Propyne | 41. Benzene |
| 16. 1,3-Butadiene | 42. Isooctane (2,2,4-Trimethylpentane) |
| 17. Cyclopentene | 43. 2,3,4-Trimethylpentane |
| 18. 3-Methyl-1-butene | 44. 3-Methylheptane |
| 19. trans-2-Pentene | 45. 2-Methylheptane |
| 20. 2-Methyl-2-butene | 46. n-Octane |
| 21. 1-Pentene | 47. Toluene |
| 22. cis-2-Pentene | 48. n-Nonane |
| 23. Methylcyclopentane | 49. Ethylbenzene |
| 24. 2,2-Dimethylbutane | 50. m-Xylene |
| 25. Cyclohexane | 51. p-Xylene |
| 26. 2,3-Dimethylbutane | 52. o-Xylene |

Extended Hydrocarbon Analysis II

Column: GS-GasPro
113-4362
60 m x 0.32 mm

Carrier: Helium at 40 cm/sec (3.3 mL/min),
measured at 80 °C

Oven: 80 °C for 0.5 min
80-175 °C at 25 °C/min
175 °C for 2 min
175-250 °C at 25 °C/min

Injection: Split, 250 °C
Split ratio 1:17

Detector: FID, 275 °C
Nitrogen makeup gas at 32 mL/min

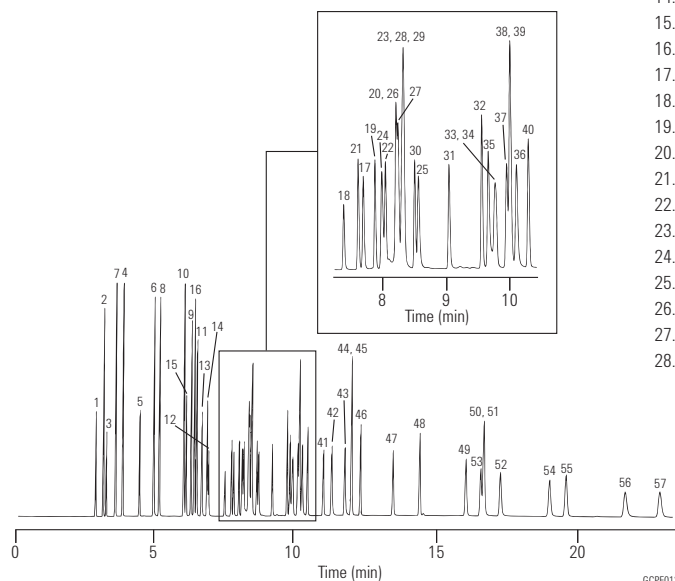
Sample: 500 µL injection of 100 ppmV
SUMMA cannister mixture

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



- | | |
|------------------------|--|
| 1. Methane | 29. Isoprene |
| 2. Ethane | 30. n-Hexane |
| 3. Ethylene | 31. 4-Methyl-1-pentene |
| 4. Propane | 32. trans-2-Hexene |
| 5. Propylene | 33. 2-Methyl-1-pentene |
| 6. Isobutane | 34. cis-2-Hexene |
| 7. Acetylene | 35. 2,4-Dimethylpentane |
| 8. n-Butane | 36. Methylcyclohexane |
| 9. trans-2-Butene | 37. 2,3-Dimethylpentane |
| 10. 1-Butene | 38. 2-Methylhexane |
| 11. cis-2-Butene | 39. 3-Methylhexane |
| 12. Cyclopentane | 40. n-Heptane |
| 13. Isopentane | 41. Benzene |
| 14. n-Pentane | 42. Isooctane (2,2,4-Trimethylpentane) |
| 15. Propyne | 43. 2,3,4-Trimethylpentane |
| 16. 1,3-Butadiene | 44. 3-Methylheptane |
| 17. Cyclopentene | 45. 2-Methylheptane |
| 18. 3-Methyl-1-butene | 46. n-Octane |
| 19. trans-2-Pentene | 47. Toluene |
| 20. 2-Methyl-2-butene | 48. n-Nonane |
| 21. 1-Pentene | 49. Ethylbenzene |
| 22. cis-2-Pentene | 50. m-Xylene |
| 23. Methylcyclopentane | 51. p-Xylene |
| 24. 2,2-Dimethylbutane | 52. o-Xylene |
| 25. Cyclohexane | 53. Styrene |
| 26. 2,3-Dimethylbutane | 54. Isopropylbenzene (Cumene) |
| 27. 2-Methylpentane | 55. n-Propylbenzene |
| 28. 3-Methylpentane | 56. 1,3,5-Trimethylbenzene |
| | 57. 1,2,4-Trimethylbenzene |

Refinery Gas

Column: HP PLOT Al_2O_3 S
19095P-S25
50 m x 0.53 mm, 15.00 μm

Carrier: Helium 7 mL/min

Oven: 100 °C Isothermal

Injection: Split, 250 °C
Split ratio 100:1

Detector: FID, 250 °C

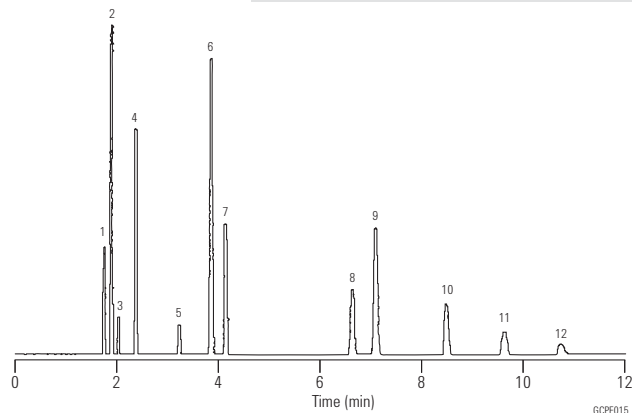
Sample: 5 μL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1. Methane
2. Ethane
3. Ethylene
4. Propane
5. Propylene
6. iso-Butane
7. n-Butane
8. trans-2-Butene
9. 1-Butene
10. cis-2 Butene
11. iso-Pentane
12. n-Pentane

**Sulfur Gas Analysis
in Light Hydrocarbon Streams I**

Column: GS-GasPro
113-4332
30 m x 0.32 mm

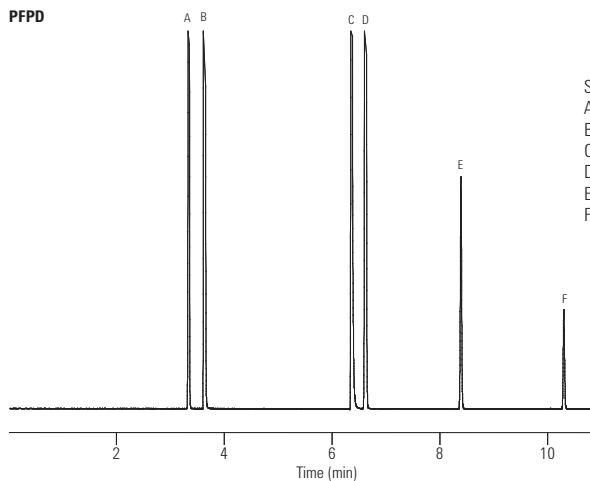
Carrier: Helium, 10 psig,
2.0 mL/min @ 60 °C

Oven: 60 °C for 2 min,
20 °C/min to 260 °C and hold

Injection: Split, 200 °C
Split ratio 1:20

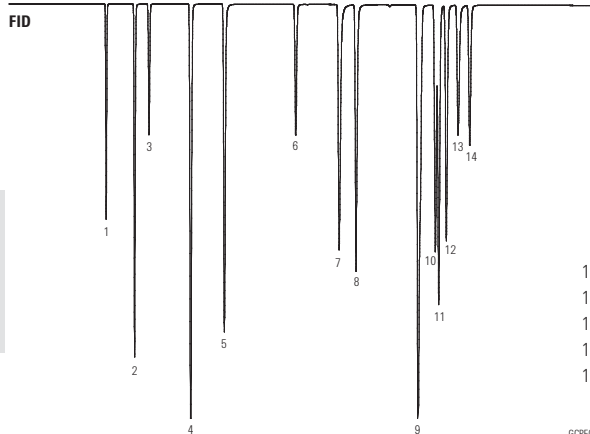
Detector: Two separate analyses under
identical conditions on FID
and PFPD

PFPD



- Sulfur compounds (PFPD)
- A. Carbonyl sulfide
 - B. Hydrogen sulfide
 - C. Sulfur dioxide
 - D. Carbon disulfide
 - E. Methyl mercaptan
 - F. Ethyl mercaptan

FID



1. Methane
2. Ethane
3. Ethylene
4. Acetylene
5. Propane
6. Propylene
7. iso-Butane
8. n-Butane
9. 1-Butene/Methyl acetylene
10. trans-2-Butene
11. 1,3-Butadiene
12. cis-2-Butene
13. iso-Pentane
14. n-Pentane

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

Sulfur Gas Analysis in Light Hydrocarbon Streams II

Column: GS-Q
113-3432
30 m x 0.32 mm, 0.20 µm

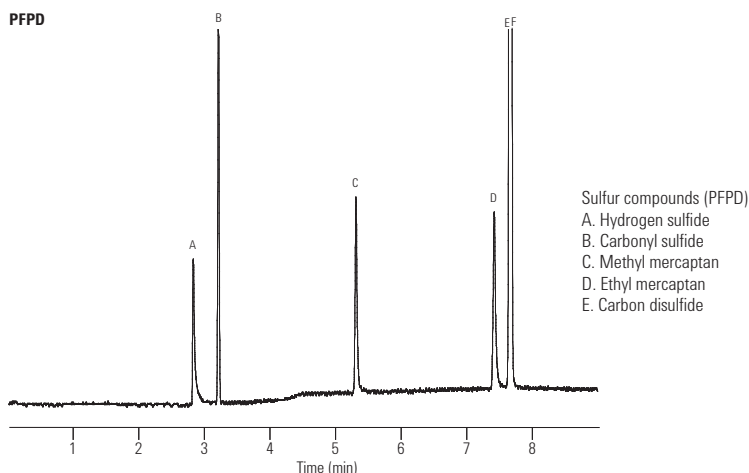
Carrier: Helium, 10 psig, 1.7 mL/min @ 100 °C

Oven: 100 °C for 2 min, 20 °C/min to 250 °C and hold

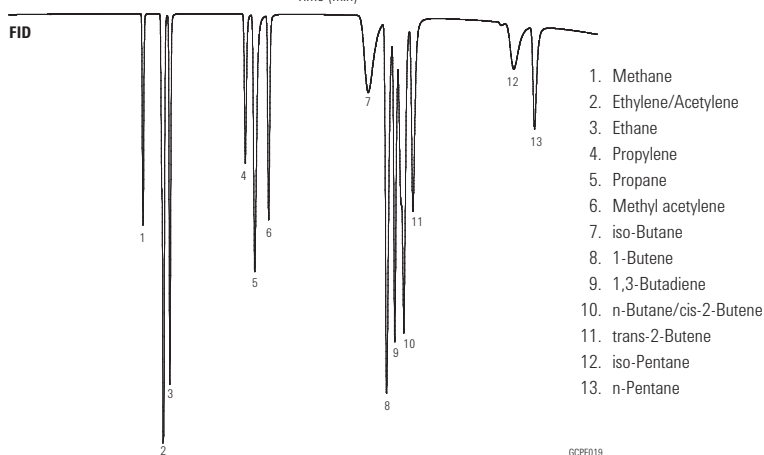
Injection: Split, 200 °C
Split ratio 1:20

Detector: Two separate analyses under identical conditions on FID and PFPD

PFPD



FID



GCPE019

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

Sulfur Compounds in Propylene (1 ppm)

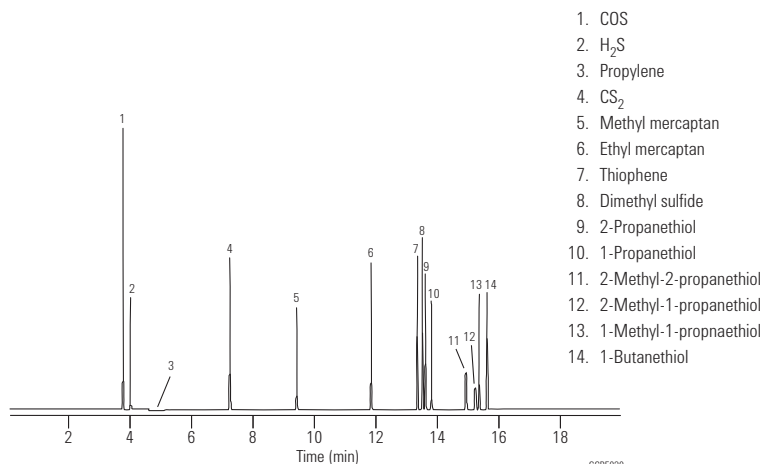
Column: GS-GasPro
113-4332
30 m x 0.32 mm

Oven: 60 °C for 2.5 min
60-250 °C at 10 °C/min

Injection: OI Analytical Volatiles Inlet
Split ratio 5:1
200 µL gas sampling valve

Detector: OI Analytical Model 5380 PFPD

Sample: 1 ppm Sulfur compounds in Propylene



GCPE020

Chromatogram courtesy of OI Analytical.

Mercaptans

Column: GS-GasPro
113-4332
30 m x 0.32 mm

Carrier: Helium at 25 cm/sec

Oven: 175 °C for 2 min
175-260 °C at 10 °C/min

Injection: Split
Split flow 80 mL/min

Detector: FID

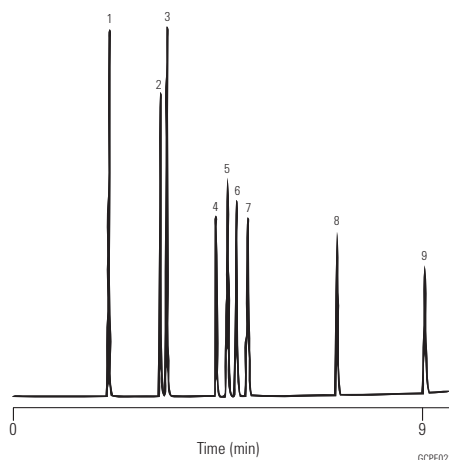
Sample: 0.2 mL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1. Ethyl mercaptan
2. 2-Propyl mercaptan
3. 1-Propyl mercaptan
4. 2-Methyl-2-propyl mercaptan
5. 2-Methyl-1-propyl mercaptan
6. 1-Methyl-1-propyl mercaptan
7. 1-Butyl mercaptan
8. 1-Pentyl mercaptan
9. 1-Hexyl mercaptan

Sulfur Compounds in Natural Gas – Synthetic Mixture

Column: HP-1
19091Z-205
50 m x 0.20 mm, 0.50 µm

Carrier: Helium

Oven: 35 °C for 10 min
35-300 °C at 7 °C/min

Injection: Split 100:1

Detector: FPD

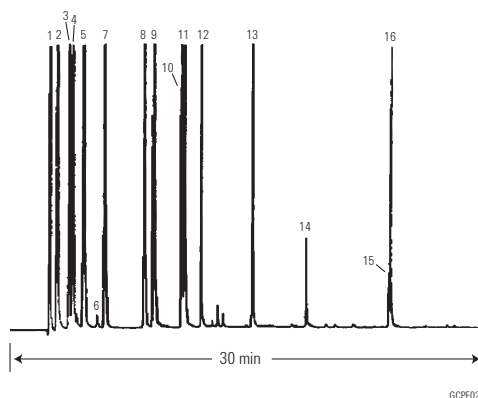
Sample: 0.5 mL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1. Hydrogen sulfide
2. Methyl mercaptan
3. Ethyl mercaptan
4. Dimethyl sulfide
5. Isopropyl mercaptan
6. tert-Butyl mercaptan
7. n-Propyl mercaptan
8. Thiophene and sec-Butyl mercaptan
9. Isobutyl mercaptan
10. n-Butyl mercaptan
11. tert-Amyl mercaptan
12. Isoamyl mercaptan
13. n-Amyl mercaptan
14. n-Hexyl mercaptan
15. tert-Dibutyl disulfide
16. n-Octyl mercaptan

Sulfur Compounds in Naphtha

Column: HP-PONA
19091S-001
50 m x 0.20 mm, 0.50 μ m

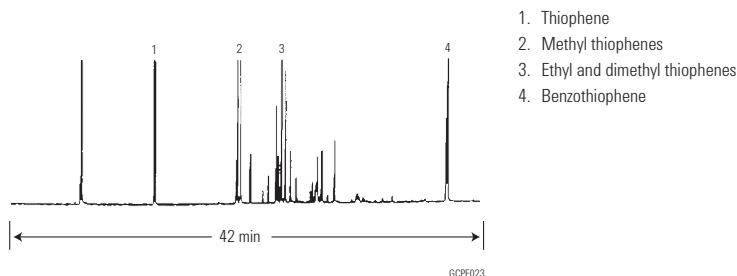
Carrier: Helium, 26 cm/sec

Oven: 35 °C for 15 min
35-70 °C at 8 °C/min
70-130 °C at 15 °C/min

Injection: Split ratio 400:1

Detector: FPD

Sample: 3 μ L

**Aromatics Analysis – ASTM D16 Analytes**

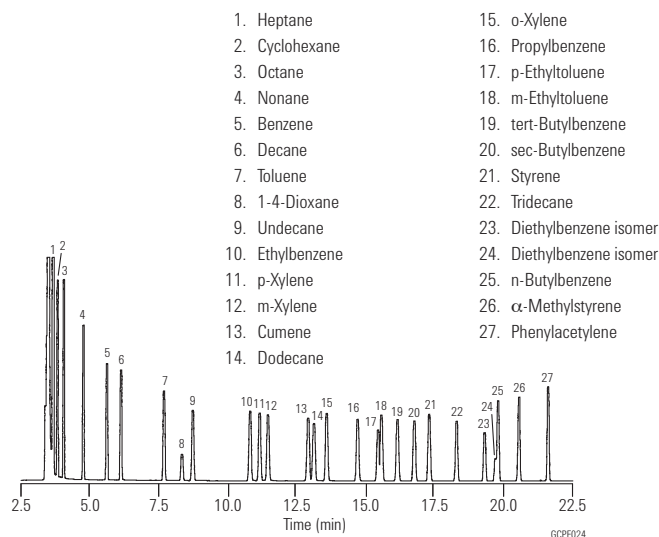
Column: HP-INNOWax
19091N-216
60 m x 0.32 mm, 0.50 μ m

Carrier: Helium at 20 psi, constant pressure mode

Oven: 75 °C for 10 min
3 °C/min to 100 °C
10 °C/min to 145 °C

Injection: Split, 250 °C
Split ratio 100:1 to 400:1

Detector: FID, 250 °C
Data acquisition rate at 20 Hz

**Aromatics Analysis – Ethylbenzene Impurities**

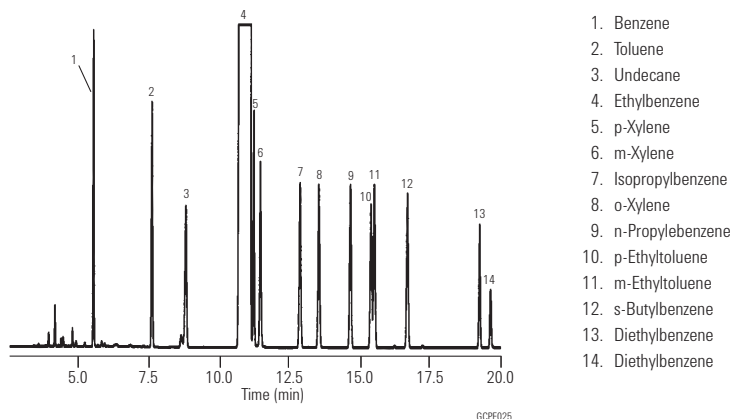
Column: HP-INNOWax
19091N-216
60 m x 0.32 mm, 0.50 μ m

Carrier: Helium at 20 psi, constant pressure mode

Oven: 75 °C for 10 min
3 °C/min to 100 °C
10 °C/min to 145 °C

Injection: Split, 250 °C
Split ratio 100:1 to 400:1

Detector: FID, 250 °C
Data acquisition rate at 20 Hz



Impurities in p-Xylene – ASTM D3798

Column: HP-INNOWax
19091N-216
60 m x 0.32 mm, 0.50 µm

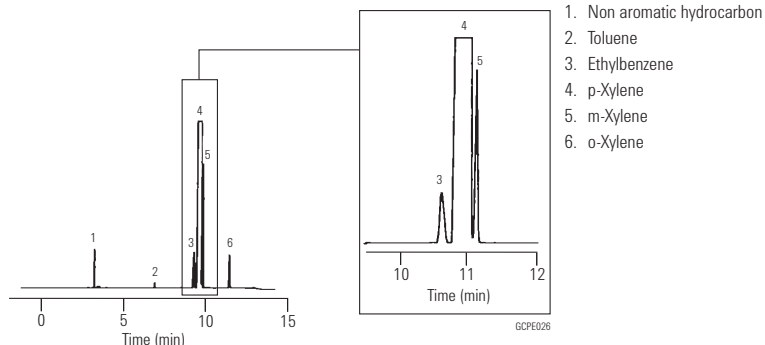
Carrier: Helium, 32 cm/sec, 19.9 psi (60 °C),
2.5 mL/min constant flow

Oven: 60 °C for 1 min
60-92 °C at 4 °C/min
92 °C for 4.5 min
92-220 °C at 20 °C/min
220 °C for 5 min

Injection: Split, 220 °C
Split ratio 100:1

Detector: FID, 270 °C

Sample: 0.5 µL
Neat, 99%+

**Ethylene Oxide Synthetic Standard**

Column: HP PLOT Q
19095P-Q04
30 m x 0.53 mm, 40.00 µm

Carrier: Helium, 25 psi

Oven: 50 °C for 2 min
50-250 °C at 15 °C/min

Injection: Split ratio 40:1

Detector: FID

Sample: 1 µL liquid injection
sample 2000 ppm v/v

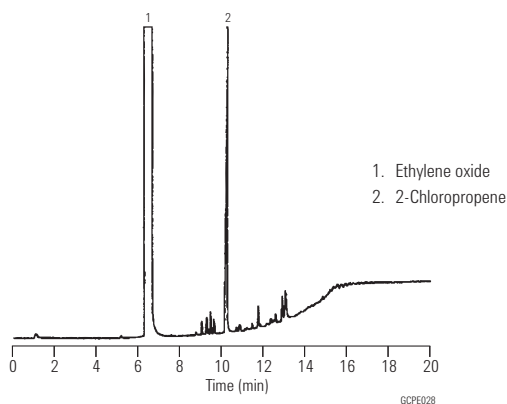
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



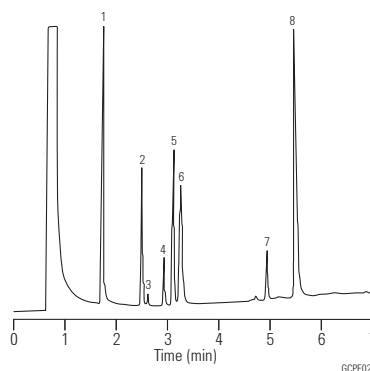
Oxygenates

Column: HP PLOT Q
19095P-Q04
30 m x 0.53 mm, 40.00 µm

Carrier: Helium, 25 psig

Oven: 150 °C for 2 min
150-250 °C at 15 °C/min

Detector: FID



1. Ethanol
2. 2-Propanone
3. Dichloromethane
4. Acetic acid, methyl ester
5. Diethyl ether
6. Pentane
7. Acetic acid, ethyl ester
8. Hexane

Oxygenates in Gasoline ASTM D5599 (GC-OFID)

Column: HP-1
19091Z-236
60 m x 0.25 mm, 1.00 µm

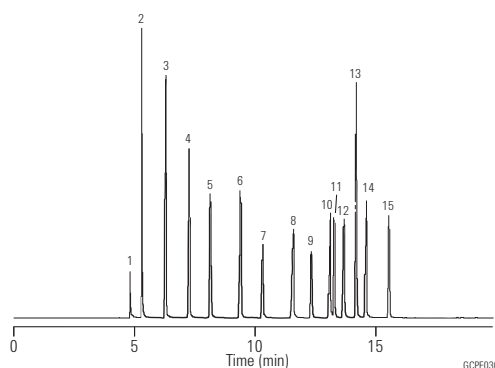
Carrier: Helium 30 cm/sec constant flow

Oven: 40 °C for 6 min
40-50 °C at 5 °C/min
50 °C for 4 min
50-175 °C at 25 °C/min
175 °C for 5 min

Injection: Split ratio 150:1

Detector: Wauson ECE OFID

Sample: 0.5 µL



1. Water
2. Methanol
3. Ethanol
4. 2-Propanol
5. t-Butanol
6. 1-Propanol
7. MTBE
8. sec-Butanol
9. DIPE
10. Isobutanol
11. ETBE
12. TAA
13. 1,2-Dimethoxyethane
14. 1-Butanol
15. TAME

Denatured Fuel Ethanol – ASTM D5501

Column: HP-1
19091Z-530
100 m x 0.25 mm, 0.50 µm

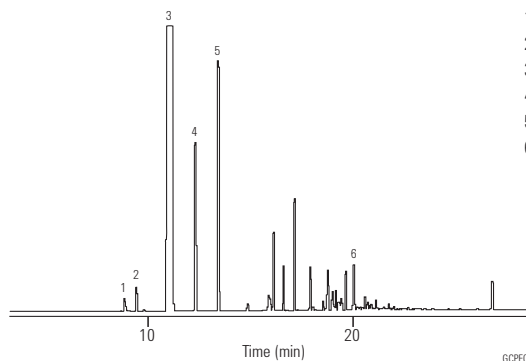
Carrier: Helium 24 cm/sec

Oven: 15 °C for 12 min
15-250 °C at 19 °C/min
250 °C for 20 min

Injection: Split ratio 200:1

Detector: FID 250 °C
Nitrogen makeup
gas at 30 mL/min

Sample: 0.5 µL



1. Methanol
2. n-Butane
3. Ethanol
4. Isopentane
5. n-Pentane
6. Other hydrocarbons

PONA Mix as Specified by AFNOR Method #2

Column: DB-Petro
128-1056
50 m x 0.20 mm, 0.50 µm

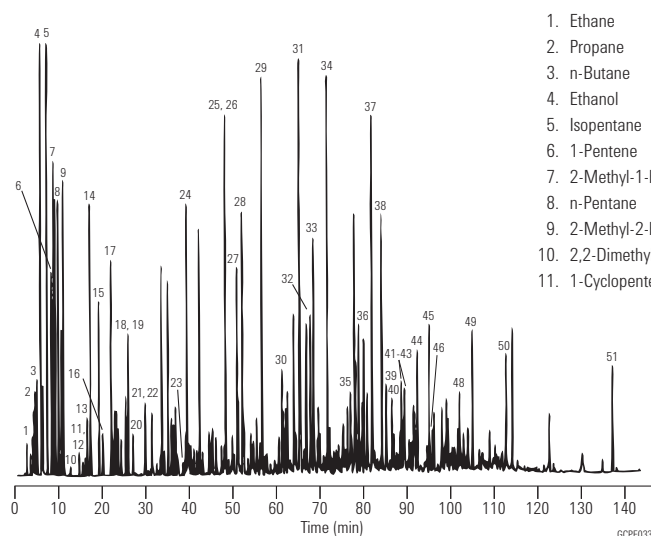
Carrier: Helium at 16.7 cm/sec,
measured at 35 °C

Injection: Split, 250 °C
Split ratio 1:200

Sample: 0.3 µL petroleum reformate

Oven: 10 °C for 15 min
10-70 °C at 1.3 °C/min
70-250 °C at 1.7 °C/min

Detector: FID, 250 °C
Nitrogen makeup gas
at 30 mL/min



- | | | |
|------------------------|-----------------------------|--------------------------------|
| 1. Ethane | 12. Cyclopentane | 31. m-Xylene |
| 2. Propane | 13. 2,3-Dimethylbutane | 32. p-Xylene |
| 3. n-Butane | 14. 2-Methylpentane | 33. o-Xylene |
| 4. Ethanol | 15. 3-Methylpentane | 34. n-Nonane |
| 5. Isopentane | 16. 2-Methyl-1-pentene | 35. n-Propylbenzene |
| 6. 1-Pentene | 17. n-Hexane | 36. 1,3,5-Trimethylbenzene |
| 7. 2-Methyl-1-butene | 18. 2,2-Dimethylpentane | 37. 1,2,4-Trimethylbenzene |
| 8. n-Pentane | 19. Methylcyclopentane | 38. n-Decane |
| 9. 2-Methyl-2-butene | 20. 2,4-Dimethylpentane | 39. 1,2,3-Trimethylbenzene |
| 10. 2,2-Dimethylbutane | 21. Benzene | 40. Indan |
| 11. 1-Cyclopentene | 22. 1-Methyl-1-cyclopentene | 41. 1,3-Diethylbenzene |
| | 23. Isooctane | 42. 1-Methyl-3-propylbenzene |
| | 24. n-Heptane | 43. 1,3-Diethyl-5-ethylbenzene |
| | 25. Toluene | 44. 1,2-Diethyl-4-ethylbenzene |
| | 26. 2,3,3-Trimethylpentane | 45. n-Undecane |
| | 27. 2-Methylheptane | 46. 1,2,4,5-Tetramethylbenzene |
| | 28. 3-Methylheptane | 47. 1,2,3,5-Tetramethylbenzene |
| | 29. n-Octane | 48. Naphthalene |
| | 30. Ethylbenzene | 49. n-Dodecane |
| | | 50. 2-Methylnaphthalene |
| | | 51. Tetradecane |

**Aromatics in Finished Gasoline –
ASTM Method 5769**

Column: DB-1
122-1063
60 m x 0.25 mm, 1.00 µm

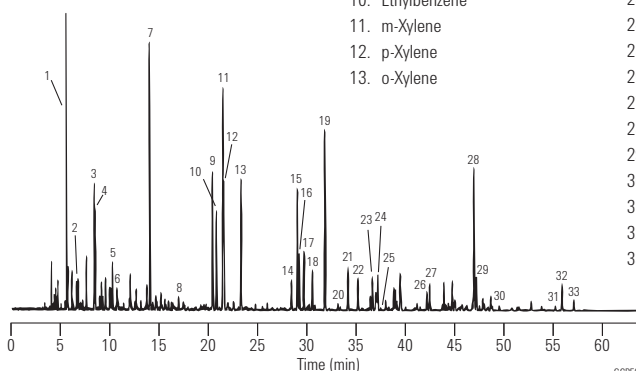
Carrier: Helium at 35 cm/sec,
measured at 50 °C

Oven: 50 °C for 1 min
50-190 °C at 2 °C/min
190 °C for 1 min

Injection: Split, 250 °C
Split ratio 1:100

Detector: MSD

Sample: 0.3 µL unleaded gasoline
Calib std: ASTM/EPA gasoline
refinery aromatics
(AccuStandard M-GRA-CAL/IS-SET)



- | | |
|-----------------------------------|--------------------------------|
| 1. Methyl-tert-butyl-ether (MTBE) | 14. n-Propylbenzene |
| 2. n-Hexane | 15. 1-Methyl-3-ethylbenzene |
| 3. Benzene-d6 (IS) | 16. 1-Methyl-4-ethylbenzene |
| 4. Benzene | 17. 1,3,5-Trimethylbenzene |
| 5. Isooctane | 18. 1-Methyl-2-ethylbenzene |
| 6. n-Heptane | 19. 1,2,4-Trimethylbenzene |
| 7. Toluene | 20. n-Decane |
| 8. n-Octane | 21. 1,2,3-Trimethylbenzene |
| 9. Ethylbenzene-d10 (IS) | 22. Indan |
| 10. Ethylbenzene | 23. 1,4-Diethylbenzene |
| 11. m-Xylene | 24. n-Butylbenzene (valley) |
| 12. p-Xylene | 25. 1,2-Diethylbenzene |
| 13. o-Xylene | 26. 1,2,4,5-Tetramethylbenzene |
| | 27. 1,2,3,5-Tetramethylbenzene |
| | 28. Naphthalene-d8 (IS) |
| | 29. Naphthalene |
| | 30. n-Dodecane |
| | 31. Pentamethylbenzene |
| | 32. 2-Methylnaphthalene |
| | 33. 1-Methylnaphthalene |

Simulated Distillation

Column: DB-2887
125-2814
10 m x 0.53 mm, 3.00 μ m

Carrier: Helium at 7 mL/min

Oven: 35-350 °C at 15 °C/min

Injection: Direct

Detector: FID
Nitrogen makeup gas
at 30 mL/min

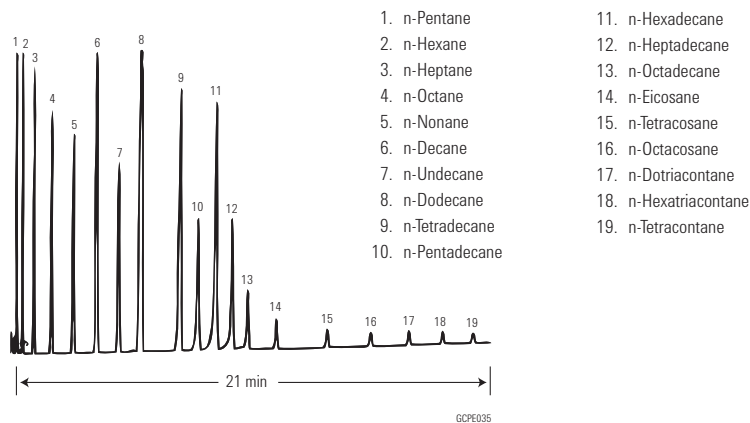
Suggested Supplies

Septum: 11 mm Certified BTO septa, 5183-4757

Liner: Direct connect, dual taper, deactivated, 4 mm id, G1544-80700

Seal: Gold plated seal, 18740-20885

Syringe: 10 μ L tapered, FN 23-26s/42/HP, 5181-1267

**Reference Gas Oil**

Column: DB-2887
125-2814
10 m x 0.53 mm, 3.00 μ m

Carrier: Helium at 7 mL/min

Oven: 35-350 °C at 15 °C/min

Injection: Direct

Detector: FID
Nitrogen makeup gas
at 30 mL/min

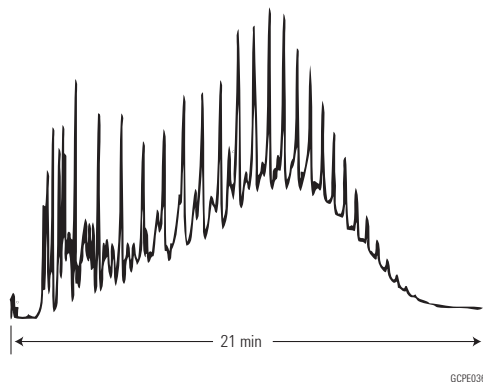
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, dual taper, deactivated, 4 mm id, G1544-80700

Seal: Gold plated seal, 18740-20885

Syringe: 10 μ L tapered, FN 23-26s/42/HP, 5181-1267



Regular Unleaded Gasoline (California Phase 1) – "Normal" GC Run I

Column: DB-Petro
122-10A6
100 m x 0.25 mm, 0.50 μ m

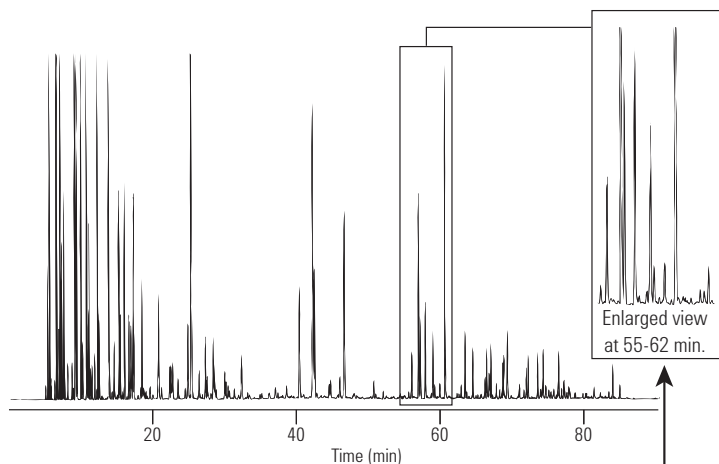
Carrier: Hydrogen at 31 cm/sec

Oven: 35 °C for 9.5 min
35-45 °C at 13.3 °C/min
45 °C for 11 min
45-60 °C at 1.4 °C/min
60 °C for 11 min
60-220 °C at 2.7 °C/min
220 °C for 3.6 min

Injection: Split ratio 1:200

Detector: FID, 300 °C

Sample: 0.2 μ L



**Compare
Resolution**

Regular Unleaded Gasoline (California Phase 1) – "Normal" GC Run II

Column: DB-1
127-1046
40 m x 0.10 mm, 0.20 μ m

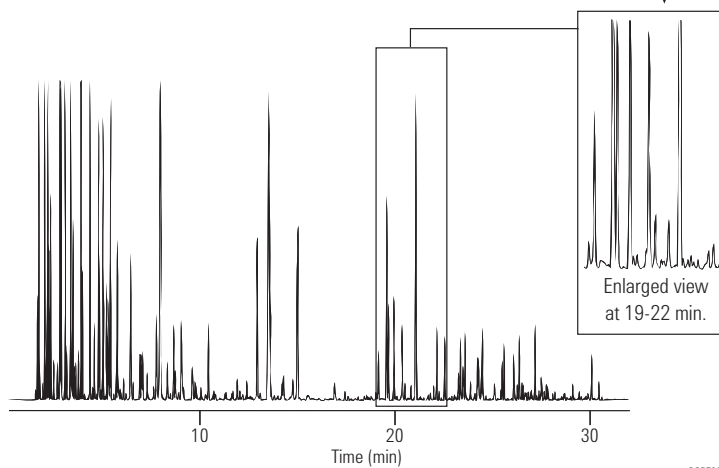
Carrier: Hydrogen at 34.8 cm/sec

Oven: 35 °C for 3.6 min
35-45 °C at 36.1 °C/min
45 °C for 4.2 min
45-60 °C at 3.9 °C/min
60 °C for 4.2 min
60-220 °C at 6.9 °C/min
220 °C for 1.4 min

Injection: Split ratio 1:400

Detector: FID, 300 °C

Sample: 0.2 μ L



GCPE037

Gasoline Unleaded ASTM D 5769

Column: CP-Sil PONA CB
CP7530
100 m x 0.25 mm, 0.50 μ m

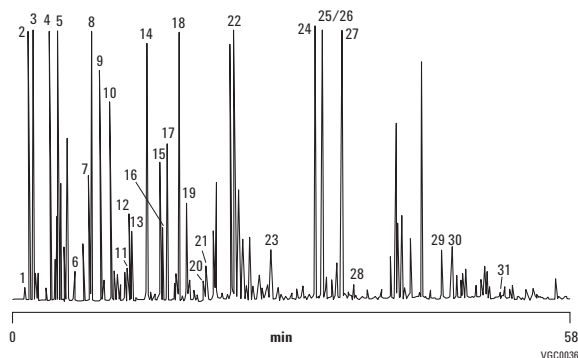
Sample: 0.1 μ L

Carrier: Helium, 240 pKa (2.4 bar, 34 psi)

Oven: 35 °C (7 min) to 250 °C, 3 °C/min

Injection: Split 80 mL/min

Detector: FID



1. Propane
2. Isobutane
3. Butane
4. 2-Methylbutane
5. Pentane
6. 2,2-Dimethylbutane
7. 2,3-Dimethylbutane
8. 2-Methylpentane
9. 3-Methylpentane
10. Hexane
11. 2,2-Dimethylpentane
12. Methylcyclopentane
13. 2,4-Dimethylpentane
14. Benzene
15. 2-Methylhexane
16. 2,3-Dimethylpentane
17. 3-Methylhexane
18. Tert. amyl methyl ether (TAME)
19. Unknown
20. 2,2-Dimethylhexane
21. Methylcyclohexane
22. Toluene
23. Octane
24. Ethylbenzene
25. p-Xylene
26. m-Xylene
27. o-Xylene
28. Nonane
29. Decane
30. 1,2,3-Trimethylbenzene
31. Undecane

Polyethylene

Column: DB-1
125-1011
15 m x 0.53 mm, 0.15 μ m

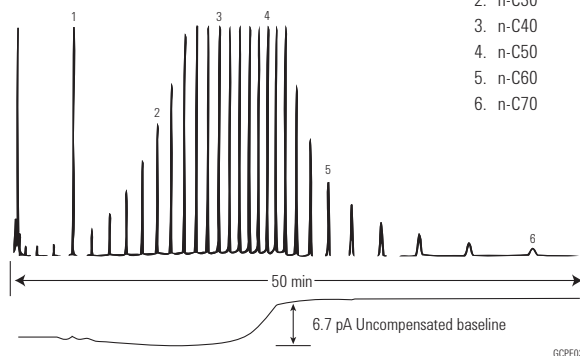
Carrier: Helium at 8 mL/min

Oven: 120-360 °C at 10 °C/min

Injection: Split ratio 1:500

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 0.5 μ L
3% Solution in CS₂



1. n-C20
2. n-C30
3. n-C40
4. n-C50
5. n-C60
6. n-C70

Direct Injection of Gasoline and Diesel Fuel in Methylene Chloride

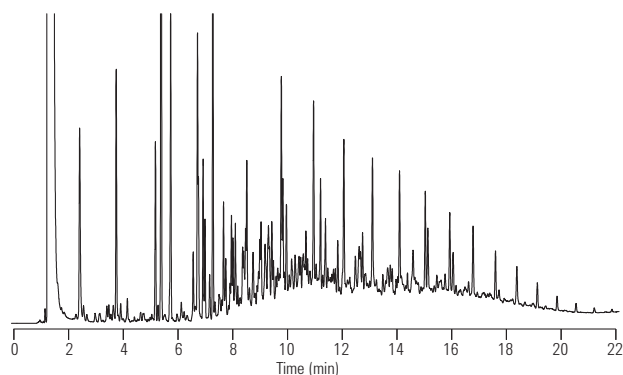
Column: DB-TPH
124-1632
30 m x 0.45 mm, 1.00 µm

Carrier: Helium at 67 cm/sec, measured at 40 °C

Oven: 40 °C for 2 min
40-280 °C at 12 °C/min

Injection: Megabore Direct, 250 °C

Detector: FID, 250 °C
Nitrogen makeup gas at 30 mL/min



GCGAS001

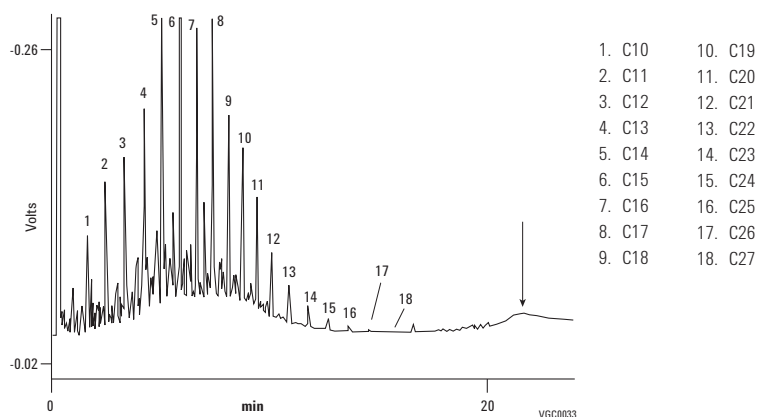
Diesel Analysis

Column: VF-5ht Fused Silica
CP9047
15 m x 0.32 mm, 0.10 µm

Carrier: H₂, 60 kPa, 0.6 bar, 8.6 psi

Oven: 50 °C (1 min), 15 °C to 180 °C,
7 °C to 230 °C, 30 °C to 380 °C

Detector: FID



VGC0033

Analysis of Oxygenates in a C1 to C5 Hydrocarbon Mix

Column: Lowox
CP8587
10 m x 0.53 mm, 10.00 µm

Sample: 1 µL

Sample Conc: 0.01% per compound

Solvent: Cyclohexano

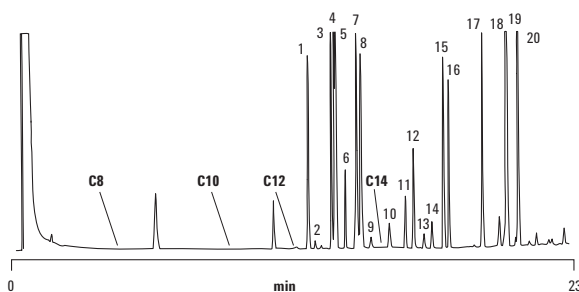
Carrier: He, 28.8 kPa (0.288 bar, 4.1 psi)

Oven: 50 °C (5 min) to 240 °C, 10 °C/min

Injection: Split, T=250 °C

Detector: FID, T=250 °C

- | | |
|-------------------------------|--|
| 1. Acetaldehyde | 11. Methanol |
| 2. Diethyl ether | 12. Acetone |
| 3. Ethyl tert-butyl ether | 13. Isovaleraldehyde |
| 4. Methyl tert-butyl ether | 14. Valeraldehyde |
| 5. Diisopropyl ether | 15. 2-Butanone |
| 6. Propionaldehyde (propanol) | 16. Ethanol |
| 7. Tert-amyl methyl ether | 17. 1-Propanol |
| 8. Dipropyl ether | 18. 2-Methyl-1-propanol (isobutanol) |
| 9. Isobutyraldehyde | 19. 2-Methyl-2-propanol (tert-butanol) |
| 10. Butyraldehyde | 20. 1-Butanol |



VGC0035

Analysis of Gases C1 to C4

Column: PoraPLOT Q
CP7554
25 m x 0.53 mm, 20.00 μ m

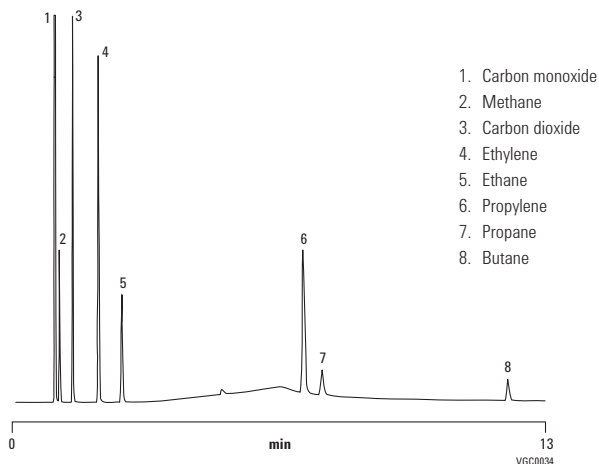
Sample: 50 μ L

Carrier: He, 65 kPa (0.65 bar, 8 psi)

Oven: 40 °C (3 min) to 150 °C, 10 °C/min

Injection: Split, 1:50, T=225 °C

Detector: TCD, T=250 °C

**Detailed Hydrocarbon Analysis of Petroleum Naphthas Through N-nonane Using ASTM D-5134**

Column: CP-Sil PONA para ASTM D-5134
CP7531
50 m x 0.21 mm, 0.50 μ m

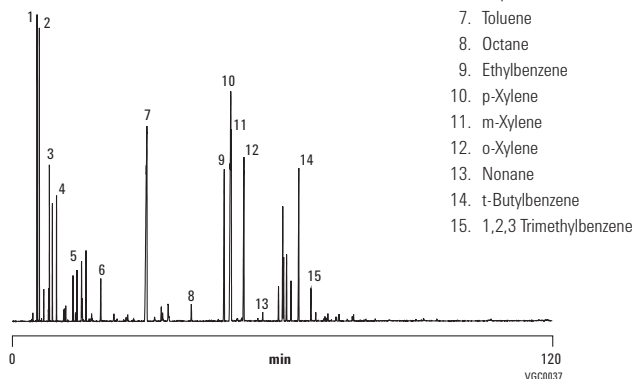
Sample: 0.2 μ L

Carrier: Helium

Oven: 35 °C (30 min) @ 2 °C/min to 200 °C (10 min)

Injection: Split/splitless 1177, full EFC control,
250 °C, split 200 mL/min

Detector: FID, 250 °C



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