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GC AND GC/MS

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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 µm

Carrier: Helium at 10 mL/min

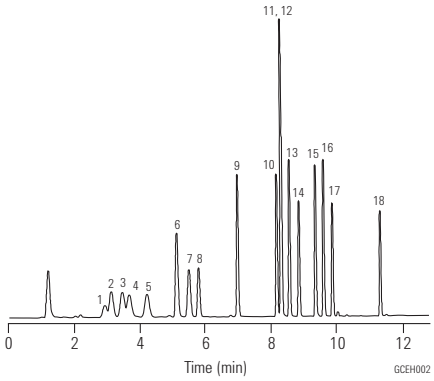
Oven: 35 °C for 4 min
35-200 °C at 20 °C/min
200 °C for 5 min

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 µm

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

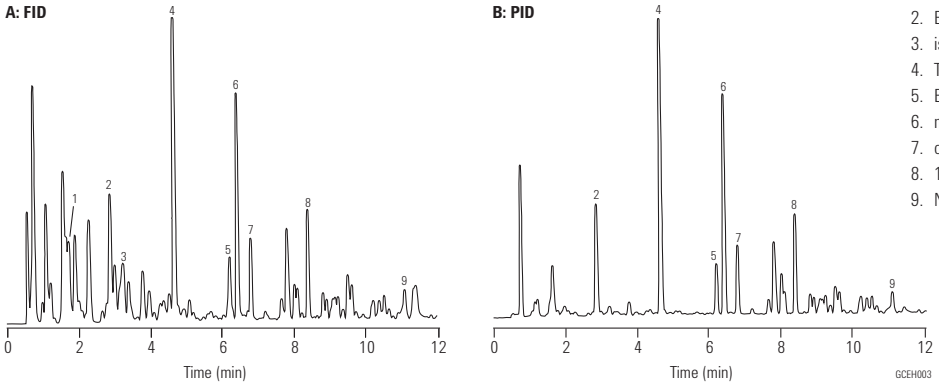
Oven: 40 °C for 2 min
40-200 °C at 12 °C/min
200 °C for 5 min

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



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

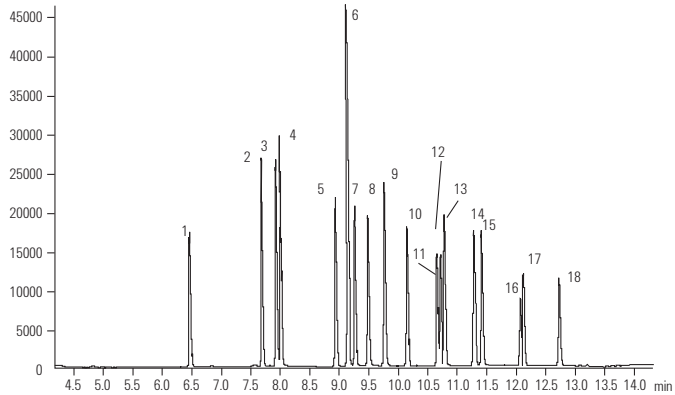
Detector: MS
280 °C

Sample: Isohexane

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

Dr. Weßling, Laboratorien GmbH

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

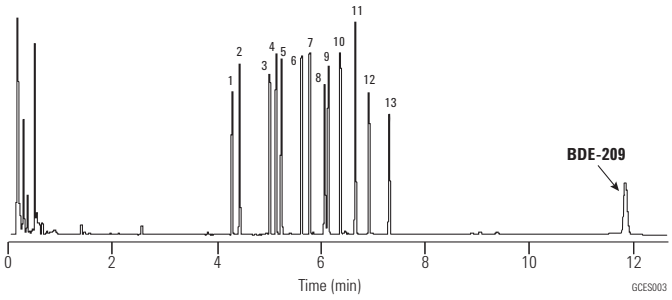
Injection: Split, 250 °C
Split ratio 20:1

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)
2. 2,4,4'-TriBDE (BDE-28)
3. 2,3',4',6-Tetra-BDE (BDE-71)
4. 2,2',4,4'-Tetra-BDE (BDE-47)
5. 2,3',4,4'-TetraBDE (BDE-66)
6. 2,2',4,4',6-PentaBDE (BDE-100)
7. 2,2',4,4',5-PentaBDE (BDE-99)
8. 2,2',3,4,4'-PentaBDE (BDE-85)
9. 2,2',4,4',5,6'-HexaBDE (BDE-154)
10. 2,2',4,4',5,5'-HexaBDE (BDE-153)
11. 2,2',3,4,4',5'-HexaBDE (BDE-138)
12. 2,2',3,4,4',5',6-HeptaBDE (BDE-183)
13. 2,3,3',4,4',5,6-HeptaBDE (BDE-190)
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

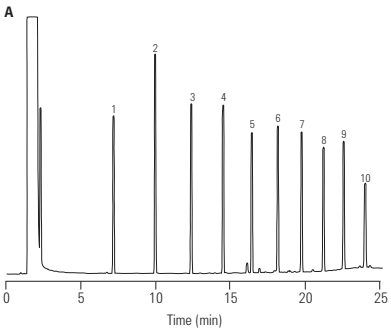
Septum: 11 mm Advanced Green septa, 5183-4759

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

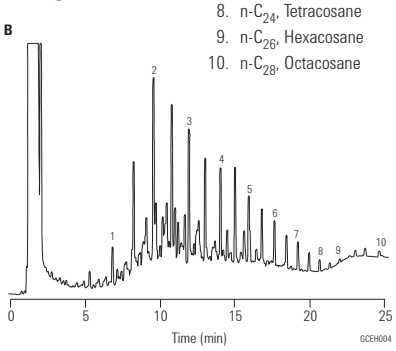
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

1. n-C_{10}, Decane
2. n-C_{12}, Dodecane
3. n-C_{14}, Tetradecane
4. n-C_{16}, Hexadecane
5. n-C_{18}, Octadecane
6. n-C_{20}, Eicosane
7. n-C_{22}, Docusane
8. n-C_{24}, Tetracosane
9. n-C_{26}, Hexacosane
10. n-C_{28}, Octacosane

Diesel Fuel Standard
50 ng/component



Diesel Fuel
0.6 mg/mL



Analysis of Polycyclic Aromatic Hydrocarbons

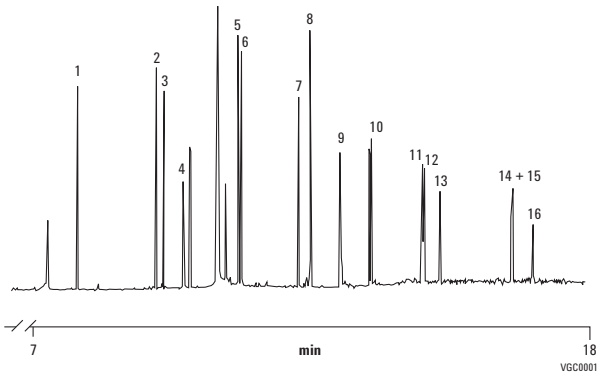
Column: **VF-Xms**
CP8805
30 m x 0.25 mm, 0.10 µm

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. Dibenz(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

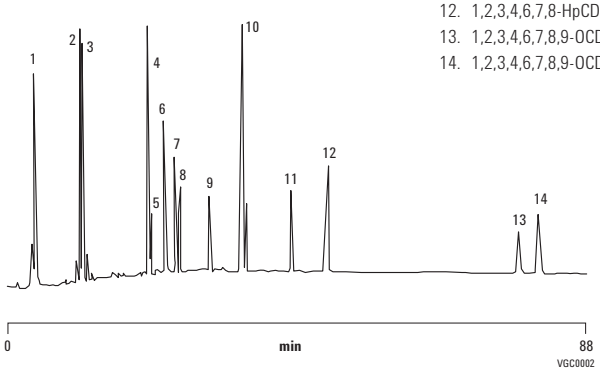
Carrier: Helium, 170 kPa (1.7 bar, 24 psi)

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)

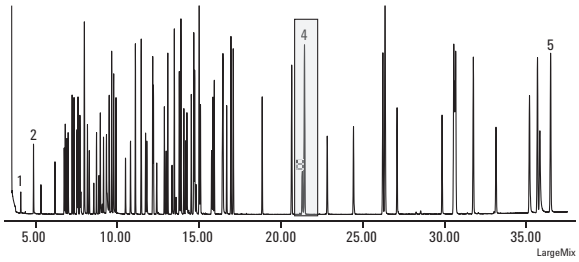
Column: **DB-5ms Ultra Inert**
122-5532UI
30 m x 0.25 mm, 0.25 µm

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

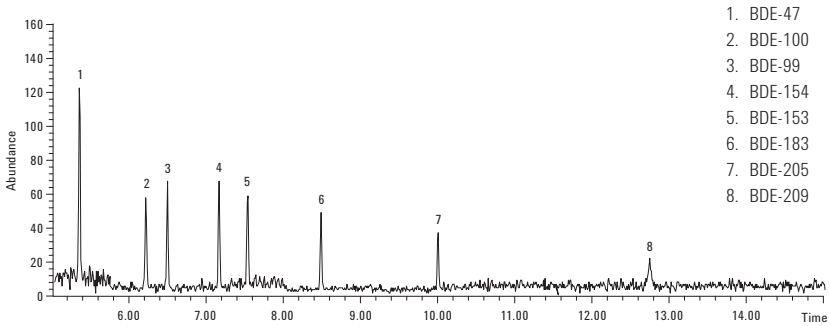
Oven: 150 to 325 °C (17 °C/min), hold 5 min

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



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/min^2 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

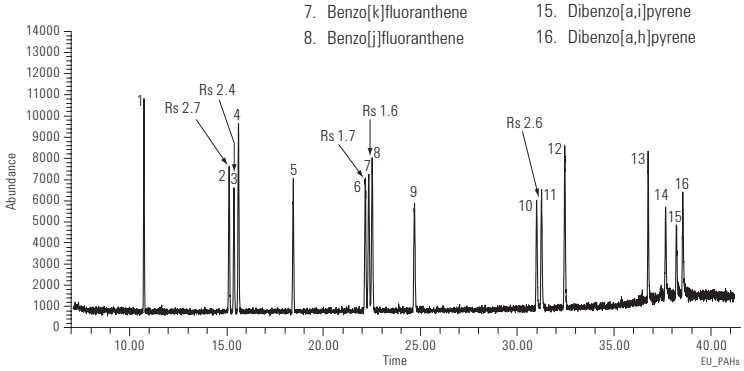
Suggested Supplies

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

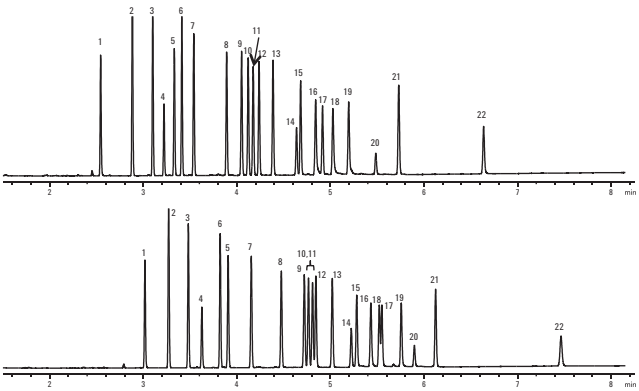
Sampler: Agilent 7693

Injection: 1 µL splitless

Detector: µECD @ 340 °C

Sample: 50 ng/mL CLP Pesticides

1. Tetrachloro-m-xylene
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



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

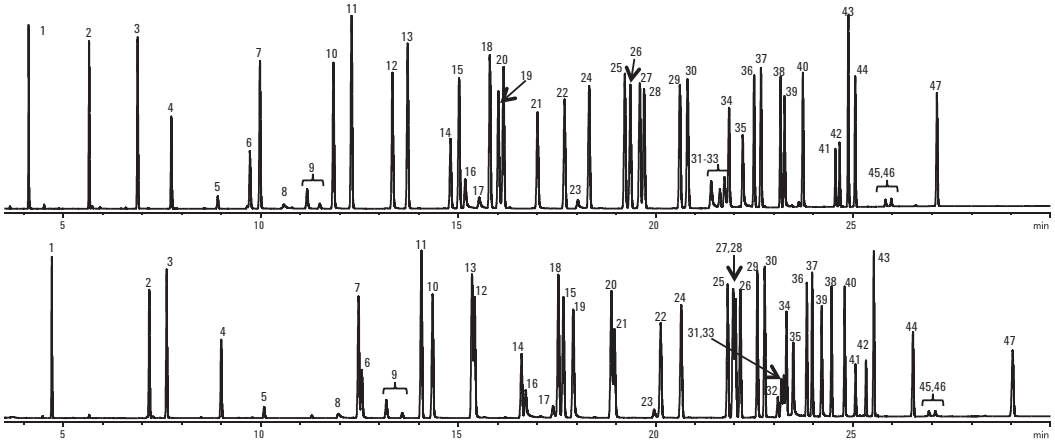
Sampler: Agilent 7693

Injection: 2 µL splitless

Detector: µECD @ 325 °C

Sample: 50 ng/mL 8081B analytes

1. 1,2-Dibromo-3-chloropropane
2. Hexachlorocyclopentadiene
3. 1-Bromo-2-nitrobenzene
4. Etradiazole
5. Chloroneb
6. Trifluralin
7. TCMX
8. Propachlor
9. Diallate isomers (250ng/mL)
10. Hexachlorobenzene
11. α-BHC
12. Pentachloronitrobenzene
13. γ-BHC
14. β-BHC
15. Heptachlor
16. Dichlone
17. Alachlor
18. δ-BHC
19. Chlorothalonil
20. Aldrin
21. DCPA
22. Isodrin
23. Kelthane
24. Heptachlor epoxide
25. γ-Chlordane
26. trans-Nonachlor
27. α-Chlordane
28. Endosulfan I
29. 4,4'-DDE
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. ΩΩΩΩDecachlorobiphenyl



DB-624UI Organic Acid Performance

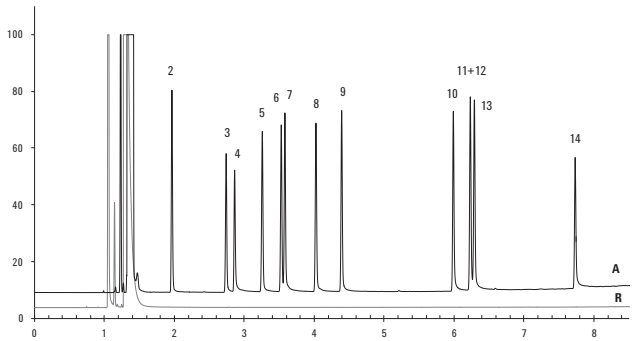
Column: **DB-Select 624 Ultra Inert**
122-0334UI
30 m x 0.25 mm, 1.4 µm

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 µm

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

Instrument: Agilent 7890A GC

Sampler: Agilent 7683B, 5.0 µL syringe
(Agilent p/n 5181-1273) 0.5 µL 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 µECD; 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.

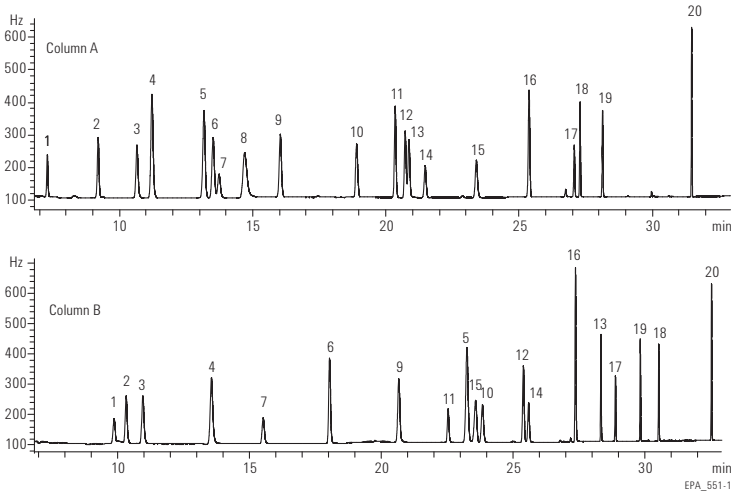
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

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

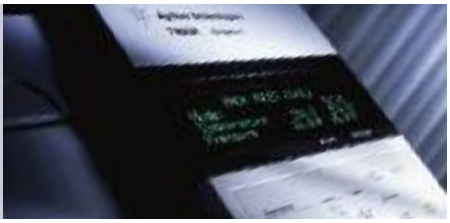
Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273

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

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

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

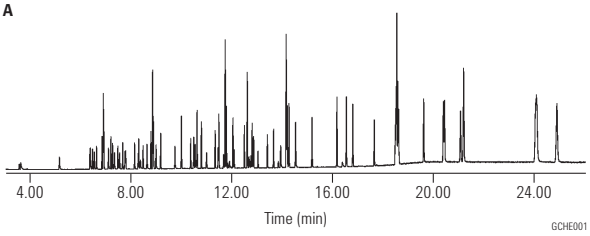
Oven: 40 °C (1 min), 25 °C/min to 320 °C
4.80 min hold

Injection: Splitless 0.5 µL 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

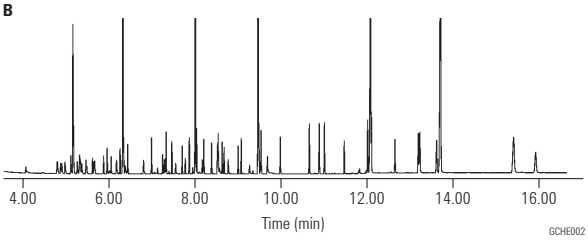
Translating 0.25 mm id column method to 0.18 mm id format results in 32% reduction in analysis time. Resolution of 77 peaks of interest is also maintained for the faster 0.18 mm id separation.

A



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 µm

B



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 µm

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)

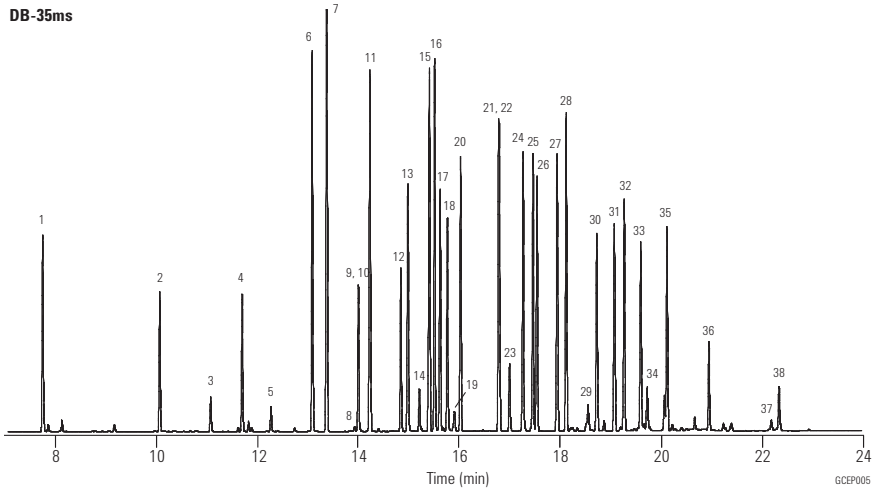
Sample: 50 pg per component

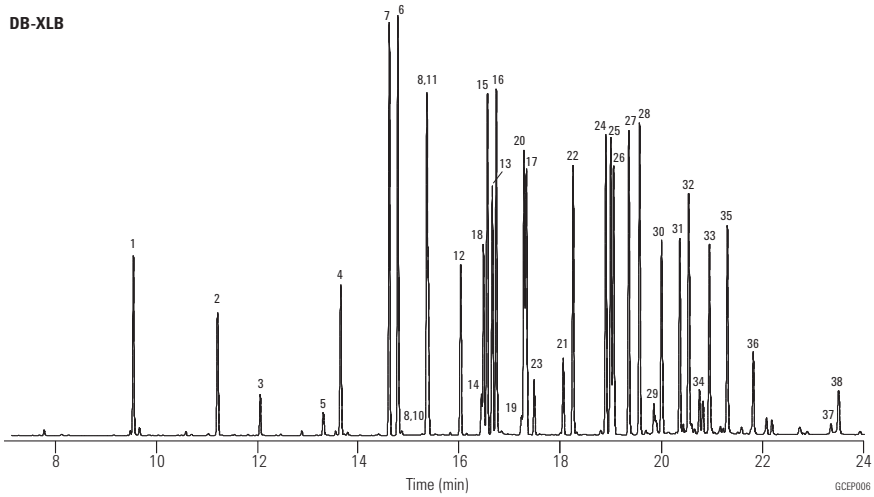
Suggested Supplies

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





1. Hexachlorocyclopentadiene
2. Etridiazole
3. Chloroneb
4. Trifluralin
5. Propachlor
6. Hexachlorobezene
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

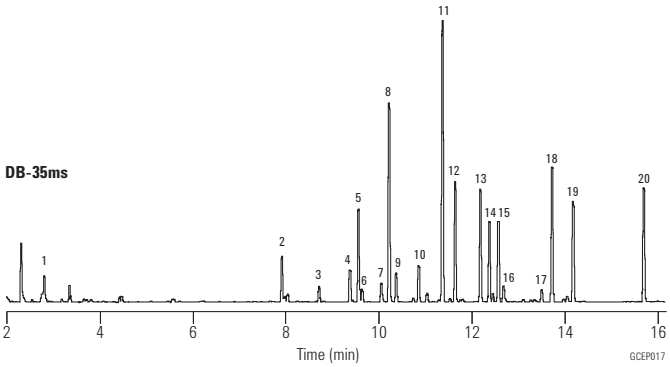
Phenoxy Acid Herbicides – Methyl Derivatives, EPA 8151A

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



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

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

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

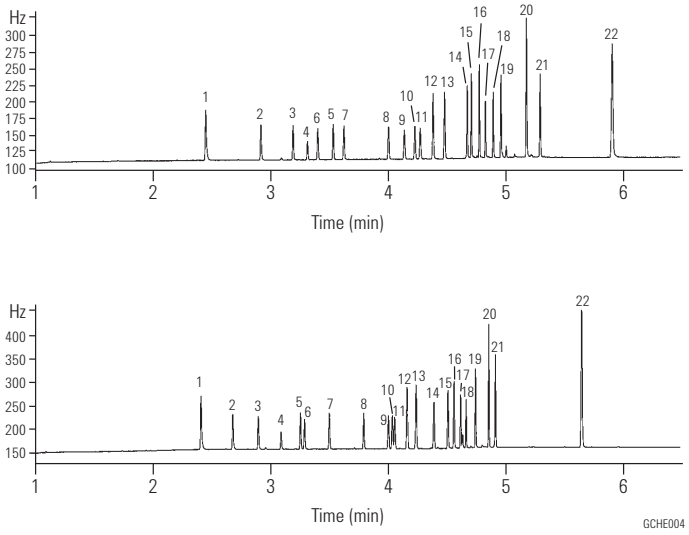
Carrier: Hydrogen (69 cm/sec at 120 °C, ramped at 99 mL/min to 106 cm/sec at 4.4 minutes)

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)

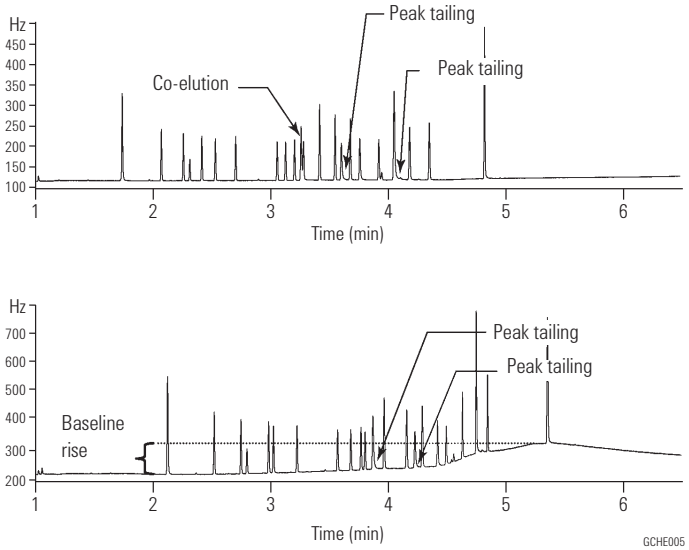
Detector: µECD 320 °C; nitrogen makeup; constant column + makeup flow 60 mL/min

DB-17ms primary column
DB-XLB confirmatory column



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 µm
Vendor R confirmatory column, 20 m x 0.18 mm, 0.14 µm



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

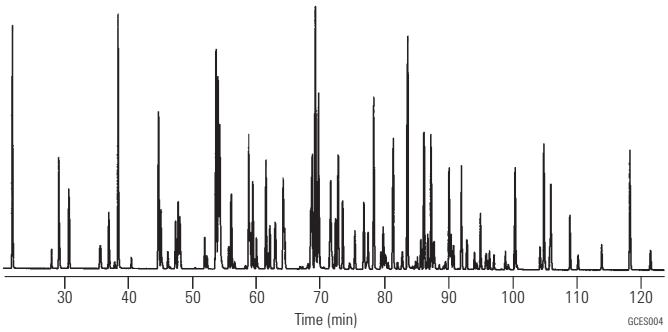
Carrier: Helium at 37 cm/sec, measured at 150 °C

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)

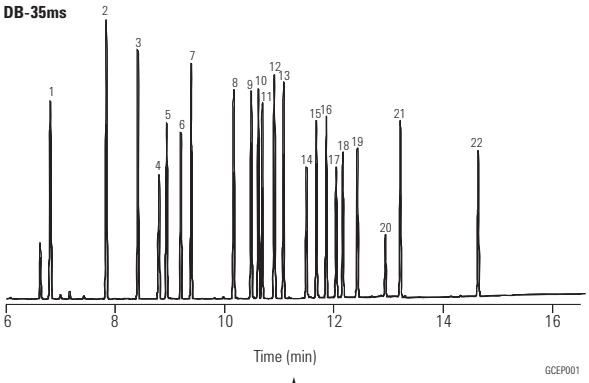
Sample: 50 pg per component

Suggested Supplies

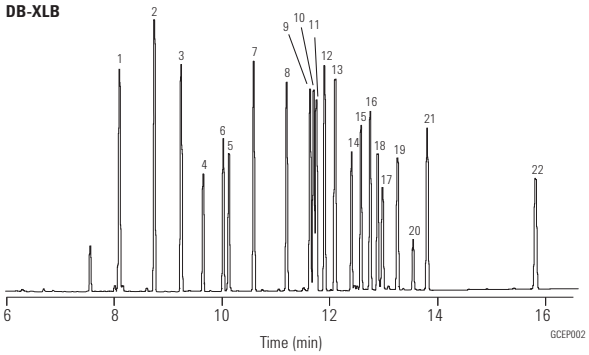
Septum: 11 mm Advanced Green septa, 5183-4759

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 1min
Bake: 260 °C for 10 min
Line & valve: 100 °C

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

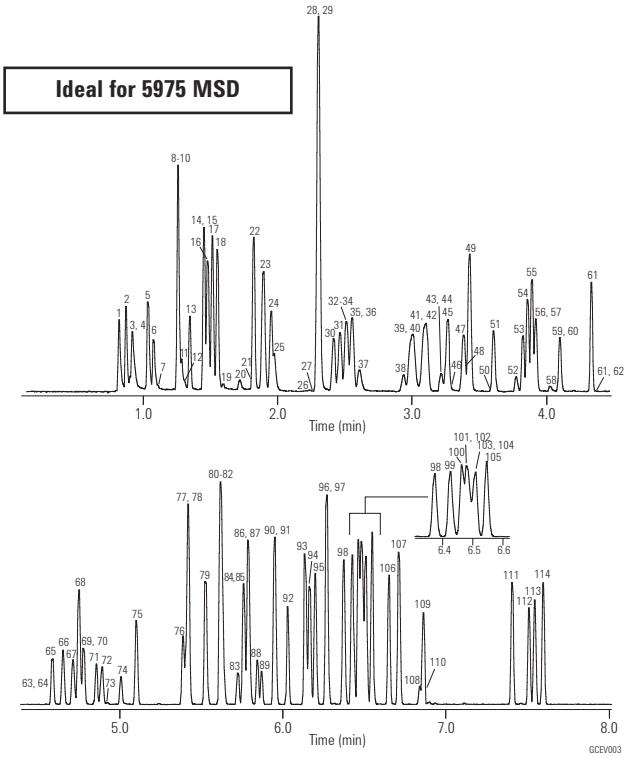
Detector: Agilent 5975 MSD
Scan range: 35-260 amu
Scan rate: 3.25 scans/sec
Quad temperature: 150 °C
Source temperature: 200 °C
Transfer line temp: 200 °C

Sample: 5 mL
- Halogentated 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

Ideal for 5975 MSD



1. Dichlorodifluoromethane
2. Chloromethane
3. Hydroxypropionitrile
4. Vinyl chloride
5. Bromomethane
6. Chloroethane
7. Ethanol
8. Acetonitrile
9. Acrolein
10. Trichlorofluoromethane
11. Isopropyl alcohol
12. Acetone
13. Ethyl ether
14. 1,1-Dichloroethene
15. tert-Butyl alcohol
16. Acrylonitrile
17. Methylene chloride
18. Allyl chloride
19. Allyl alcohol
20. 1-Propanol
21. Propargyl alcohol
22. trans-1,2-Dichloroethene
23. MTBE
24. 1,1-Dichloroethane
25. Propionitrile
26. 2-Butanone
27. Diisopropyl ether
28. cis-1,2-Dichloroethene
29. Methacrylonitrile
30. Bromochloromethane
31. Chloroform
32. 2,2-Dichloropropane
33. Ethyl acetate
34. Ethyl-tert-butyl ether
35. Methyl acrylate
36. Dibromofluoromethane (IS)
37. Isobutanol
38. Dichloroethane-d4 (IS)
39. Pentafluorobenzene
40. 1,2-Dichloroethane
41. 1,1,1-Trichloroethane
42. 1-Chlorobutane
43. Crotonaldehyde
44. 2-Chloroethanol
45. 1,1-Dichloropropene
46. 1-Butanol
47. Carbon tetrachloride
48. Chloroacetonitrile
49. Benzene
50. tert-Amylmethyl ether
51. Fluorobenzene (IS)
52. 2-Pentanone
53. Dibromomethane
54. 1,2-Dichloropropane
55. Trichloroethene
56. Bromodichloromethane
57. 2-Nitropropane
58. 1,4-Dioxane
59. Epichlorohydrin
60. Methyl methacrylate
61. cis-1,3-Dichloropropene
62. Propiolactone
63. Bromoacetone
64. Pyridine
65. trans-1,3-Dichloropropene
66. 1,1,2-Trichloroethane
67. Toluene-d8 (IS)
68. Toluene
69. 1,3-Dichloropropane
70. Paraldehyde
71. Ethyl methacrylate
72. Dibromochloromethane
73. 3-Chloropropionitrile
74. 1,2-Dibromoethane
75. Tetrachloroethene
76. 1,1,1,2-Tetrachloroethane
77. 1-Chlorohexane
78. Chlorobenzene
79. Ethylbenzene
80. Bromoform
81. m-Xylene
82. p-Xylene
83. trans-Dichlorobutene
84. 1,3-Dichloro-2-propanol
85. Styrene
86. 1,1,2,2-Tetrachloroethane
87. o-Xylene
88. 1,2,3-Trichlropropane
89. cis-Dichlorobutene
90. 4-Bromofluorobenzene (IS)
91. Isopropylbenzene
92. Bromobenzene
93. Propylbenzene
94. 2-Chlorotoluene
95. 4-Chlorotoluene
96. 1,3,5-Trimethylbenzene
97. Pentachloroethane
98. tert-Butylbenzene
99. 1,2,4-Trimethylbenzene
100. sec-Butylbenzene
101. 1,3-Dichlorobenzene
102. Benzylchloride
103. 1,4-Dichlorobenzene-d4 (IS)
104. 1,4-Dichlorobenzene
105. Isopropyltoluene
106. 1,2-Dichlorobenzene
107. Butylbenzene
108. 1,2-Dibromo-3-chloropropane
109. Hexachloroethane
110. Nitrobenzene
111. 1,2,4-Trichlorobenzene
112. Naphthalene
113. Hexachlorobutadiene
114. 1,2,3-Trichlorobenzene

PBDEs

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

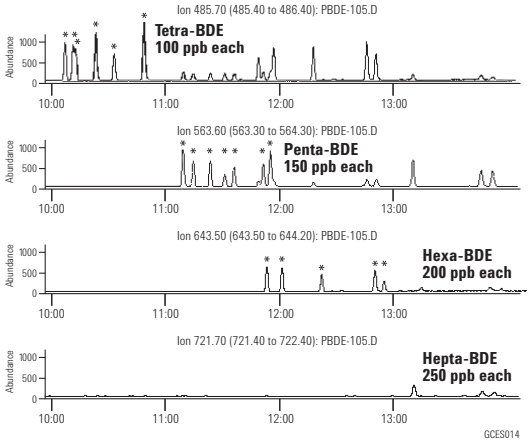
Carrier: Helium at 38 cm/sec at 100 °C (1.2 mL/min), constant flow mode

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

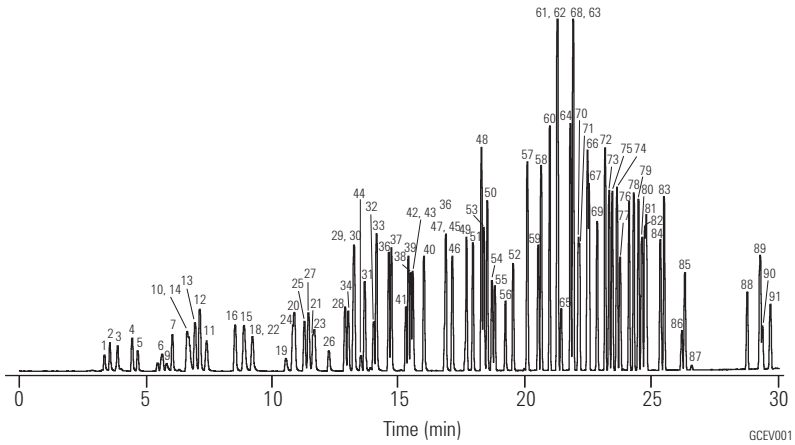
Sampler: Purge and trap (O.I.A. 4560)
Purge: Helium for 11 min at 40 mL/min
Trap: Tenax/Silica Gel/Carbosieve
Preheat: 175 °C
Desorb: 220 °C for 0.6 min

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



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

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

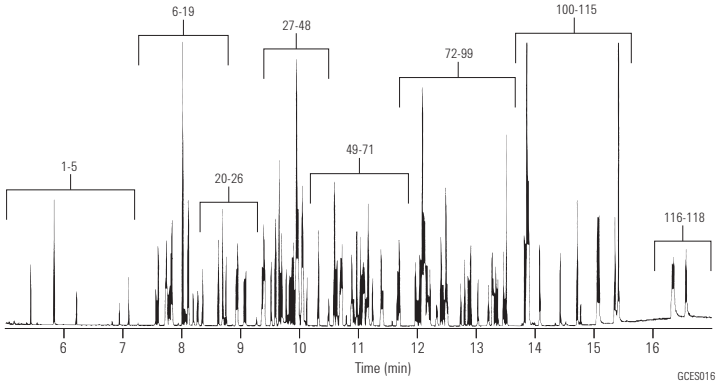
Suggested Supplies

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



Pesticides and Fire Retardants (US EPA 527)

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

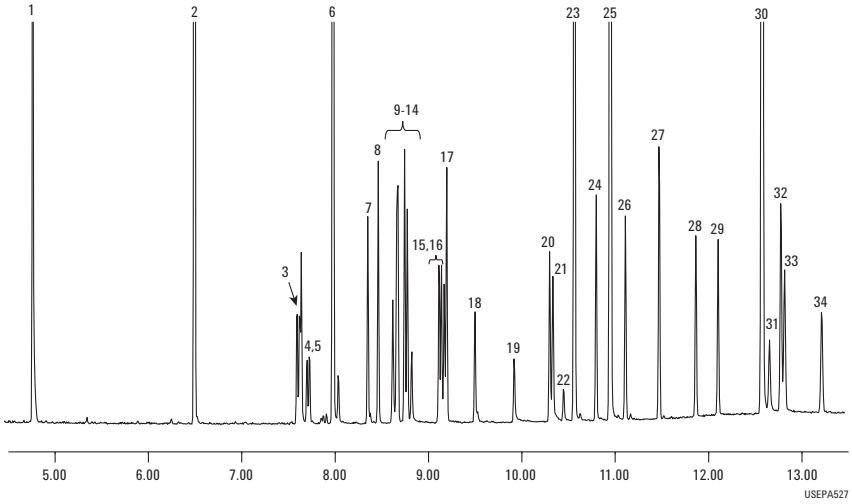
Carrier: Helium, 52 cm/sec, constant flow

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. Benthiocarb
14. Parathion
15. Terbus sulfone
16. Bioallethrin
17. Oxychlordane
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

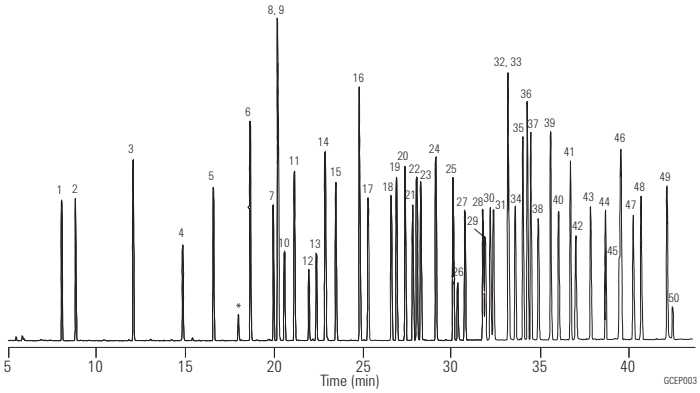
Sample: 1 µL of 35 µg/mL composite 8081A standards, AccuStandard Inc.

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

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

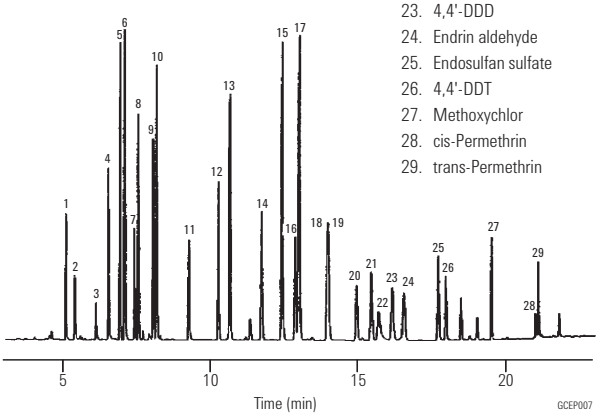
Oven: 80 °C for 1 min
80-180 °C at 30 °C/min
180-205 °C at 3 °C/min
205 °C for 4 min
205-290 °C at 2 °C/min
290 °C for 2 min

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
2. Chloroneb
3. Propachlor
4. Trifluralin
5. α-BHC
6. Hexachlorobezene
7. β-BHC
8. δ-BHC
9. γ-BHC
10. Chlorothalonil
11. Heptachlor
12. Aldrin
13. DCPA
14. Heptachlor epoxide
15. γ-Chlordane
16. Endosulfan I
17. α-Chlordane
18. Dieldrin
19. 4,4'-DDE
20. Endrin
21. Endosulfan II
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)

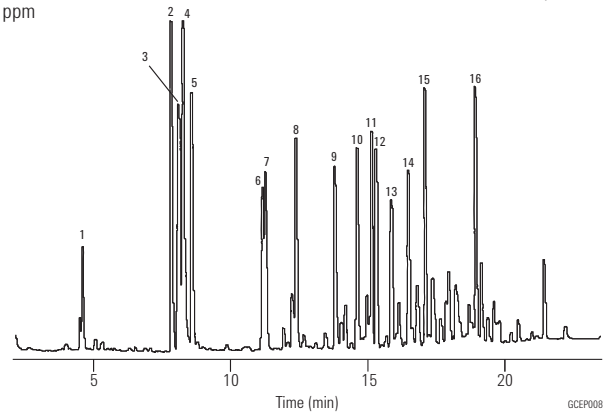
Oven: 80 °C for 1 min
80-175 °C at 30 °C/min
175 °C for 4 min
175-215 °C at 6 °C/min
215 °C for 2 min
215-290 °C at 15 °C/min
290 °C for 5 min

Injection: Splitless, 250 °C
1 min purge delay

Detector: ECD, 300 °C
Makeup gas: N_2, 60 mL/min
Anode purge 6 mL/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.

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

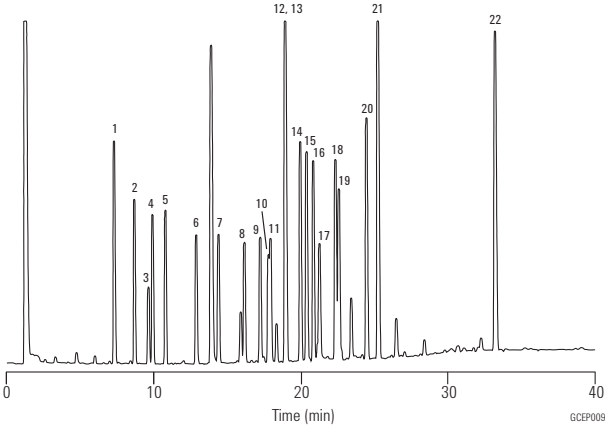
Suggested Supplies

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



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 isooctane

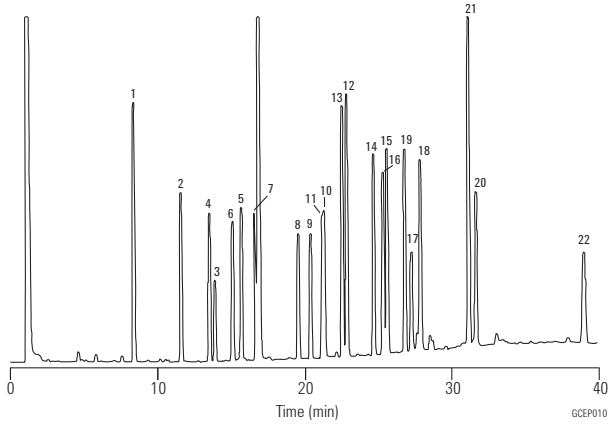
Suggested Supplies

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



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

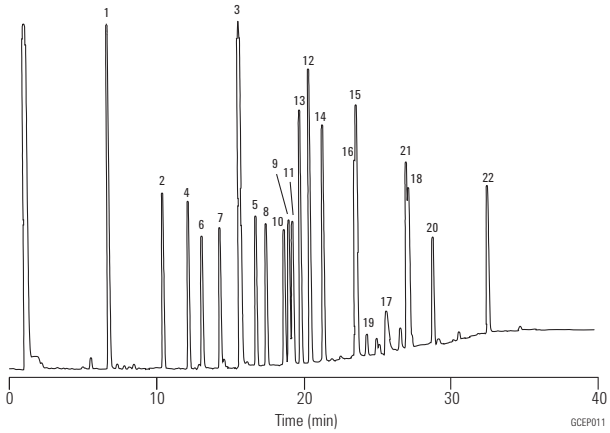
Suggested Supplies

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



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

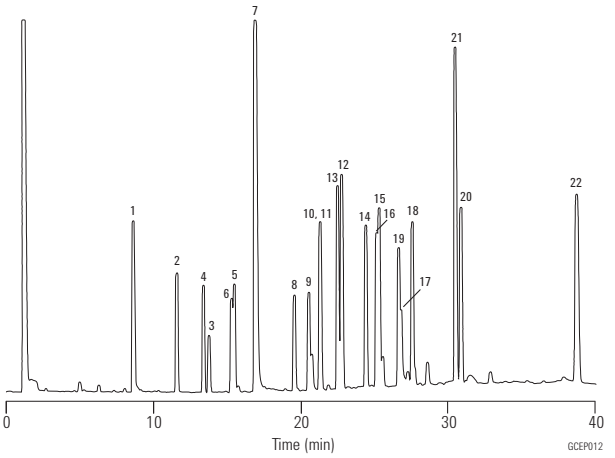
Suggested Supplies

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



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

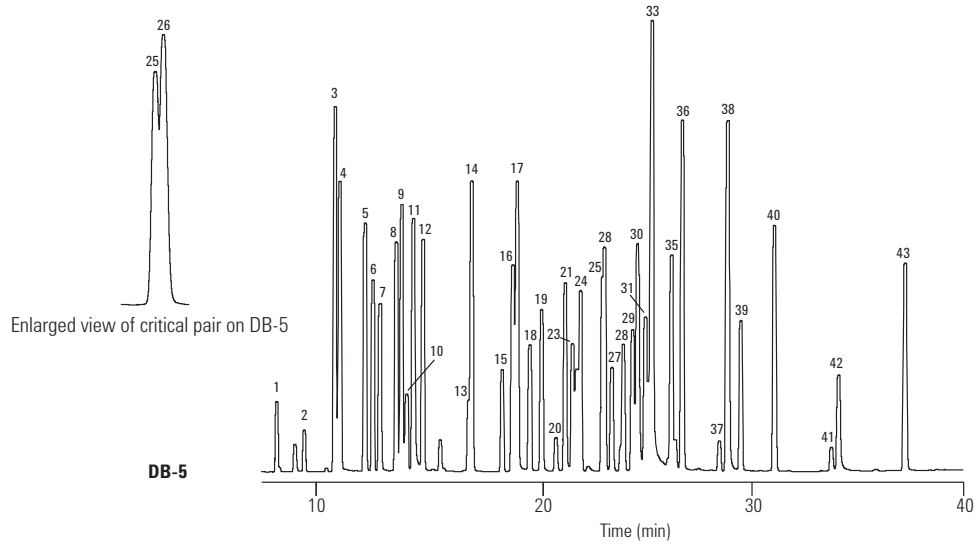
Oven: 60 °C for 0.5 min
60-140 °C at 20 °C/min
140-280 °C at 11 °C/min
280 °C for 23 min

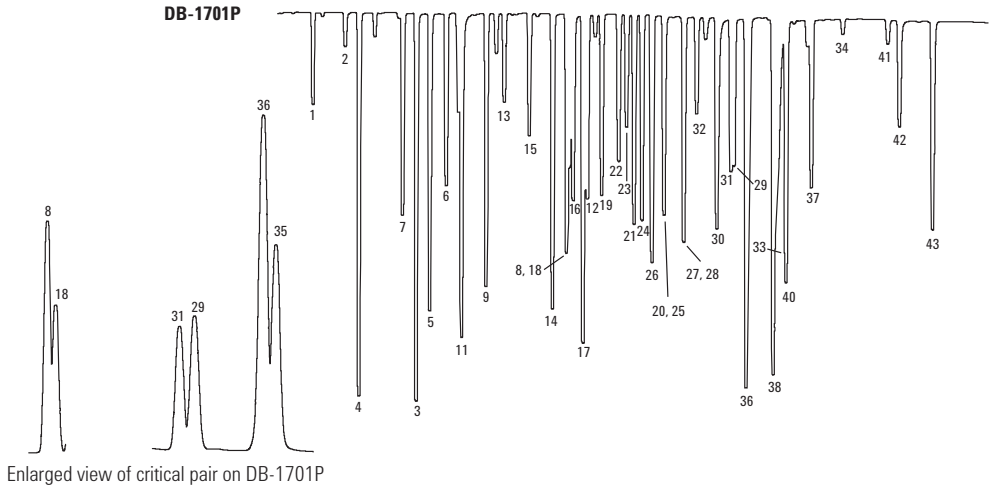
Injection: Splitless, 200 °C

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

Sample: 2.0 µL, 20-200 pg/µL

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





Organochlorine Pesticides

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

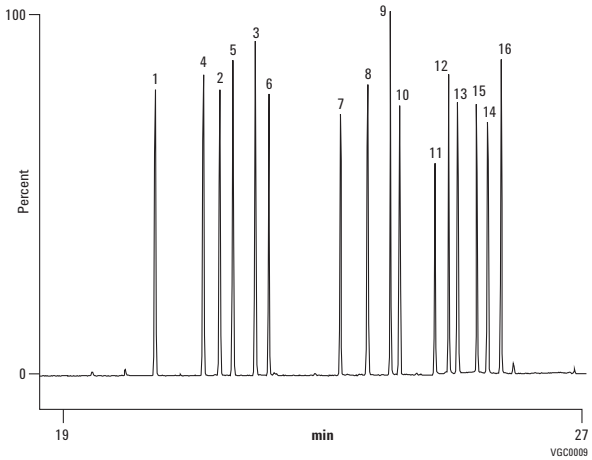
Sample: 1.0 µL

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

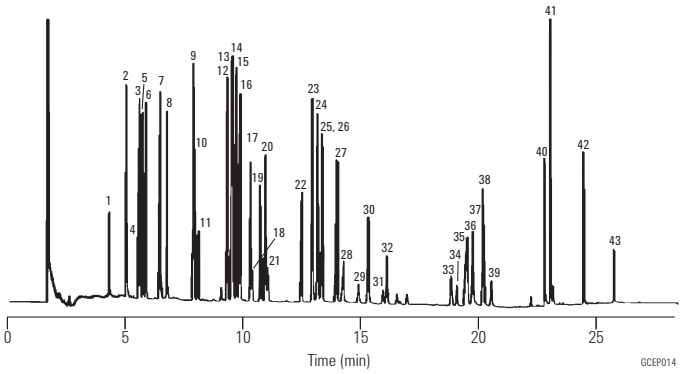
Detector: NPD, 290 °C
Helium makeup gas at 30 mL/min

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

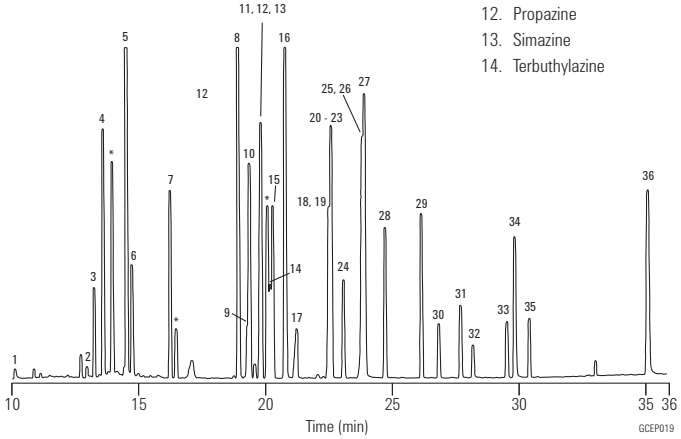
Sample: 2 µL x 10-50 ng/µL solution
in acetone

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



1. Monuron
2. Diuron
3. EPTC
4. Dichlobenil
5. Vernolate
6. Pebulate
7. Molinate
8. Sulfallate
9. Atraton
10. Prometon
11. Atrazine
12. Propazine
13. Simazine
14. Terbuthylazine
15. Pronamide
16. Secbumeton
17. Terbacil
18. Alachlor
19. Propanil
20. Ametryn
21. Prometryne
22. Simetryn
23. Metribuzin
24. Terbutryn
25. Metolachlor
26. Bromacil
27. Dacthal
28. Diphenamid
29. Butachlor
30. Napropamide
31. Carboxin
32. Tricyclazole
33. Norflurazon
34. Hexazinone
35. Difolotan
36. Fluridone

* Impurity

Herbicides II

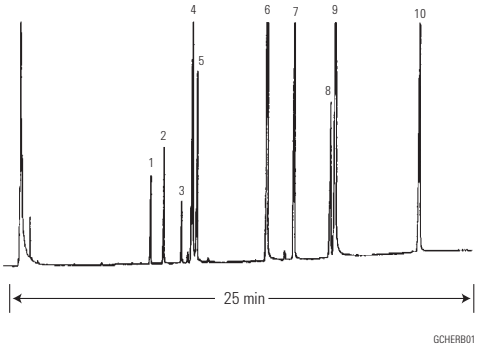
Column: **DB-210**
122-0232
30 m x 0.25 mm, 0.25 µm

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



1. Phorate
2. Ethoprop
3. Terbufos
4. Atrazine
5. Fonofos
6. Propachlor
7. Chlorpyrifos
8. Alachlor
9. Metolachlor
10. Cyanazine

C_1 and C_2 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

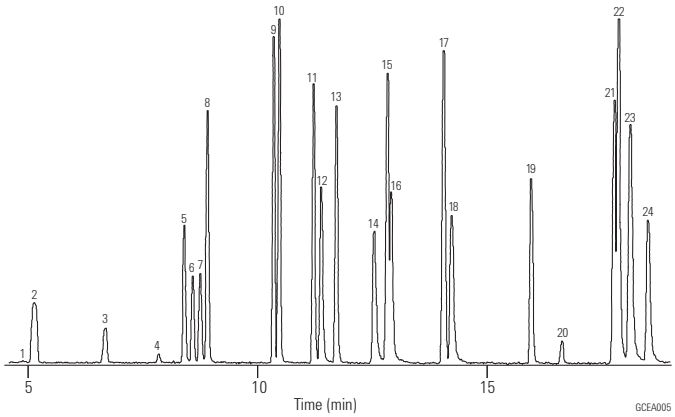
Injection: Splitless, 250 °C
0.20 min purge activation time

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	152a
2.	Trifluoromethane	23	14.	1,2-Dichloro-1,1,2,2-tetrafluoroethane	114
3.	Bromotrifluoromethane	13B1	15.	2-Chloro-1,1,1,2-tetrafluoroethane	124
4.	Chloropentafluoroethane	115	16.	1-Chloro-1,1-difluoroethane	142b
5.	Pentafluoroethane	125	17.	Dichlorofluoromethane	21
6.	1,1,1-Trifluoroethane	143a	18.	Trichlorofluoromethane	11
7.	Dichlorodifluoromethane	12	19.	Chloroethane	160
8.	Chlorodifluoromethane	22	20.	Dichloromethane	30
9.	1,1,1,2-Tetrafluoroethane	134a	21.	1,1-Dichloro-1-fluoroethane	141b
10.	Chloromethane	40	22.	2,2-Dichloro-1,1,1-trifluoroethane	123
11.	1,1,2,2-Tetrafluoroethane	134	23.	1,1,2-Trichloro-1,2,2-trifluoroethane	113
12.	Bromochlorodifluoromethane	12B1	24.	1,2-Dibromo-1,1,2,2-tetrafluoroethane	114B2

*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)

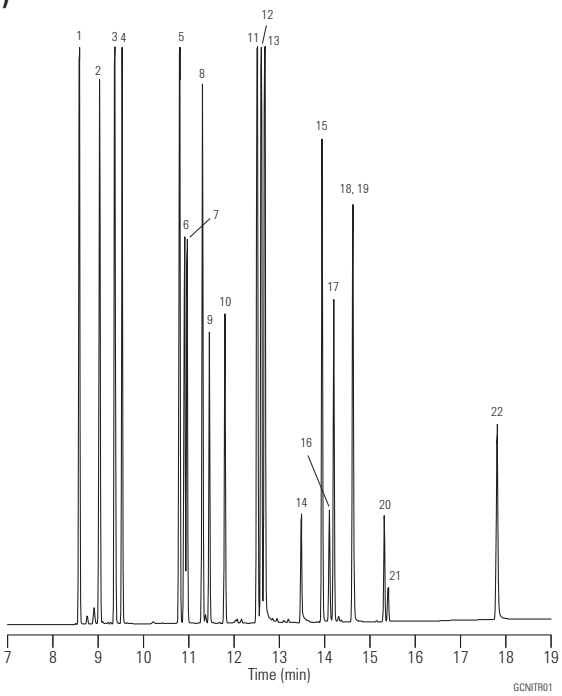
Column: **DB-35**
125-1937
30 m x 0.53 mm, 0.50 µm

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



1. Eptam
2. Sutan
3. Vernam
4. Tillam
5. Ordram
6. Treflan
7. Balan
8. Ro-Neet
9. Propachlor
10. Tolban
11. Propazine
12. Atrazine
13. Simazine
14. Terbacil
15. Sencor
16. Dual
17. Paarlan
18. Prowl
19. Bromacil
20. Oxadiazon
21. GOAL
22. Hexazinone

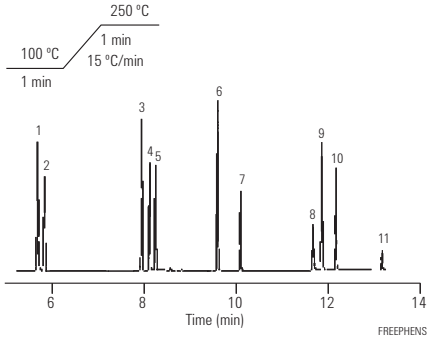
Free Phenols

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



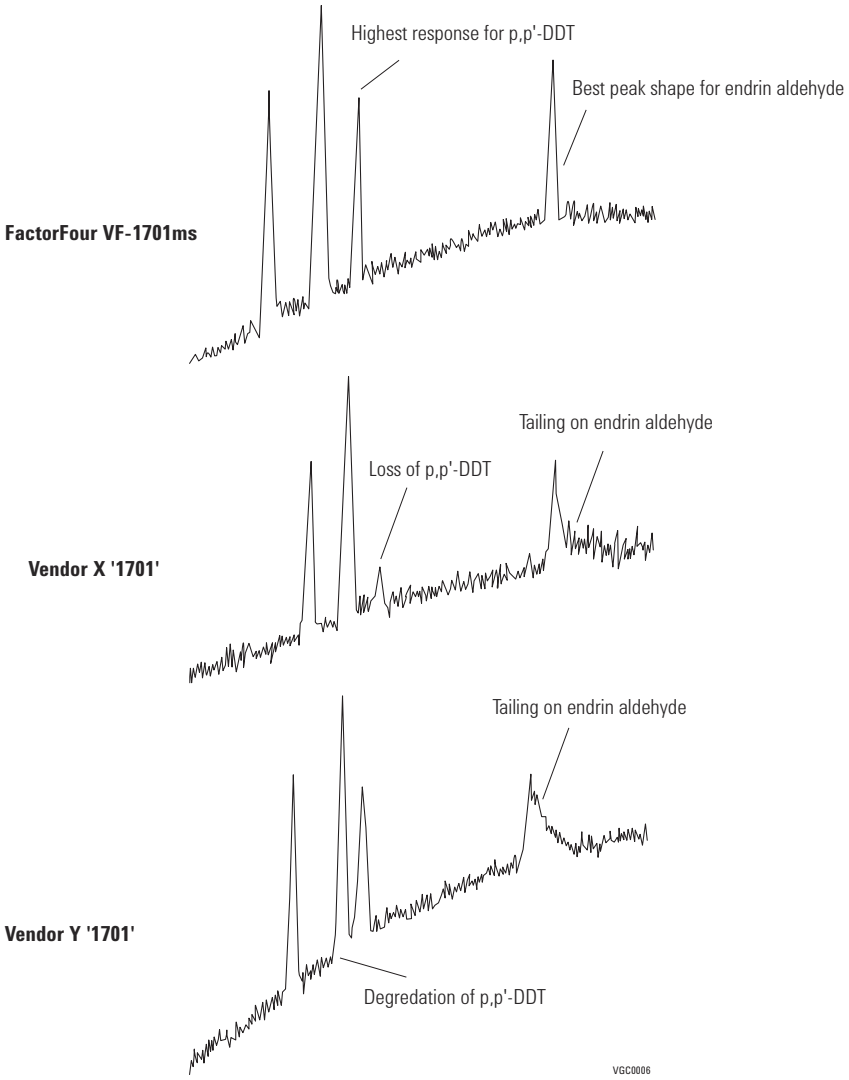
1. Phenol
2. 2-chlorophenol
3. 2,4-dimethylphenol
4. 2-nitrophenol
5. 2,4-dichlorophenol
6. 4-chloro-3-methylphenol
7. 2,4,6-trichlorophenol
8. 2,4-dinitrophenol
9. 4-nitrophenol
10. 2-methyl-4,6-dinitrophenol
11. Pentachlorophenol

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



Organochlorine Pesticides to EPA 625 via GC/MS

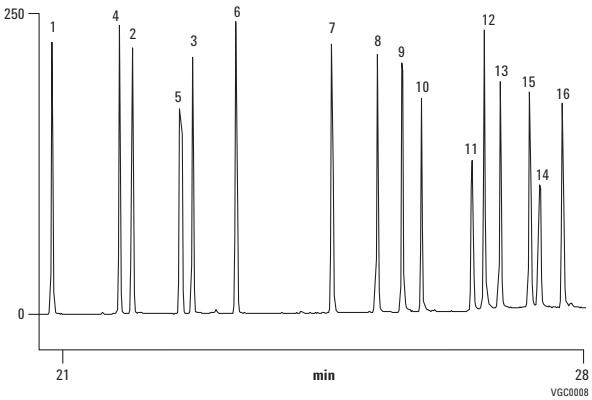
Column: **VF-35ms**
CP8877
30 m x 0.25 mm, 0.25 µm

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. 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

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

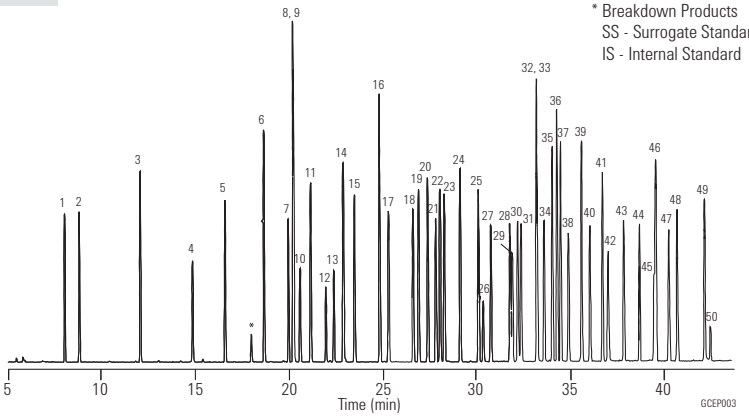
Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

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

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

* Breakdown Products
SS - Surrogate Standard
IS - Internal Standard



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

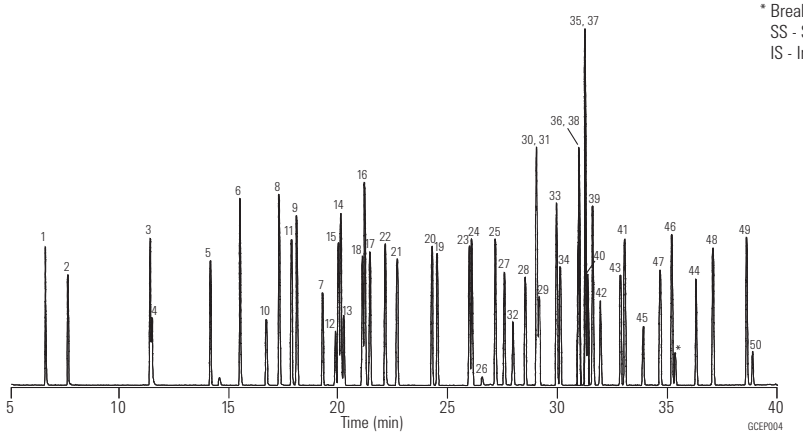
Detector: MSD, 300 °C transfer line
Full scan at m/z 50-500

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

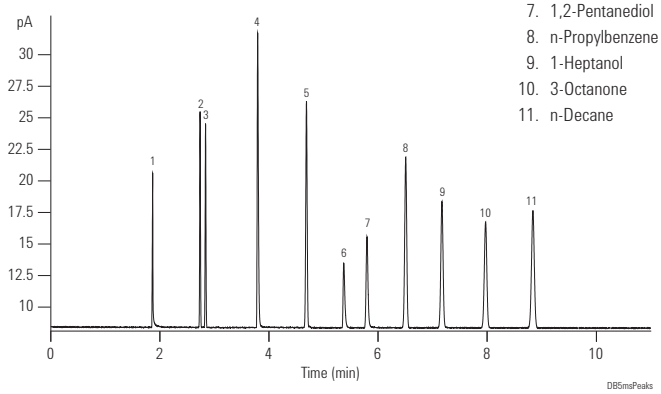
Sampler: Agilent 7683B, 0.5 µL syringe (P/N 5188-5246), 0.02 µL split injection

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.

1. 1-Propionic acid
2. 1-Octene
3. n-Octane
4. 4-Picoline
5. n-Nonane
6. Trimethyl phosphate
7. 1,2-Pentanediol
8. n-Propylbenzene
9. 1-Heptanol
10. 3-Octanone
11. n-Decane



Trace Level Polycyclic Aromatic Hydrocarbon (PAH) Analyses

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

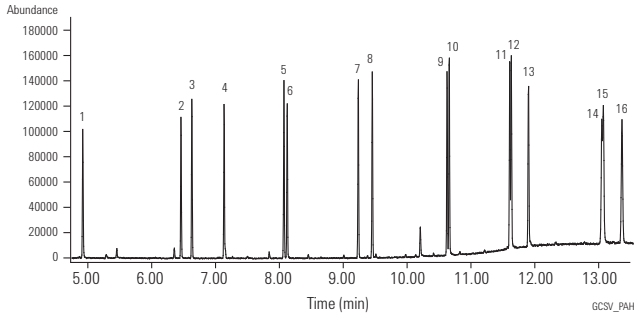
Carrier: Helium constant flow 30 cm/s

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



Tetrachlorodibenzo-p-furans

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

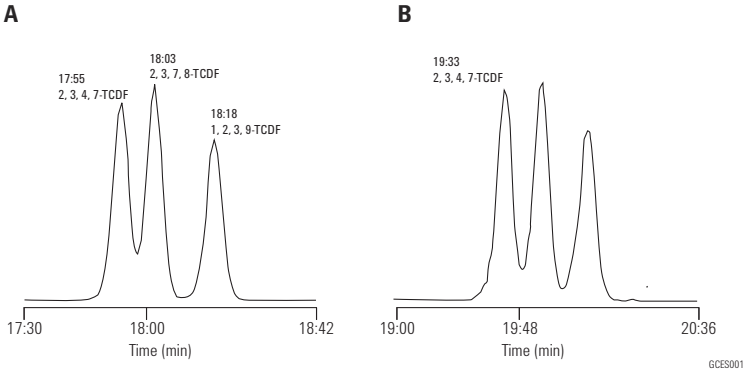
Column B: **DB-225ms**
122-2932
30 m x 0.25 mm, 0.25 µm

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

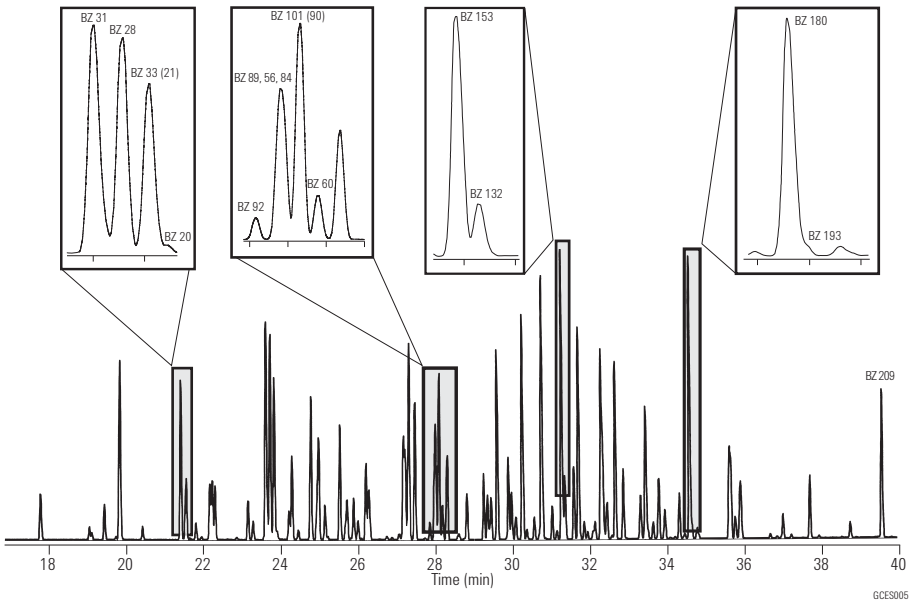
Sample: 2 µL dilute Aroclor mixture

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

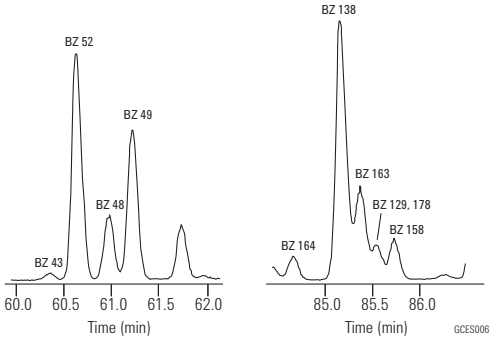
Carrier: Helium at 34.2 cm/sec, measured at 150 °C

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

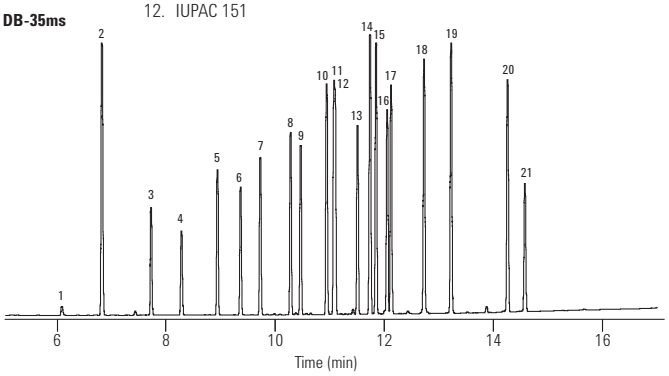
Detector: µECD, 350 °C
Nitrogen makeup gas
(column + makeup flow = 30 mL/min constant flow)

Sample: 50 pg per component

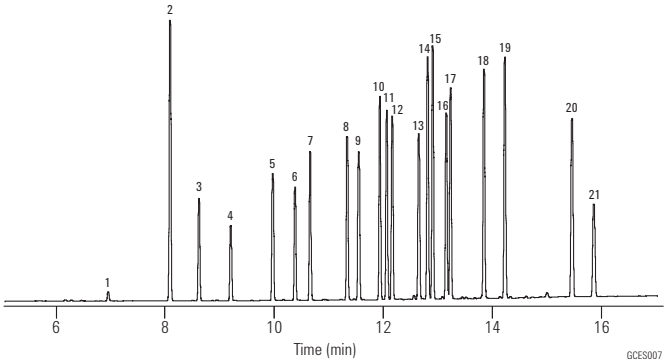
1. IUPAC 1
2. Tetrachloro-m-xylene (IS/SS)
3. IUPAC 5
4. IUPAC 18
5. IUPAC 31
6. IUPAC 52
7. IUPAC 44
8. IUPAC 66
9. IUPAC 101
10. IUPAC 87
11. IUPAC 110
12. IUPAC 151
13. IUPAC 153
14. IUPAC 141
15. IUPAC 137
16. IUPAC 187
17. IUPAC 183
18. IUPAC 180
19. IUPAC 170
20. IUPAC 206
21. Decachlorobiphenyl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

IS/SS - Internal Standard/ Surrogate Standard

DB-35ms



DB-XLB



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

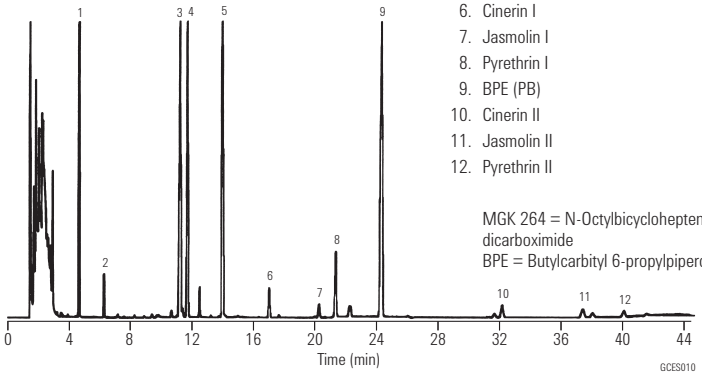
Chromatogram courtesy of Khan Nguyen and Richard Moorman of Sandoz Agro Inc.

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



Organotin Compounds I

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

Carrier: Helium, 100 kPa

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

Injection: Splitless

Detector: AED, 330 °C

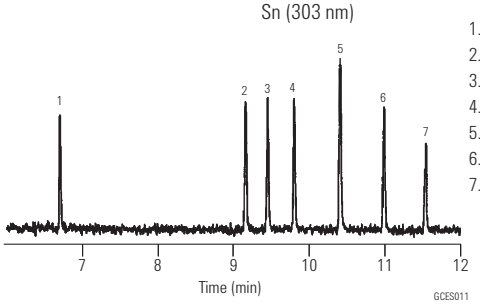
Sample: 1 µL

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



1. Dimethylpentyltin
2. Tetrabutyltin
3. Methyltripentyltin
4. Tributylpentyltin
5. Dibutylpentyltin
6. Butlypentyltin
7. Tetrapentyltin

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

Oven: 60-360 °C at 5 °C/min

Injection: Splitless, 300 °C

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

Sample: 1 µL

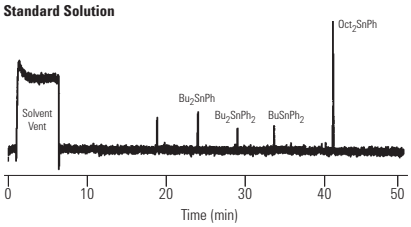
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

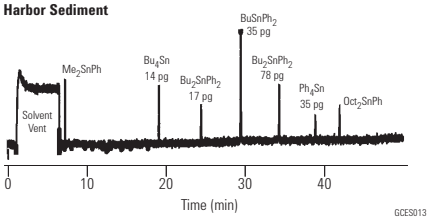
Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730

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

Standard Solution



Harbor Sediment



Semivolatile Compounds, US EPA Method 8270

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

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

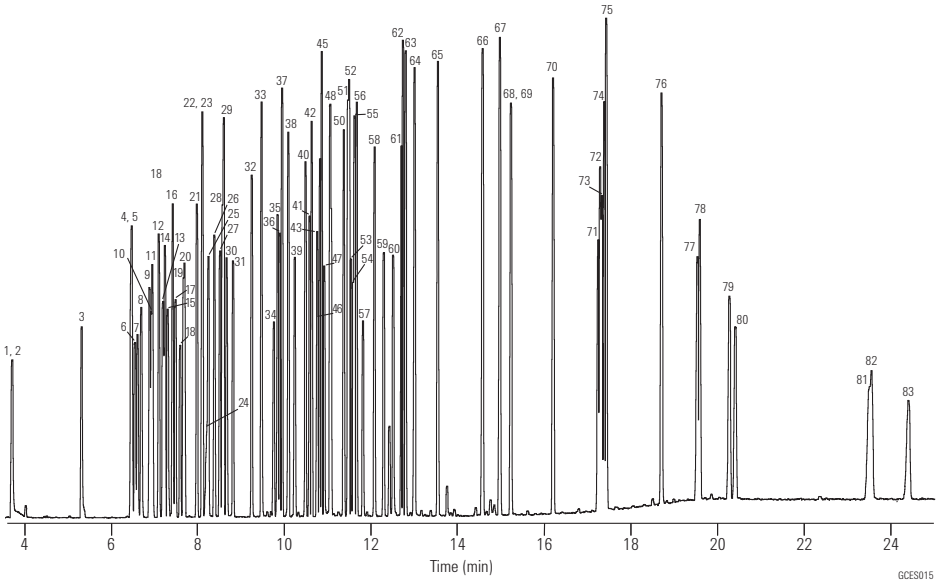
Detector: 5973 MSD, 310 °C transfer line
Scan range 35-500 amu, 3.25 scans/sec

Sample: 1 µL 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 µL tapered, FN 23-26s/42/HP, 5181-1267

1. n-Nitrosodimethylamine
2. Pyridine
3. 2-Fluorophenol
4. Phenol-d5
5. Phenol
6. Aniline
7. Bis(2-chloroethyl) ether
8. 2-Chlorophenol
9. 1,3-Dichlorobenzene
10. 1,4-Dichlorobenzene-d4
11. 1,4-Dichlorobenzene
12. Benzyl alcohol
13. 1,2-Dichlorobenzene
14. 2-Methylphenol
15. Bis(2-chloroisopropyl) ether
16. 4-Methylphenol
17. n-Nitroso-di-n-propylamine
18. Hexachloroethane
19. Nitrobenzene-d5
20. Nitrobenzene
21. Isophorone
22. 2-Nitrophenol
23. 2,4-Dimethylphenol
24. Benzoic acid
25. Bis(2-chloroethoxy) methane
26. 2,4-Dichlorophenol
27. 1,2,4-Trichlorobenzene
28. Naphthalene-d8
29. Naphthalene
30. 4-Chloroaniline
31. Hexachlorobutadiene
32. 4-Chloro-3-methylphenol
33. 2-Methylnaphthalene
34. Hexachlorocyclopentadiene
35. 2,4,6-Trichlorophenol
36. 2,4,5-Trichlorophenol
37. 2-Fluorobiphenyl
38. 2-Chloronaphthalene
39. 2-Nitroaniline
40. Dimethylphthalate
41. 2,6-Dinitrotoluene
42. Acenaphthylene
43. 3-Nitroaniline
44. Acenaphthene-d10
45. Acenaphthene
46. 2,4-Dinitrophenol
47. 4-Nitrophenol
48. Dibenzofuran
49. 2,4-Dinitrotoluene
50. Diethylphthalate
51. 4-Chlorophenyl-phenyl ether
52. Fluorene
53. 4-Nitroaniline
54. 4,6-Dinitro-2-methylphenol
55. n-Nitrosodiphenylamine
56. Azobenzene
57. 2,4,6-Tribromophenol
58. 4-Bromophenyl-phenylether
59. Hexachlorobenzene
60. Pentachlorophenol
61. Phenanthrene-d10
62. Phenanthrene
63. Anthracene
64. Carbazole
65. Di-n-butylphthalate
66. Fluoranthene
67. Pyrene
68. Terphenyl-d14
69. Benzidine
70. Butylbenzylphthalate
71. 3,3'-Dichlorobenzidine
72. Benzo[a]anthracene
73. Chrysene-d12
74. Chrysene
75. Bis(2-ethylhexyl) phthalate
76. Di-n-octylphthalate
77. Benzo[b]fluoranthene
78. Benzo[k]fluoranthene
79. Benzo[a]pyrene
80. Perylene-d12
81. Indeno[1,2,3-cd]pyrene
82. Dibenz[a,h]anthracene
83. Benzo[g,h,i]perylene



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 µm film, but the price paid is a slightly longer run time.
An HP-5ms, 30 m x 0.25 mm id, 0.25 µm, 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 µm, 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 µm, 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

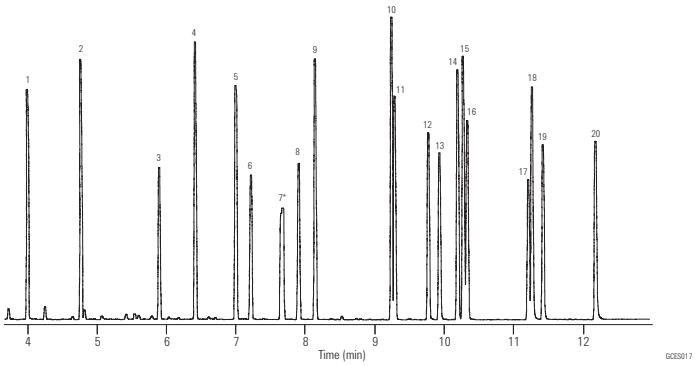
Septum: 11 mm Advanced Green septa, 5183-4759

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

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

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

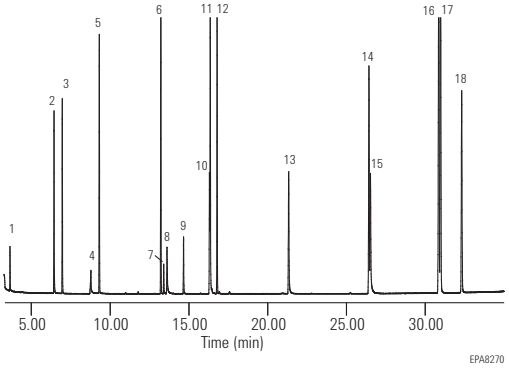
Detector: MSD source at 300 °C, quadrupole at 180 °C, transfer line at 290 °C, full scan m/z 50-550

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 dichoronezene-D4
4. 1,4 dichlorobenzene
5. Naphthalene-D8
6. Acenapthene-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 µm

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

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

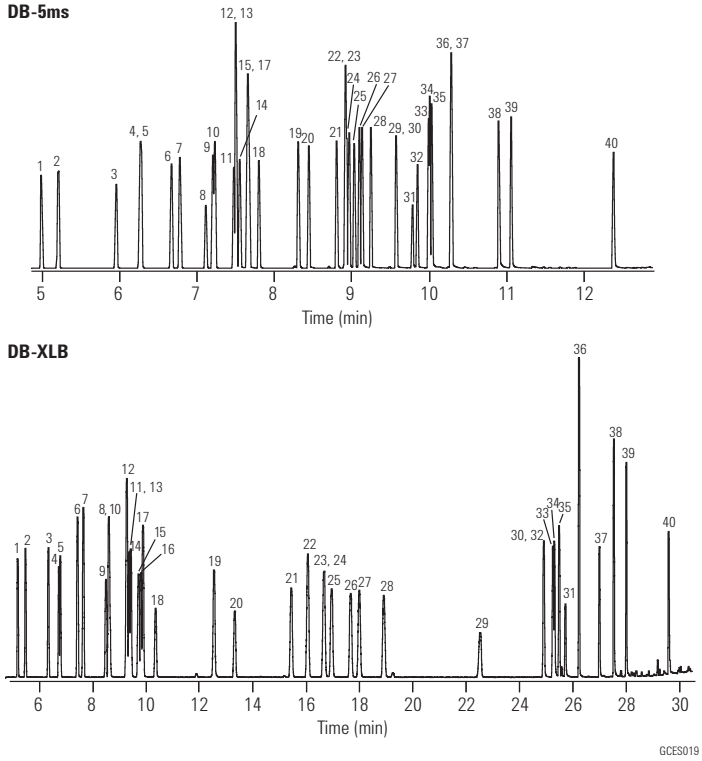
Detector: MSD, 320 °C Transfer Line
Quadrapole at 150 °C
Source at 230 °C

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

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

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



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

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

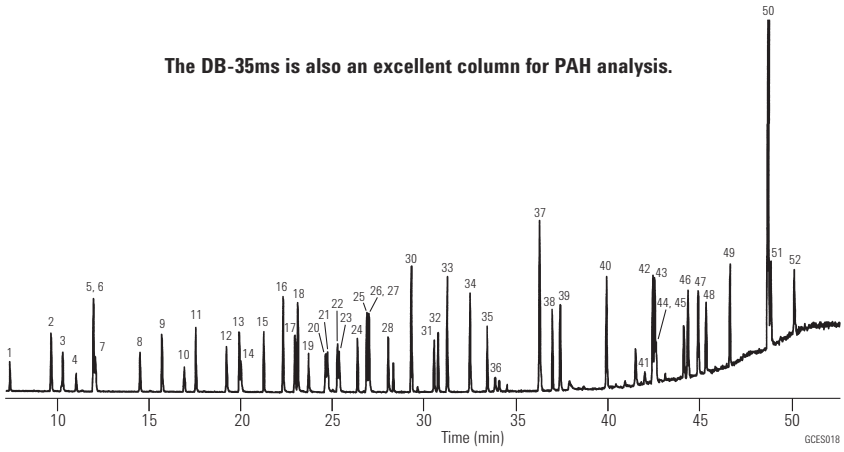
Septum: 11 mm Advanced Green septa, 5183-4759

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]fluoroanthene	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

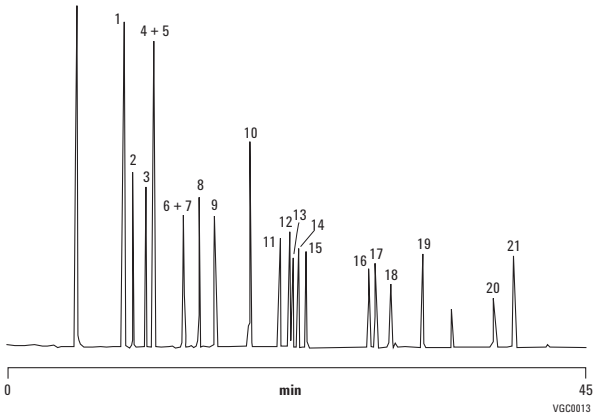
Column: **VF-5ms, CP8944, 30 m x 0.25 mm, 0.25 µm**

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 µm

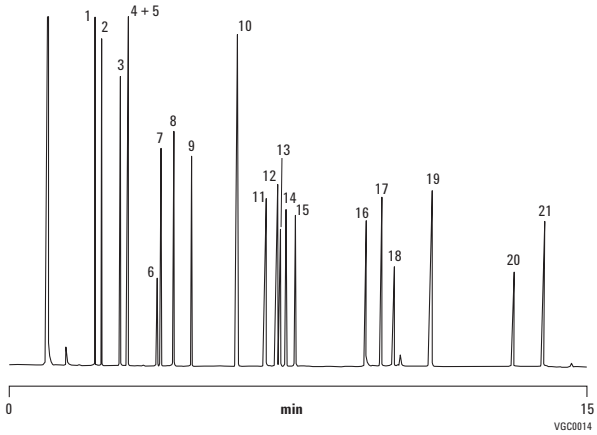
Sample Conc: 1 ppm

Oven: 80 °C to 200 °C, 8 °C/min

Carrier: H_2, 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

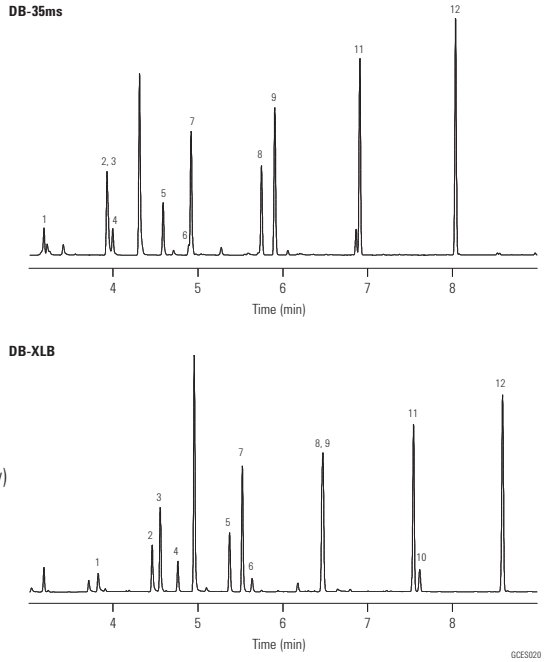
Carrier: Helium at 45 cm/sec
(EPC in constant flow mode)

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



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

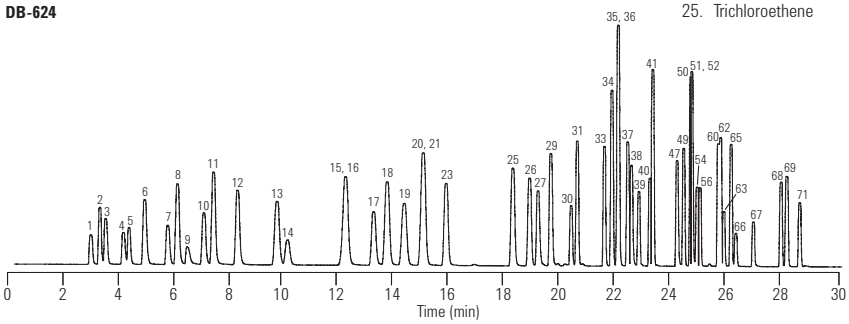
Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

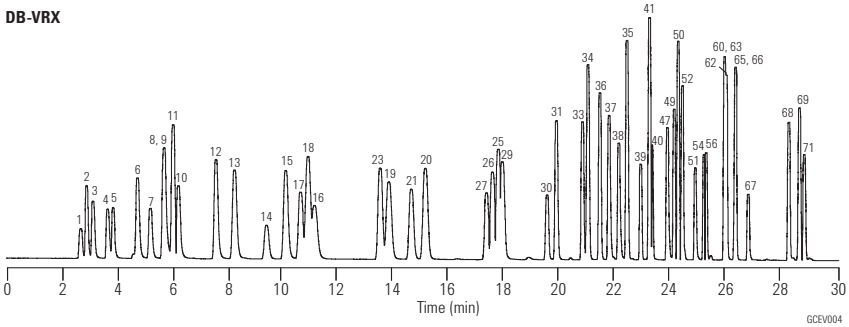
Septum: 11 mm Advanced Green septa, 5183-4759

1. Dichlorodifluoromethane
2. Chloromethane
3. Vinyl chloride
4. Bromomethane
5. Chloroethane
6. Trichlorofluoromethane
7. 2-Chloropropane (IS)
8. 1,1-Dichloroethene
9. Iodomethane
10. Allyl chloride
11. Methylene chloride
12. trans-1,2-Dichloroethene
13. 1,1-Dichloroethane
14. Chloroprene
15. cis-1,2-Dichloroethene
16. 2,2-Dichloropropane
17. Bromochloromethane
18. Chloroform
19. 1,1,1-Trichloroethane
20. Carbon tetrachloride
21. 1,1-Dichloropropene
22. Benzene
23. 1,2-Dichloroethane
24. Fluorobenzene (IS)
25. Trichloroethene
26. 1,2-Dichloropropane
27. Dibromomethane
28. Trifluorotoluene (IS)
29. Bromodichloromethane
30. 2-Chloroethyl vinyl ether
31. cis-1,3-Dichloropropene
32. Toluene
33. trans-1,3-Dichloropropene
34. 1,1,2-Trichloroethane
35. Tetrachloroethene
36. 1,3-Dichloropropane
37. Dibromochloromethane
38. 1,2-Dibromoethane
39. 1-Chloro-3-fluorobenzene (IS)
40. Chlorobenzene
41. 1,1,1,2-Tetrachloroethane
42. Ethylbenzene
43. m-Xlyene
44. p-Xylene
45. Styrene
46. o-Xylene
47. Bromoform
48. Isopropylbenzene
49. cis-1,4-Dichlorobutene
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

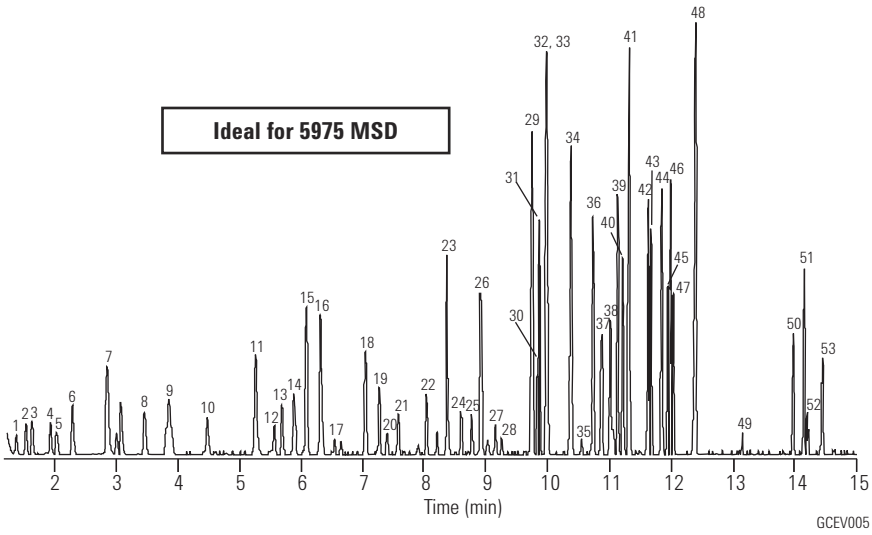
Detector: MSD, 250 °C transfer line
Full scan 35 -260 amu
3.25 scans per second

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
2. Chloromethane
3. Vinyl chloride
4. Bromomethane
5. Chloroethane
6. Trichlorofluoromethane
7. 1,1-Dichloroethene
8. Methylene chloride
9. trans-1,2-Dichloroethene
10. 1,1-Dichloroethane
11. 2,2-Dichloropropane
12. Bromochloromethane
13. Chloroform
14. 1,1,1-Trichloroethane
15. Carbon tetrachloride
16. Benzene
17. Fluorobenzene
18. Trichloroethene
19. 1,2-Dichloropropane
20. Dibromomethane
21. Bromodichloromethane
22. cis-1,3-Dichloropropene
23. Toluene
24. trans-1,3-Dichloropropene
25. 1,1,2-Trichloroethane
26. Tetrachloroethene
27. Dibromochloromethane
28. 1,2-Dibromomethane
29. Chlorobenzene
30. 1,1,1,2-Tetrachloroethane
31. Ethylbenzene
32. m-Xylene
33. p-Xylene
34. o-Xylene
35. Bromoform
36. Isopropylbenzene
37. Bromofluorobenzene
38. Bromobenzene
39. n-Propylbenzene
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

Suggested Supplies

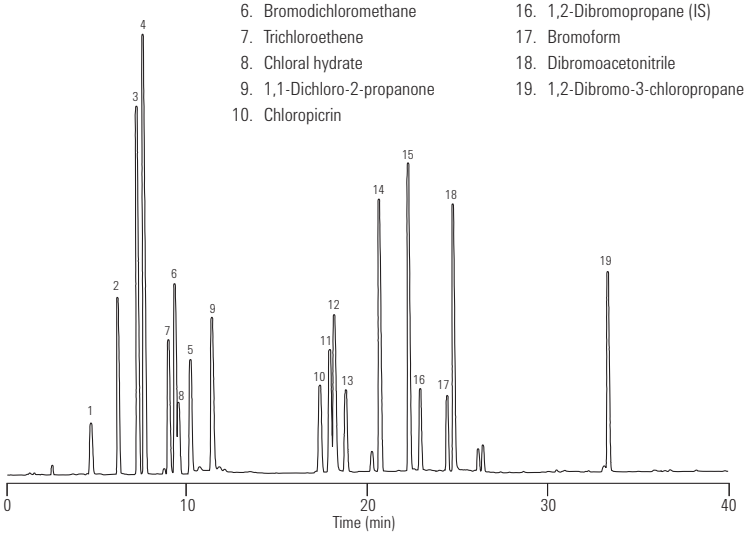
Septum: 11 mm Advanced Green septa, 5183-4759

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



GCEV008

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

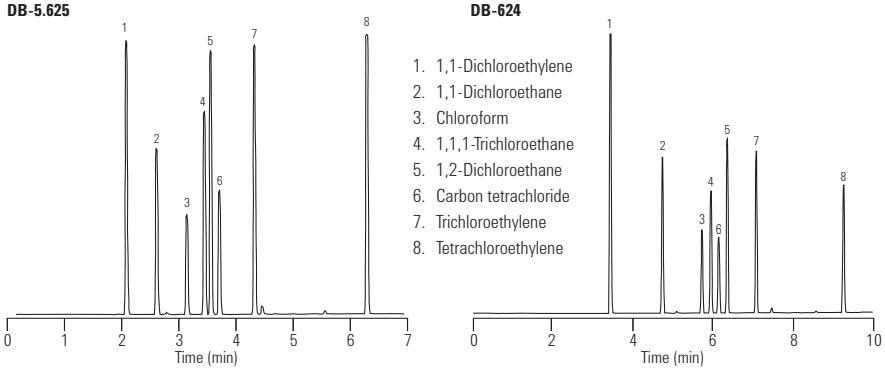
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

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

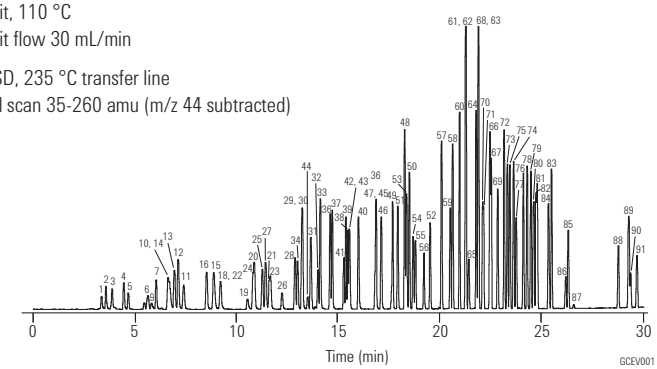
Sampler: Purge and trap (O.I.A. 4560)
Purge: Helium for 11 min at 40 mL/min
Trap: Tenax/Silica Gel/Carbosieve
Preheat: 175 °C
Desorb: 220 °C for 0.6 min

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

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

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



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

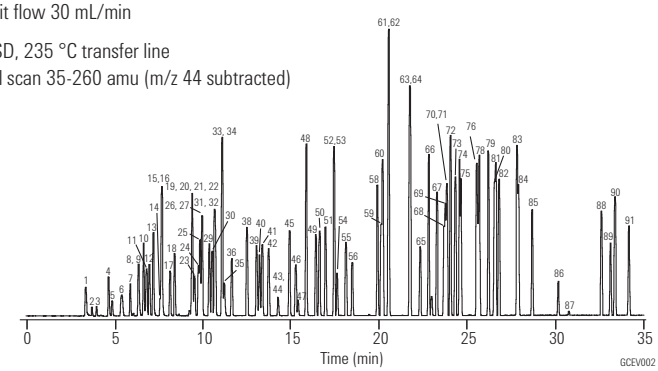
Sampler: Purge and trap (O.I.A. 4560)
Purge: Helium for 11 min at 40 mL/min
Trap: Tenax/Silica Gel/Carbosieve
Preheat: 175 °C
Desorb: 220 °C for 0.6 min

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

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

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

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 1min
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

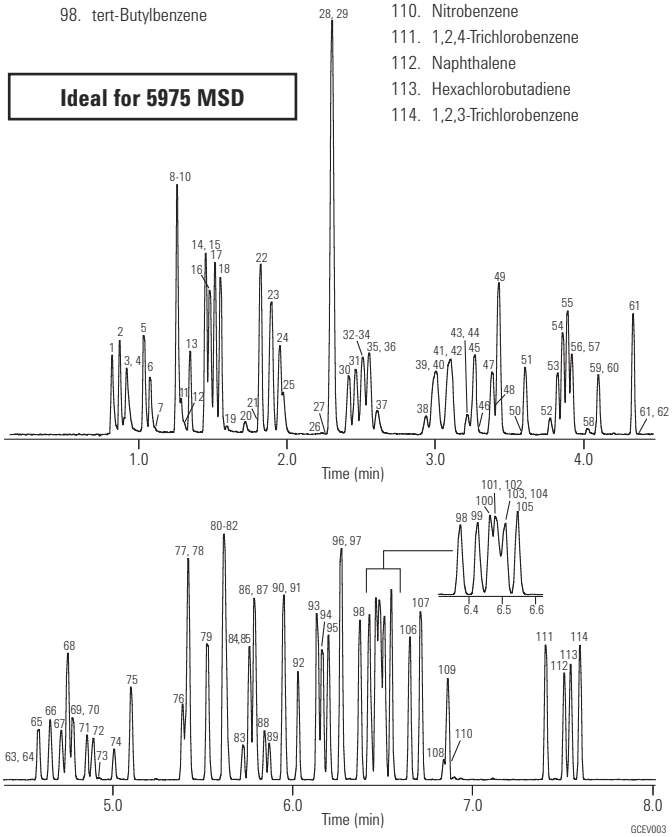
Sample: 5 mL
- Halogentated and aromatic analytes at 40 ppb
- Internal standards at 20 ppb
- Polar analytes (i.e., ethers, alcohols and ketones at 100-800 ppb)

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
2. Chloromethane
3. Hydroxypropionitrile
4. Vinyl chloride
5. Bromomethane
6. Chloroethane
7. Ethanol
8. Acetonitrile
9. Acrolein
10. Trichlorofluoromethane
11. Isopropyl alcohol
12. Acetone
13. Ethyl ether
14. 1,1-Dichloroethene
15. tert-Butyl alcohol
16. Acrylonitrile
17. Methylene chloride
18. Allyl chloride
19. Allyl alcohol
20. 1-Propanol
21. Propargyl alcohol
22. trans-1,2-Dichloroethene
23. MTBE
24. 1,1-Dichloroethane
25. Propionitrile
26. 2-Butanone
27. Diisopropyl ether
28. cis-1,2-Dichloroethene
29. Methacrylonitrile
30. Bromochloromethane
31. Chloroform
32. 2,2-Dichloropropane
33. Ethyl acetate
34. Ethyl-tert-butyl ether
35. Methyl acrylate
36. Dibromofluoromethane (IS)
37. Isobutanol
38. Dichloroethane-d4 (IS)
39. Pentafluorobenzene
40. 1,2-Dichloroethane
41. 1,1,1-Trichloroethane
42. 1-Chlorobutane
43. Crotonaldehyde
44. 2-Chloroethanol
45. 1,1-Dichloropropene
46. 1-Butanol
47. Carbon tetrachloride
48. Chloroacetonitrile
49. Benzene
50. tert-Amylmethyl ether
51. Fluorobenzene (IS)
52. 2-Pentanone
53. Dibromomethane
54. 1,2-Dichloropropane
55. Trichloroethene
56. Bromodichloromethane
57. 2-Nitropropane
58. 1,4-Dioxane
59. Epichlorohydrin
60. Methyl methacrylate
61. cis-1,3-Dichloropropene
62. Propiolactone
63. Bromoacetone
64. Pyridine
65. trans-1,3-Dichloropropene
66. 1,1,2-Trichloroethane
67. Toluene-d8 (IS)
68. Toluene
69. 1,3-Dichloropropane
70. Paraldehyde
71. Ethyl methacrylate
72. Dibromochloromethane
73. 3-Chloropropionitrile
74. 1,2-Dibromoethane
75. Tetrachloroethene
76. 1,1,1,2-Tetrachloroethane
77. 1-Chlorohexane
78. Chlorobenzene
79. Ethylbenzene
80. Bromoform
81. m-Xylene
82. p-Xylene
83. trans-Dichlorobutene
84. 1,3-Dichloro-2-propanol
85. Styrene
86. 1,1,2,2-Tetrachloroethane
87. o-Xylene
88. 1,2,3-Trichlropropane
89. cis-Dichlorobutene
90. 4-Bromofluorobenzene (IS)
91. Isopropylbenzene
92. Bromobenzene
93. Propylbenzene
94. 2-Chlorotoluene
95. 4-Chlorotoluene
96. 1,3,5-Trimethylbenzene
97. Pentachloroethane
98. tert-Butylbenzene
99. 1,2,4-Trimethylbenzene
100. sec-Butylbenzene
101. 1,3-Dichlorobenzene
102. Benzylchloride
103. 1,4-Dichlorobenzene-d4 (IS)
104. 1,4-Dichlorobenzene
105. Isopropyltoluene
106. 1,2-Dichlorobenzene
107. Butylbenzene
108. 1,2-Dibromo-3-chloropropane
109. Hexachloroethane
110. Nitrobenzene
111. 1,2,4-Trichlorobenzene
112. Naphthalene
113. Hexachlorobutadiene
114. 1,2,3-Trichlorobenzene

Ideal for 5975 MSD



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 CO_2 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

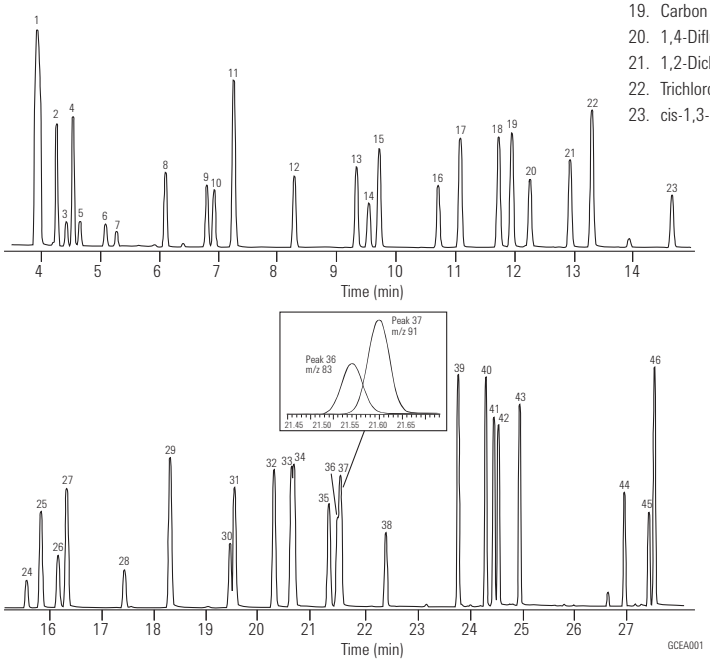
Suggested Supplies

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

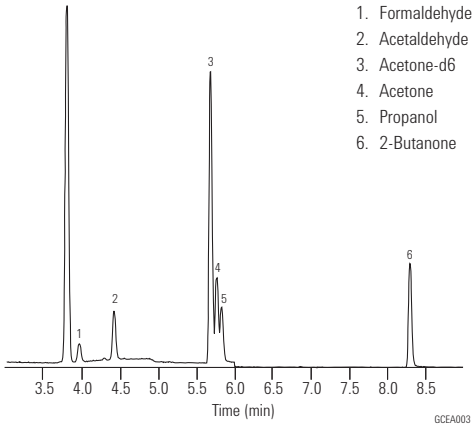
Agilent wishes to thank Entech Instruments for providing this chromatogram.

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 in Air

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

Carrier: Helium, 1.5 mL/min

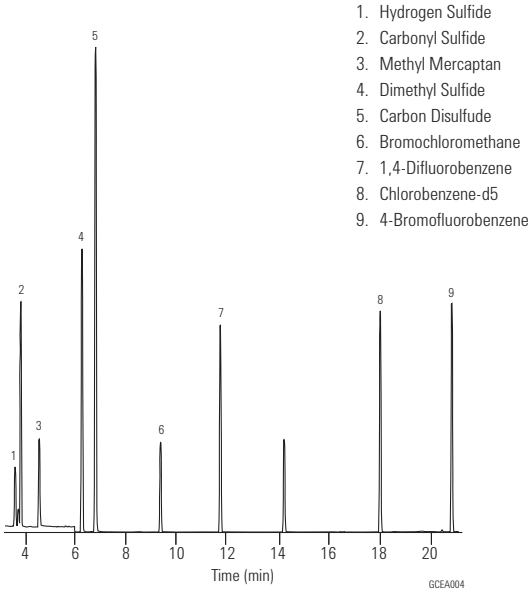
Oven: 35 °C for 5 min
35-140 °C at 6 °C/min
140-220 °C at 15 °C/min
220 °C for 3 min

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.



N_2O I

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

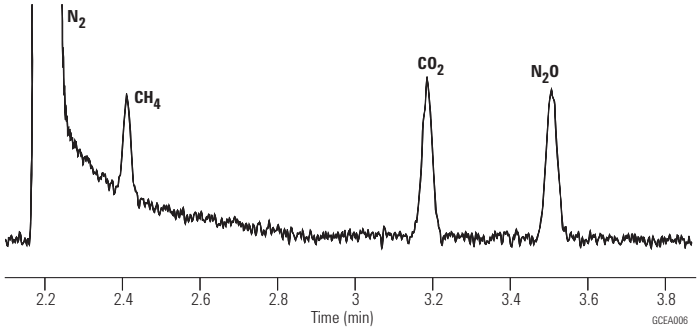
Carrier: Helium, 5 psi (approximately 8 mL/min)

Oven: 35 °C isothermal

Injection: 250 µL, injected
Split ratio 1:3

Detector: TCD, 200 °C

Sample: approximately 200 ppmV methane
200 ppmV CO_2
250 ppmV N_2O (nitrogen balance gas)



N_2O II

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

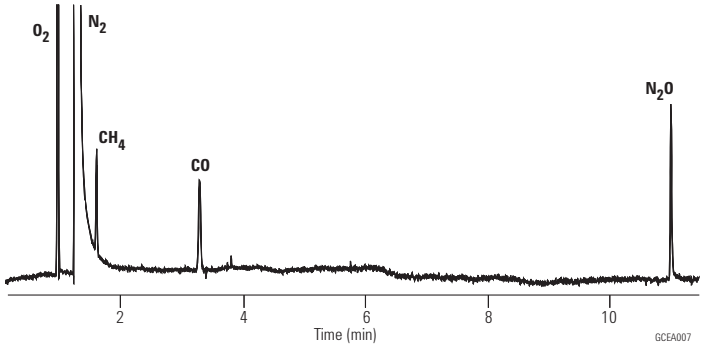
Carrier: Helium, 6 psi (approximately 10 mL/min)

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 CO_2
250 ppmV N_2O (nitrogen balance gas)



N_2O III

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

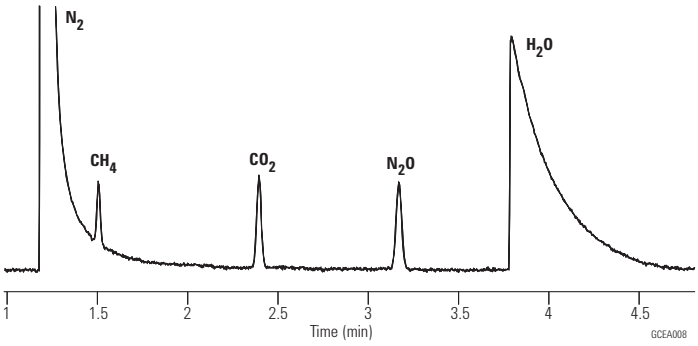
Carrier: Helium, 12 psi (approximately 3 mL/min)

Oven: 35 °C isothermal

Injection: 250 µL injected
Split ratio 1:4

Detector: TCD, 200 °C

Sample: approximately 200 ppmV methane
200 ppmV CO_2
250 ppmV N_2O (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

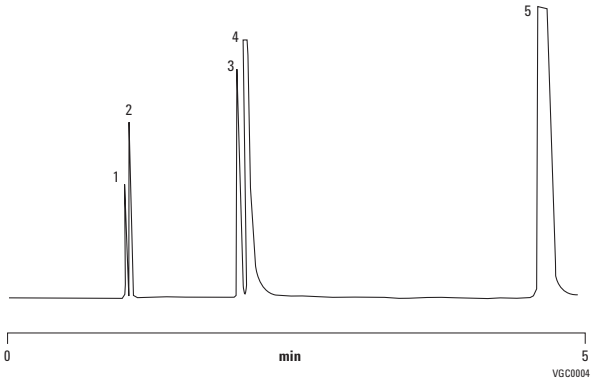
Sample Conc: % range

Carrier: H_2

Oven: 30 °C

Injection: Split, 100 mL/min

Detector: TCD



1. Helium
2. Neon
3. Argon
4. Oxygen
5. Nitrogen

Fast Analysis of Permanent Gases and CO_2 using Tandem PLOT Columns

Column: **CP-Sil PAH UltiMetal**
CP7429

Sample: 10 µL

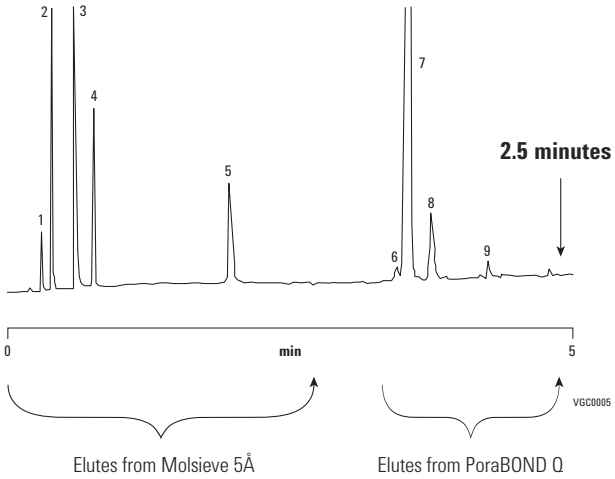
Sample Conc: % level

Carrier: H_2, 60 kPA

Oven: 45 °C

Injection: Split 50 mL/min

Detector: µ-TCD



1. He (from ms-5A)
2. O_2 (from ms-5A)
3. N_2 (from ms-5Å)
4. Methane (from ms-5Å)
5. CO (from ms-5Å)
6. He (from PBQ)
7. $N_2 + O_2 + CO$ (from PBQ)
8. Methane (from PBQ)
9. CO_2 (from PBQ)

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

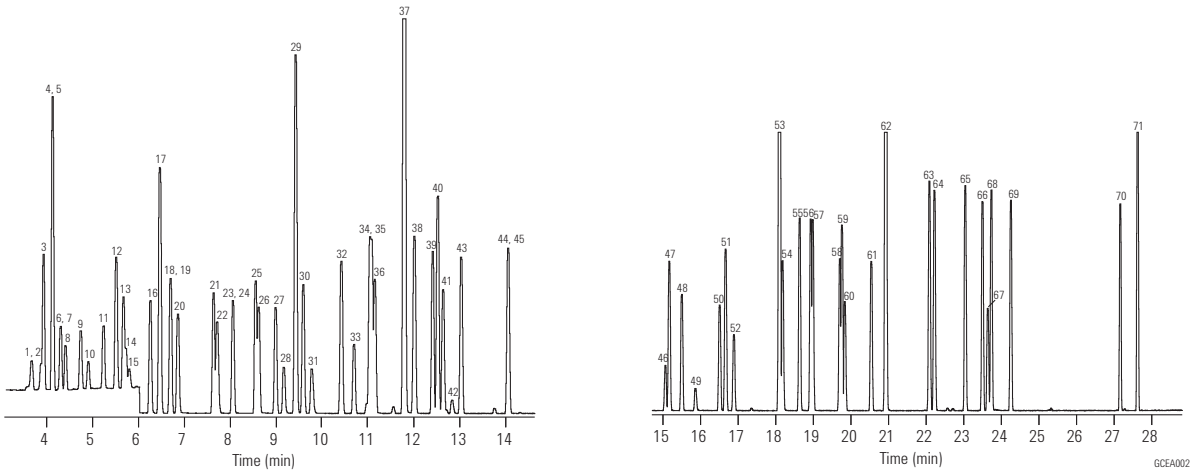
Detector: GC/MS 6890/5973N
Scan 29-180 amu 0-6 min
33-280 amu 6-30 min
Electron Impact 70 eV

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)

Suggested Supplies

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

	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		



Agilent wishes to thank Entech Instruments for providing this chromatogram.

Food, Flavor, and Fragrance Applications

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

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

Carrier: Helium, 2.3 mL/min, constant flow set a 35 °C

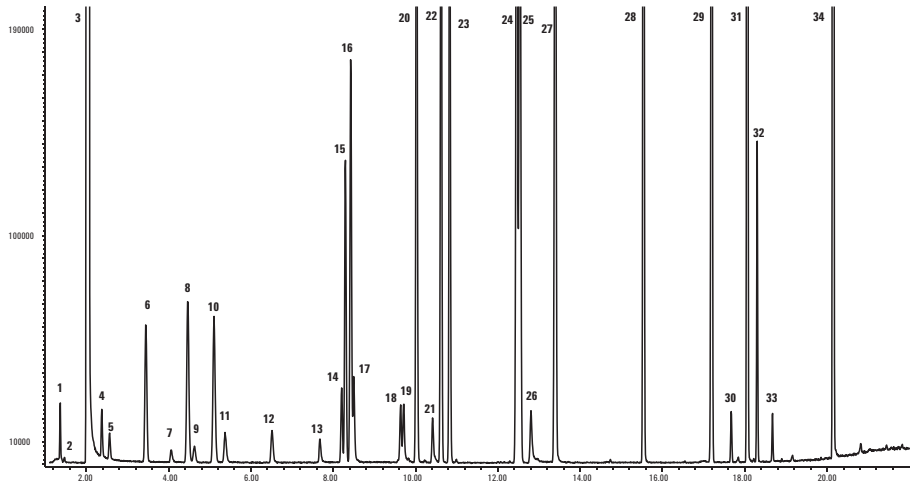
Oven: 35 °C for 5 min
10 °C/min to 100 °C for 1.5 min
15 °C/min to 220 °C for 3.0 min
25 °C/min to 250 °C for 2.8 min

Inlet: Split/splitless, 220 °C, 1 µL, split 20:1

MSD Restrictor: Scan mode 30-400 amu, source temp 230 °C, quad temp 150 °C, transfer line temp 260 °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 butanonate
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 µm

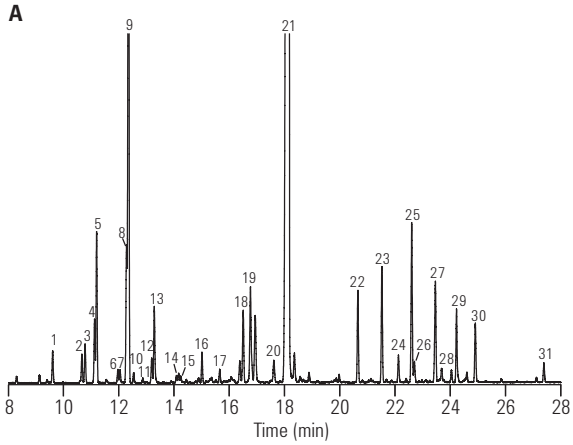
Column B: **DB-1**
121-1022
20 m x 0.18 mm, 0.18 µm

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

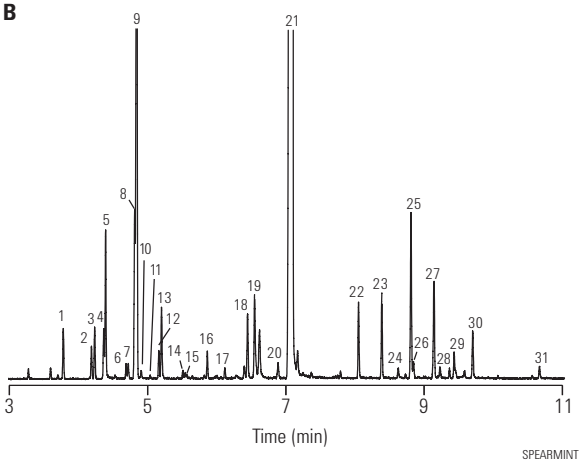
Oven: A: 40 °C hold 1 min, 5 °C/min to 290 °C
B: 40 °C hold 0.38 min, 13 °C/min to 290 °C hold 13.09 min

Injection: 250 °C, Split 40:1, 1 µL injection

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



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



1. α-Pinene
2. Sabinene
3. β-Pinene
4. 3-Octanol
5. Myrcene
6. α-Terpinene
7. ρ-Cymene
8. 1,8-Cineol
9. Limonene
10. cis-Ocimene
11. trans-Ocimene
12. γ-Terpinene
13. trans-Sabinene hydrate
14. Terpinolene
15. Linalool
16. 3-Octyl acetate
17. Isomenthone
18. Terpinen-4-ol
19. Dihydrocarvone
20. trans-Carveol
21. l-Carvone
22. trans-Dihydrocarveol acetate
23. cis-Carvyl acetate
24. cis-Jasmone
25. β-Bourbonene
26. α-Bourbonene
27. β-Caryophylene
28. α-Copaene
29. trans-β-Farnesene
30. Germacrene-d
31. Viridiflorol

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 µm

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

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

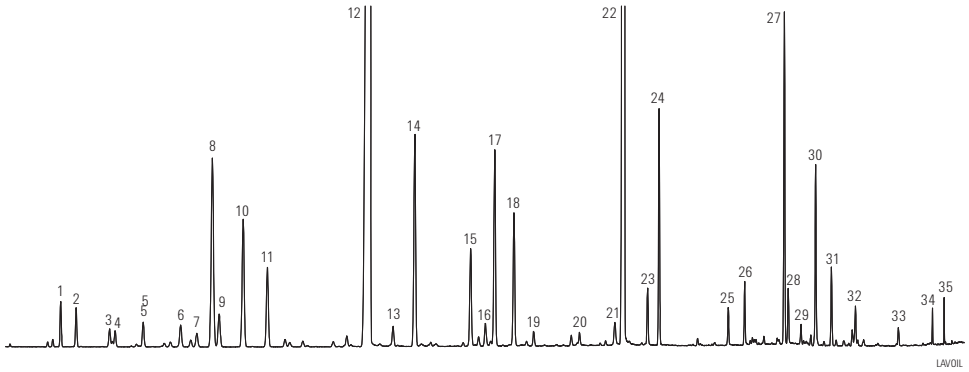
Suggested Supplies

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

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



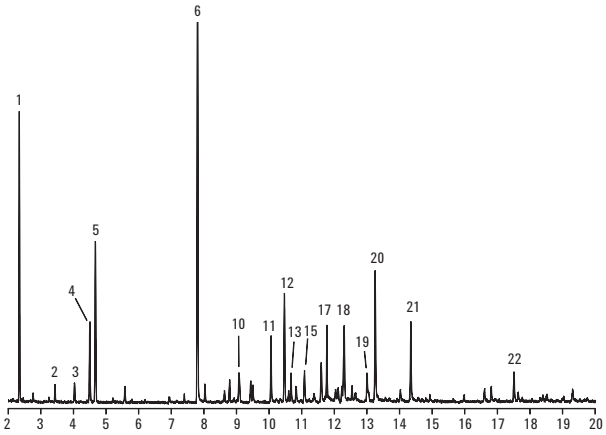
GC/MS total ion chromatogram of lavender oil sample on an Agilent J&W DB-1ms Ultra Inert 30 m x 0.25 mm, 0.25 µm capillary GC column (P/N 122-0132UI). The well-resolved, sharp peaks observed on the column ensure reliable analysis and fingerprinting of lavender oils.

Essential Oils

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

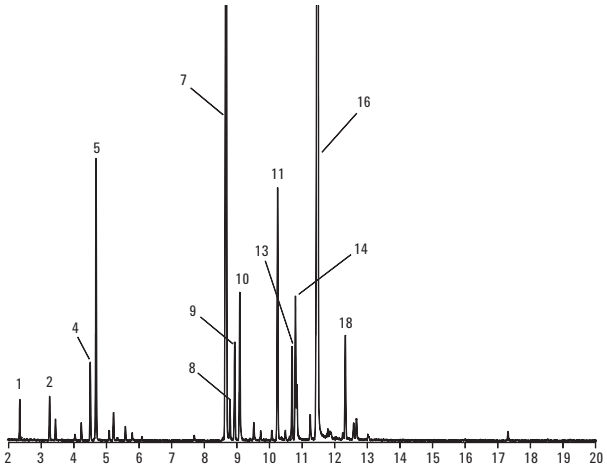
Carrier:	Hydrogen @ 44.3 cm/sec Measured @ 45 °C	Injection:	Split 1:30, 250 °C 1 µL of 1:35 oil in acetone
Oven:	45 °C hold 0.77 min 7.79 °C/min to 250 °C	Detector:	MSD full scan at m/z 40-500 250 °C transfer line

Wild chamomile



1. α-Pinene
2. β-Pinene
3. β-Myrcene
4. D-Limonene
5. Eucalyptol
6. 2,4-Hexadienal
7. Menthone
8. γ-Terpinene
9. Menthofuran
10. Iso-Menthone
11. Δ-Carane
12. Bornyl acetate
13. β-Caryophyllene
14. Isomenthol
15. Citronellyl formate
16. Menthol
17. t-β-Farnesene
18. γ-Cadinene
19. δ-Cadinene
20. Citronellol
21. Nerol
22. β-Maaliene

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

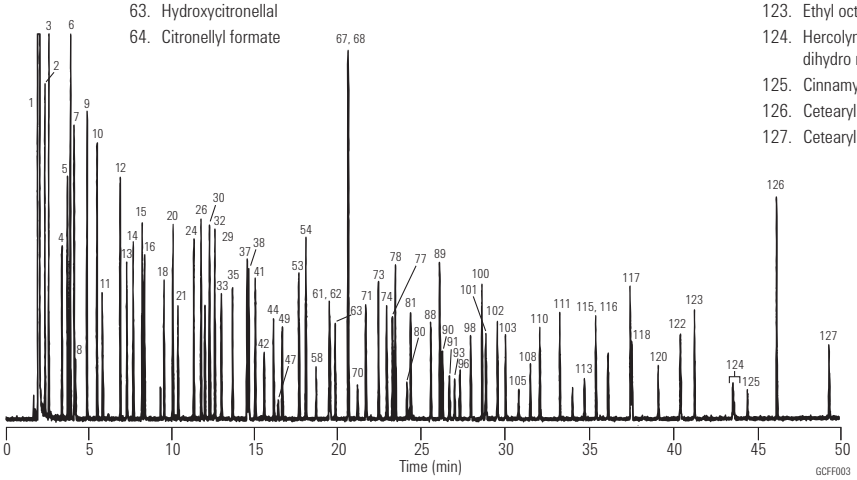
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

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



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

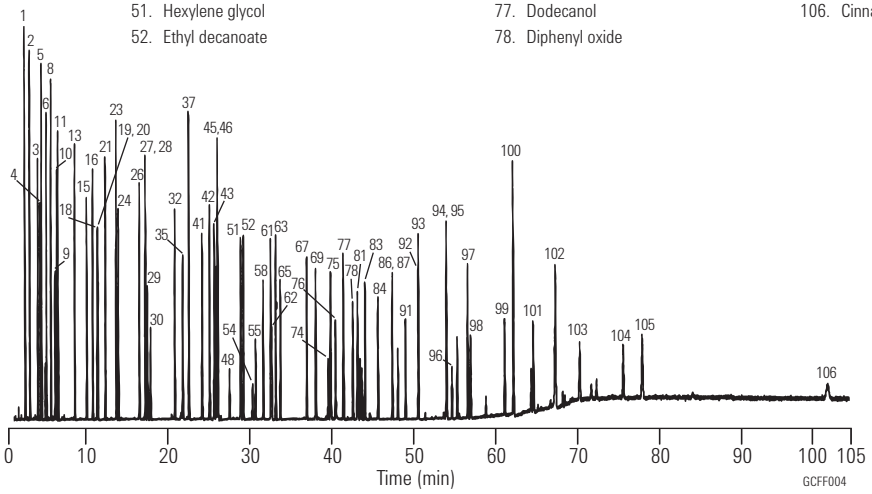
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

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



Perfume

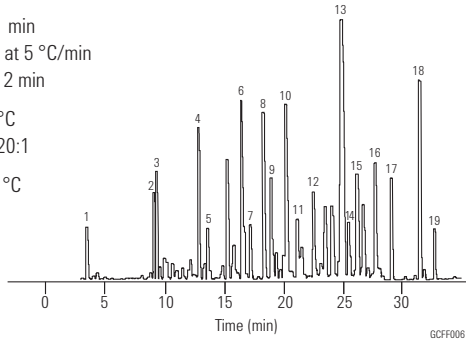
Column: **HP-INNOWax**
19091N-133
30 m x 0.25 mm, 0.25 µm

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

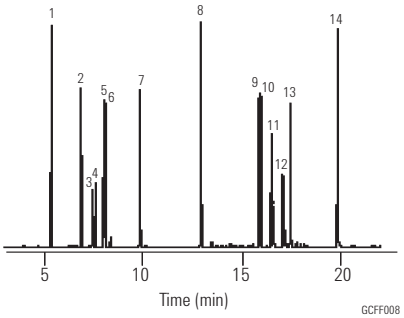
Carrier: Hydrogen, 39 cm/sec, constant pressure

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-(+)-Menthol
10. 1R,2S,5R-(-)-Menthol
11. α-Terpineol
12. (+/-)-Isoborneol
13. (+)-Borneol
14. trans-Cinnamaldehyde

Menthol

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

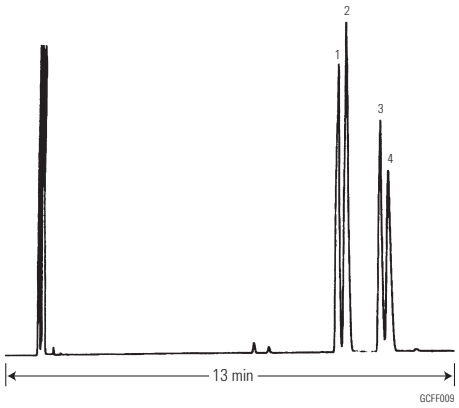
Carrier: Hydrogen, 55 cm/sec

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. (+)-Menthol
4. (-)-Menthol

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

Suggested Supplies

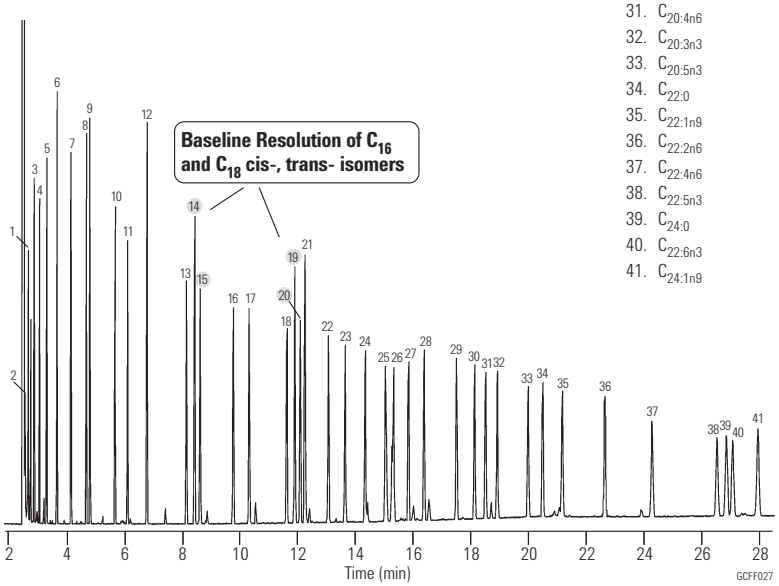
Septum: 11 mm Advanced Green septa, 5183-4759

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. $C_{6:0}$
2. $C_{7:0}$
3. $C_{8:0}$
4. $C_{9:0}$
5. $C_{10:0}$
6. $C_{11:0}$
7. $C_{12:0}$
8. BHT
9. $C_{13:0}$
10. $C_{14:0}$
11. $C_{14:1n5}$
12. $C_{15:0}$
13. $C_{16:0}$
14. $C_{16:1n7(trans)}$
15. $C_{16:1n7(cis)}$
16. $C_{17:0}$
17. $C_{17:1}$
18. $C_{18:0}$
19. $C_{18:1n9(trans)}$
20. $C_{18:1n9(cis)}$
21. $C_{18:1n7}$
22. $C_{18:2n6}$
23. $C_{18:3n6}$
24. $C_{18:3n3}$
25. $C_{18:2(d9,11)}$
26. $C_{18:2(d10,12)}$
27. $C_{20:0}$
28. $C_{20:1n9}$
29. $C_{20:2n6}$
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. $C_{24:1n9}$



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

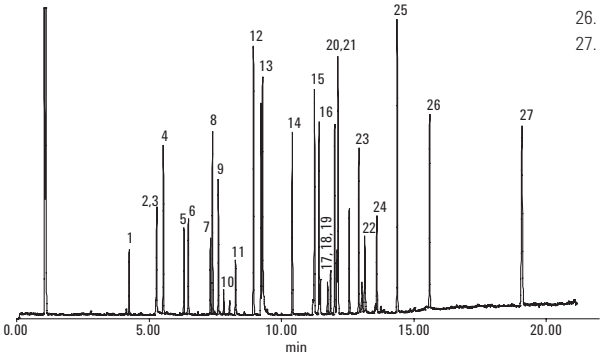
Carrier: Helium, 1.0 mL/min

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

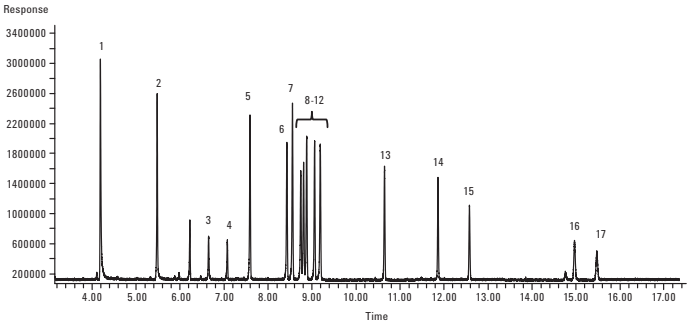


Organophosphorus Pesticide Residues in Olive Oil Extract

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

Instrument:	Agilent 7890/5975C
Sampler:	Agilent 7683B, 5.0 µL 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 µL splitless; 250 °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 °C
Oven:	95 °C (0.5 min), 25 °C/min to 210 °C, 10 °C/min to 250 °C (0.5 min), 20 °C to 290 °C (4.5 min)
Postrun Backflush:	7.5 min at 290 °C, Aux EPC pressure 54 psi during backflush, 2 psi inlet pressure during backflush
Detector:	MSD: 300 °C transfer line, 300 °C source, 150 °C quad FPD: 230 °C, Hydrogen 75 mL/min, Air 100 mL/min, Carrier + makeup (N_2) 60 mL/min

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



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

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

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

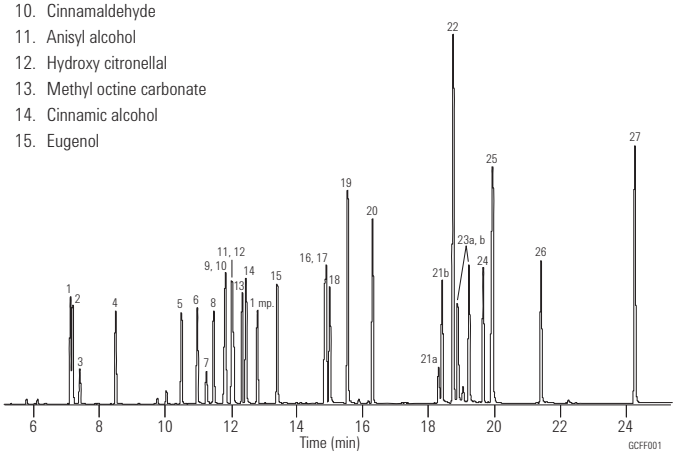
Seal: Gold plated seal, 18740-20885

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

1. Limonene
2. Benzyl alcohol
3. Phenyl acetaldehyde
4. Linalool
5. Methyl heptin carbonate
6. Citronellol
7. Neral
8. Geraniol
9. Citral (geranial)
10. Cinnamaldehyde
11. Anisyl alcohol
12. Hydroxy citronellal
13. Methyl octine carbonate
14. Cinnamic alcohol
15. Eugenol
16. Coumarin
17. Cinnamyl acetate
18. Isoeugenol
19. Alpha isomethyl ionone
20. Lilial (BMHCA)

21a. Lyral 1
21b. Lyral 2
22. Amyl cinnamyl alcohol

23a. Farnesol 1
23b. Farnesol 1
24. Hexyl cinnamaldeyde
25. Benzyl benzoate
26. Benzyl salicylate
27. Benzyl cinnamate



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

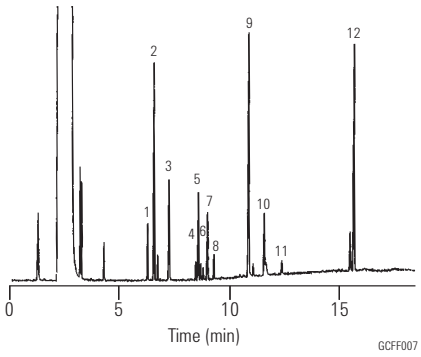
Suggested Supplies

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. 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

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 minV

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

Detector: Nitrogen makeup gas at 30 mL/min

Suggested Supplies

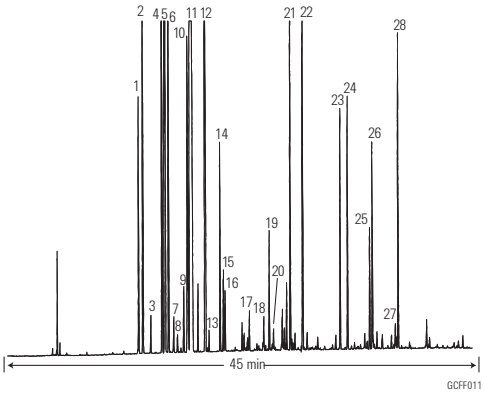
Septum: 11 mm Advanced Green septa, 5183-4759

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
2. β-Thujone
3. Camphene
4. Sabinene
5. β-Pinene
6. Myrcene
7. Octanal
8. α-Phellandrene
9. α-Terpinene
10. r-Cymene
11. δ-Limonene
12. γ-Trepinene
13. Octanol
14. Terpinolene
15. Linalool
16. Nonanal
17. Citronellal
18. Trepinen-4-ol
19. α-Trepineol
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

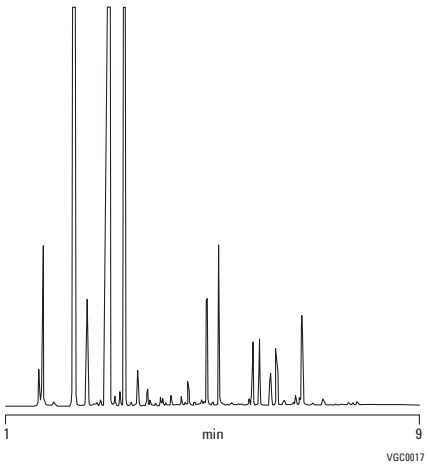
Solvent: Producto puro

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 µm

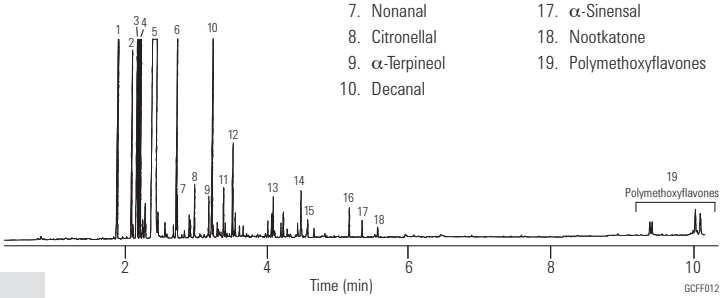
Carrier: Hydrogen at 60 cm/sec, measured at 70 °C

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



Chromatogram courtesy of Tastemaker

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

Peppermint Oil

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

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

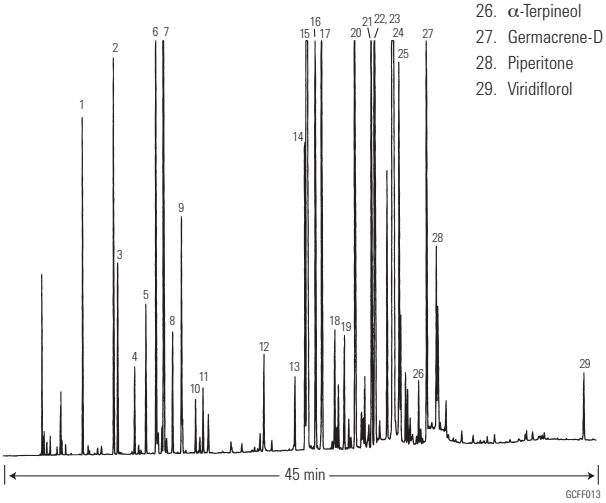
Oven: 75 °C for 8 min
75-200 °C at 4 °C/min
200° C for 5 min

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

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

Sample: 1µL neat

1. α-Pinene
2. β-Pinene
3. Sabinene
4. Myrcene
5. α-Terpinene
6. (+/-)-Limonene
7. 1,8-Cineol
8. cis-Ocimene
9. Terpinene
10. r-Cymene
11. γ-Terpinolene
12. 3-Octanol
13. 1-Octen-3-ol
14. trans-Sabinene hydrate
15. (+/-)-Methone
16. Methofuran
17. d-Isomethone
18. β-Bourbonene
19. Linalool
20. Menthyl acetate
21. Neomenthol
22. Trepinen-4-ol
23. β-Caryophyllene
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 µL tapered, FN 23-26s/42/HP, 5181-1273

Spearmint Oil (Western)

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

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 µL neat

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

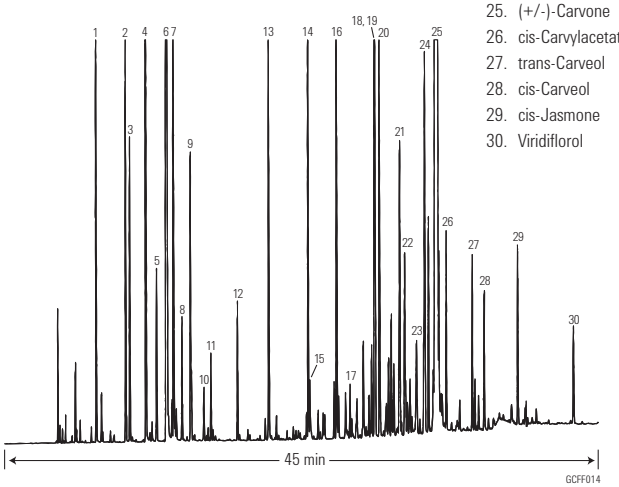
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

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

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

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



Ylang Ylang Oil

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

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 µL of 10% oil in methylene chloride

Suggested Supplies

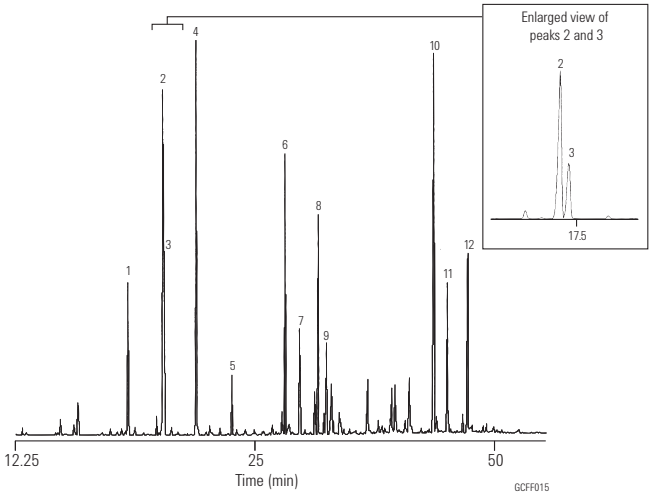
Septum: 11 mm Advanced Green septa, 5183-4759

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



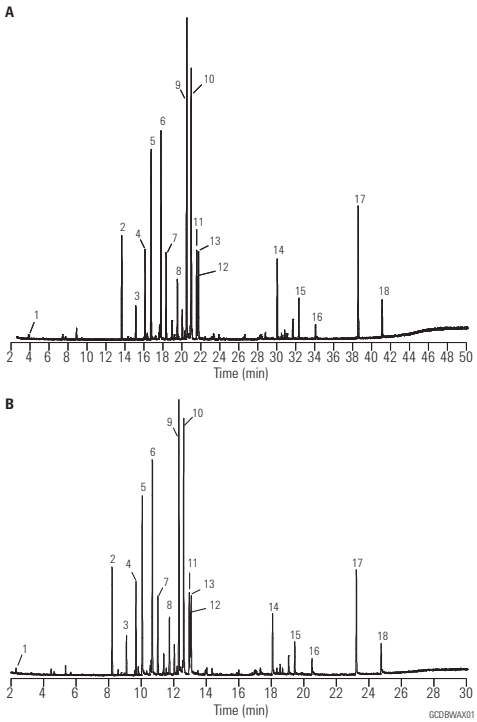
Ylang Ylang Oil

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

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



1. α-Pinene
2. Methyl-ρ-cresol
3. α-Copaene
4. α-Gurjunene
5. Linalool
6. β-Caryophyllene
7. Methyl benzoate
8. α-Caryophyllene
9. Germacrene-d
10. Benzyl acetate
11. Farnescene
12. δ-Cadinene
13. Geranial acetate
14. trans-Cinnamyl acetate
15. β-Bisbolene
16. Farnesyl acetate
17. Benzyl benzoate
18. Benzyl salicylate

Rosemary Oil

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

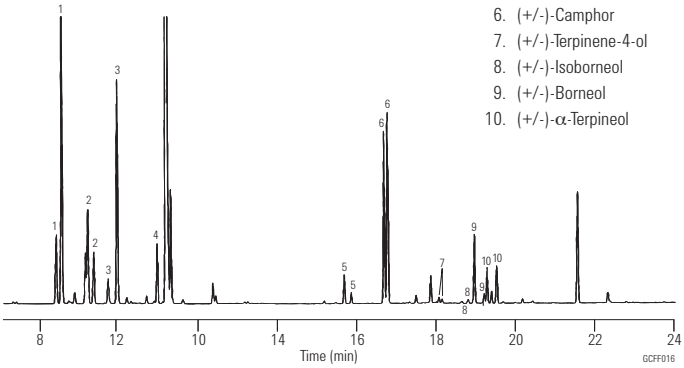
Carrier: Hydrogen at 40 cm/sec, measured at 60 °C

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

1. (+/-)-α-Pinene
2. (+/-)-Camphene
3. (+/-)-β-Pinene
4. (+/-)-Limonene
5. (+/-)-Linalool
6. (+/-)-Camphor
7. (+/-)-Terpinene-4-ol
8. (+/-)-Isoborneol
9. (+/-)-Borneol
10. (+/-)-α-Terpineol



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

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
Desorbtion: 250 °C for 15 min

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

Detector: MSD, 280 °C transfer line

Suggested Supplies

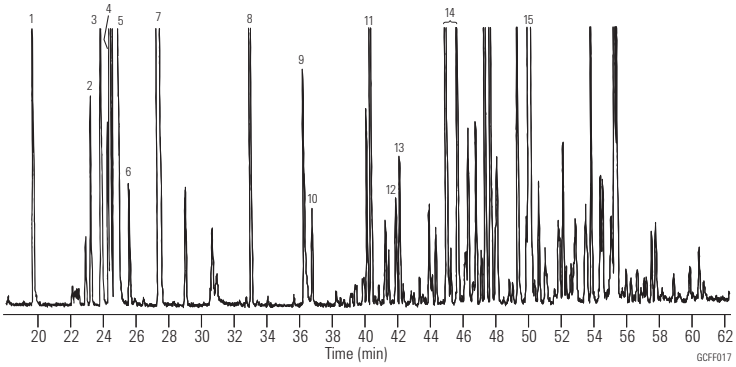
Septum: 11 mm Advanced Green septa, 5183-4759

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



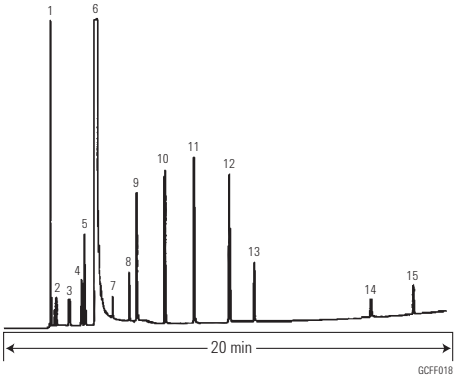
Alcohol Beverage Standard

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

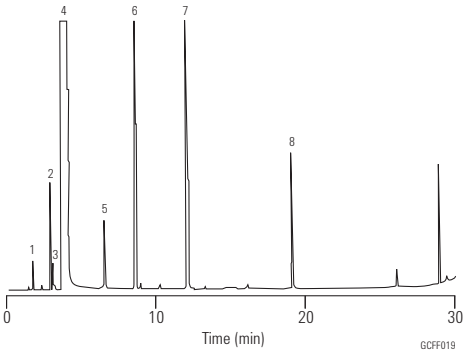
Carrier: Helium, 33 cm/sec, 15.5 psi (35°C)
1.5 mL/min constant flow

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

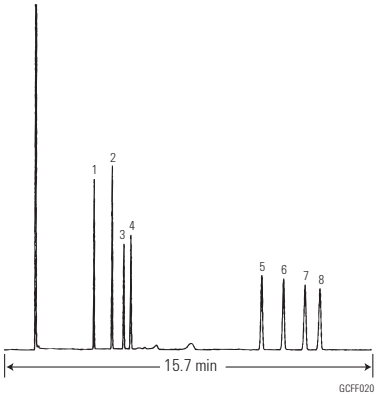
Carrier: Hydrogen a 36.5 cm/sec

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

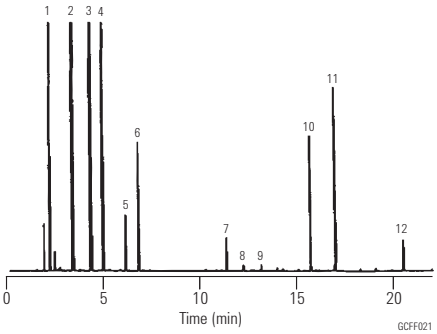
Column: **HP-INNOWax**
19091N-213
30 m x 0.32 mm, 0.50 µm

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

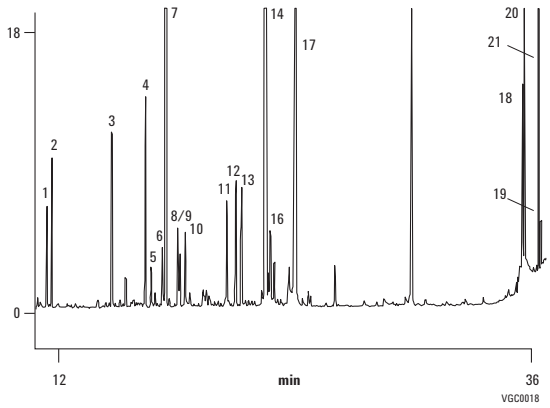
Sample Conc: 40 ppb

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. Arabitol
7. Ribitol
8. 3-0-Methylglucose 1
9. Xylose 2
10. Rhamnitol
11. 3-0-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

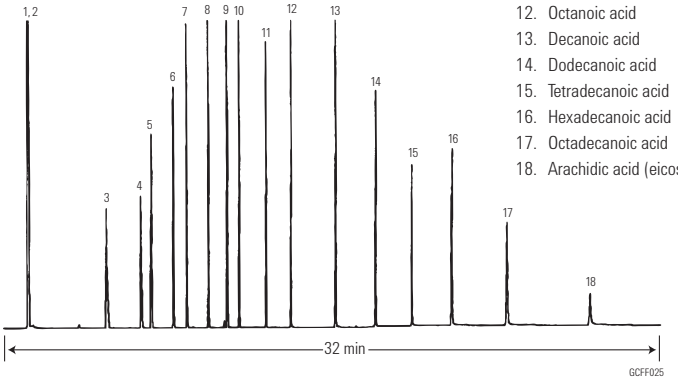
Suggested Supplies

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

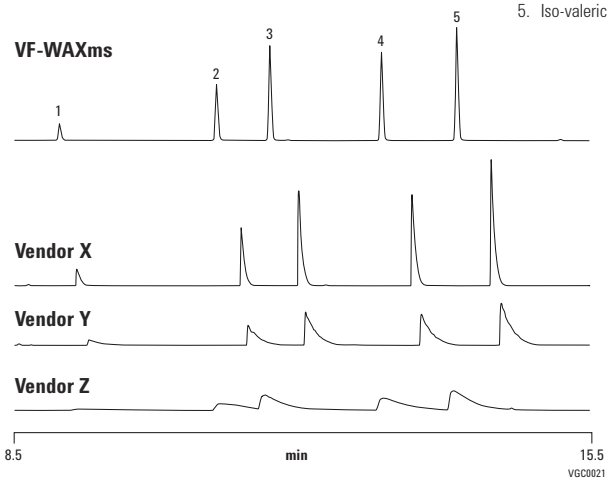
Sample: Acid sample, 0.1% (Cyclohexane), 1.0 µL

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

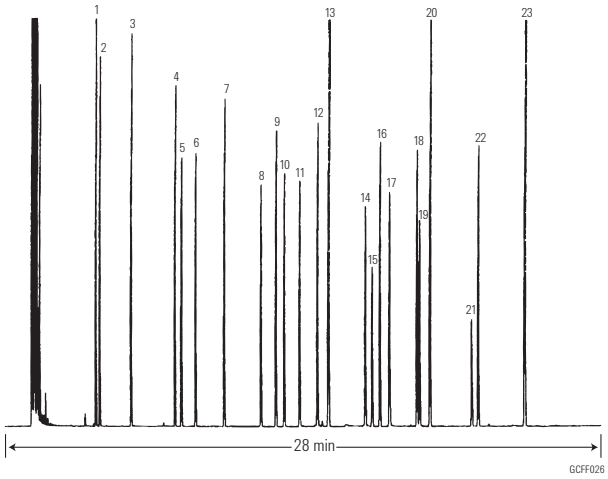
Column: **DB-5**
122-5032
30 m x 0.25 mm, 0.25 µm

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-methyl 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 µL

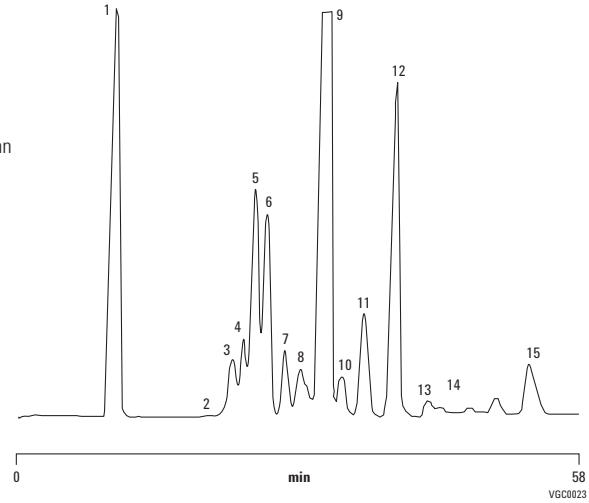
Sample Conc: 5 g approx. per component on the column

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 µm**

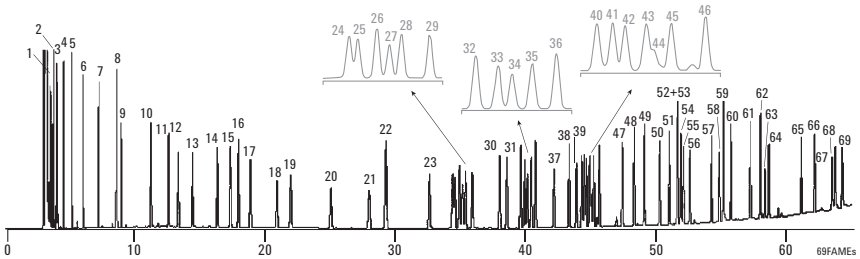
Carrier: He at 1.4 mL/min constant flow

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 µL of 70 ppm each in $CHCl_3$

Detector: FID, 260 °C

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



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

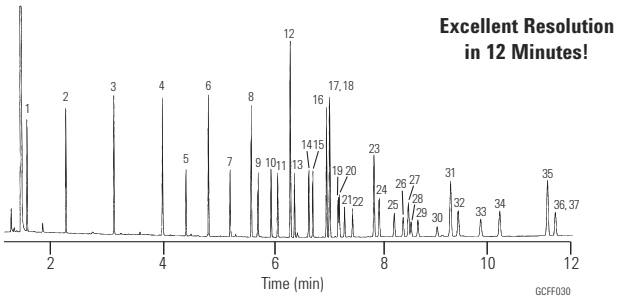
Septum: 11 mm Advanced Green septa, 5183-4759

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

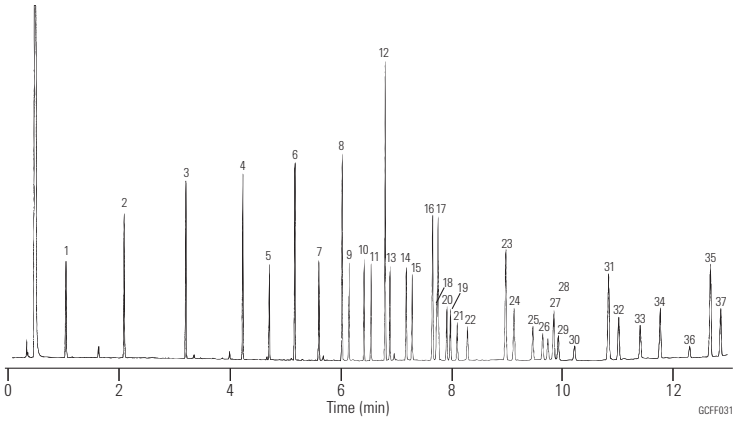
Septum: 11 mm Advanced Green septa, 5183-4759

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

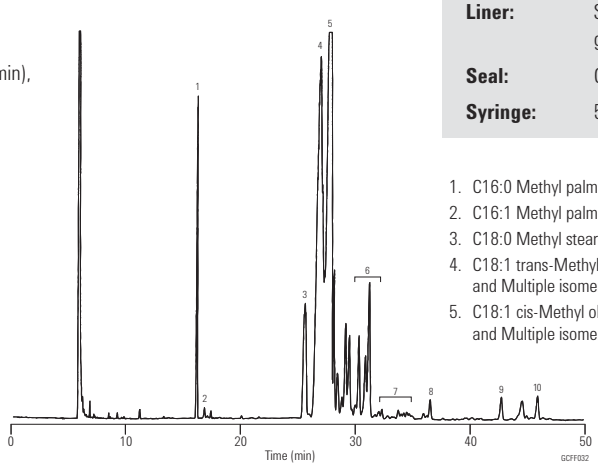
Carrier: Helium at 15 cm/sec (0.44 mL/min), measured at 150 °C

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

Butter Triglycerides I

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

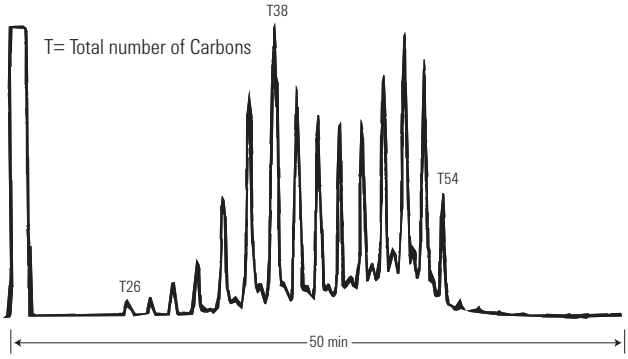
Carrier: Hydrogen at 55 cm/sec, measured at 250°C

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

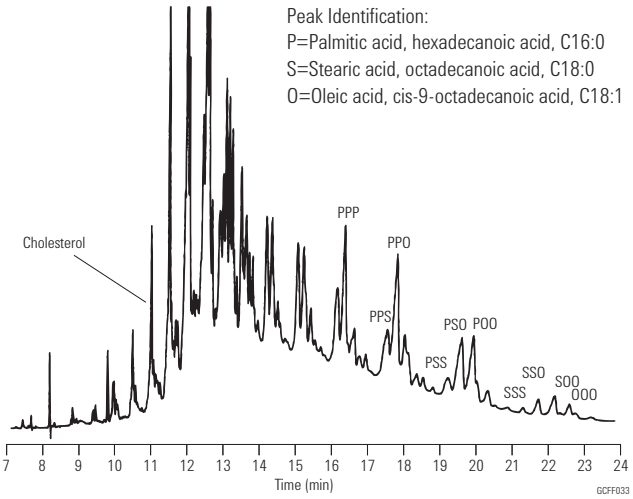
Carrier: Hydrogen at 40 cm/sec

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

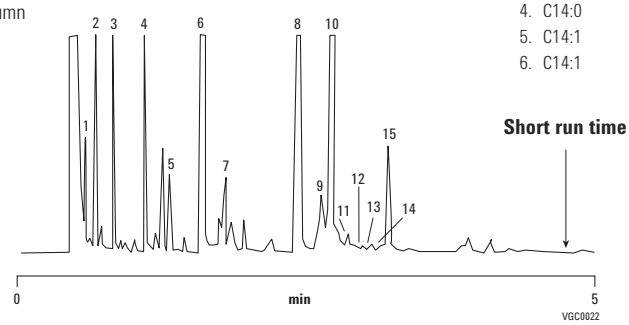
Sample: 0.5 µL ca. 5 ng per component on column

Carrier: Hydrogen, 70 kPa

Oven: 185 °C

Injection: Split, 1:100
T=275 °C

Detector: FID



1. C8:0
2. C10:0
3. C12:0
4. C14:0
5. C14:1
6. C14:1
7. C16:1 9-cis
8. C16:1 9-cis
9. C18:1 trans
10. C18:1 9-cis
11. C18:1 13-cis
12. C18:2 9-trans, 12-trans
13. C18:2 9-cis, 12-trans
14. C18:2 9-trans,12-cis
15. C18:2 9-cis, 12-cis

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

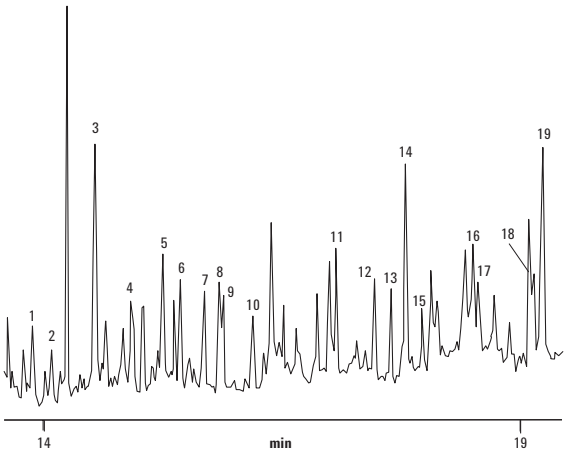
Oven: 70 °C (3.0 min), 25 °C to 190 °C/min (0.0 min) to 10 °C/min to 320 °C (10 min)

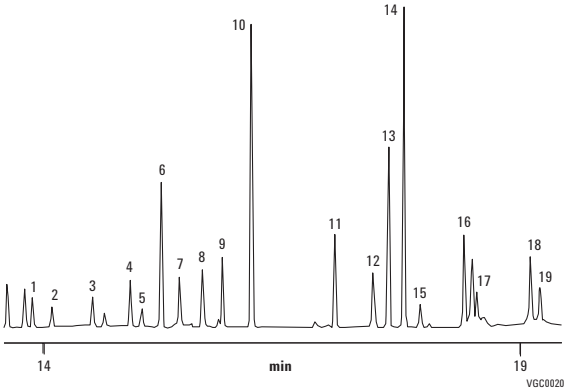
Injection: 1079 with carbofrit liner

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

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

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





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 CS_2

Suggested Supplies

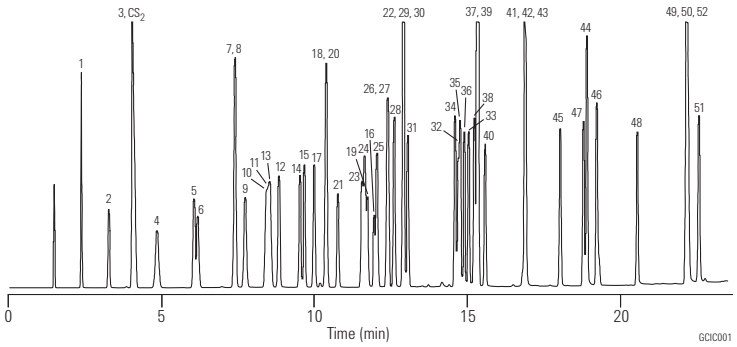
Septum: 11 mm Advanced Green septa, 5183-4759

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

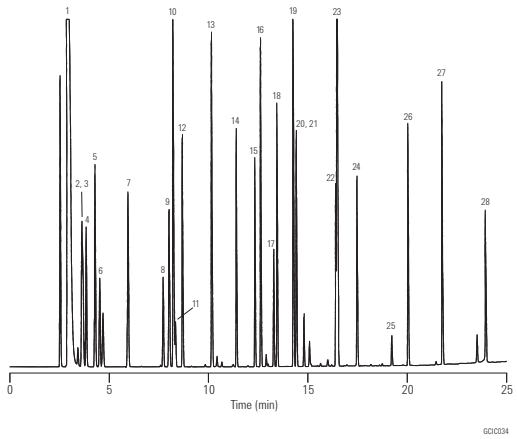
Suggested Supplies

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

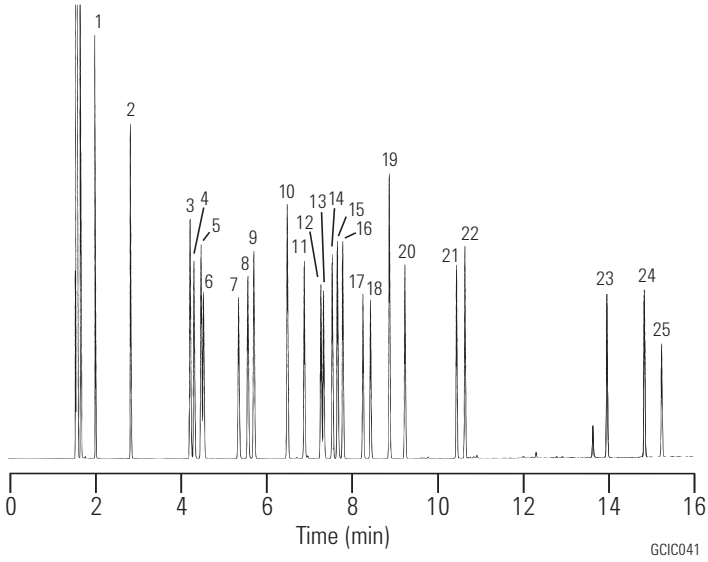
Suggested Supplies

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

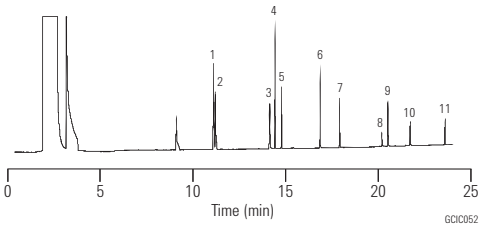
Suggested Supplies

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

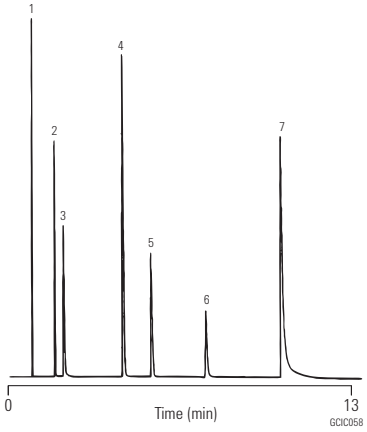
Sample: 50 µL

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. CO_2
3. SF_6
4. COS
5. H_2S
6. Ethylene oxide
7. SO_2

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 CS_2

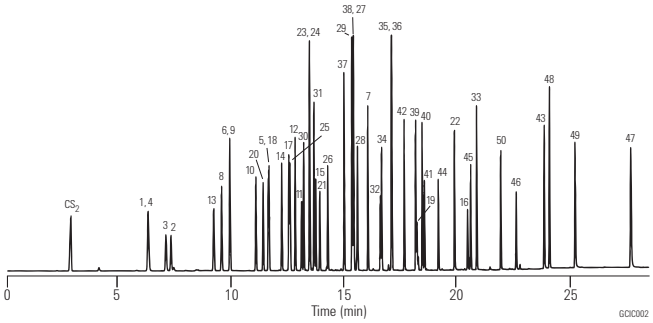
Suggested Supplies

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

Alcohols III

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

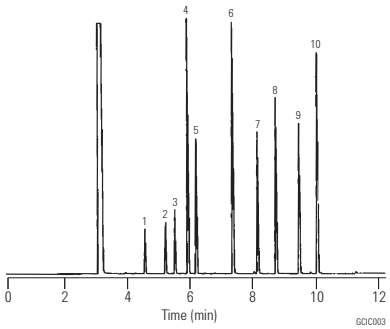
Carrier: Helium, 29 cm/sec, 3.0 psi (45 °C)

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

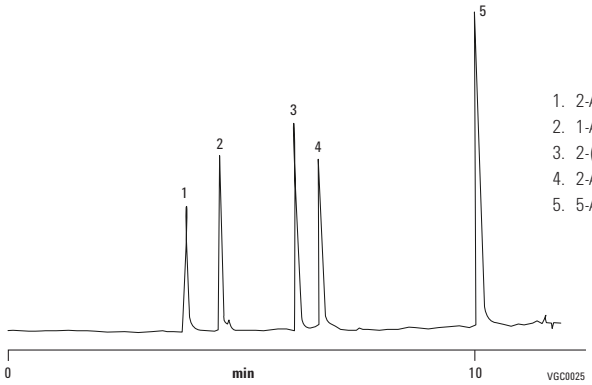
Solvent: Water

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



1. 2-Amino-ethanol
2. 1-Amino-2-propaol
3. 2-(Ethlamino)-ethanol
4. 2-Amino-1-butanol
5. 5-Amino-1-pentanol

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

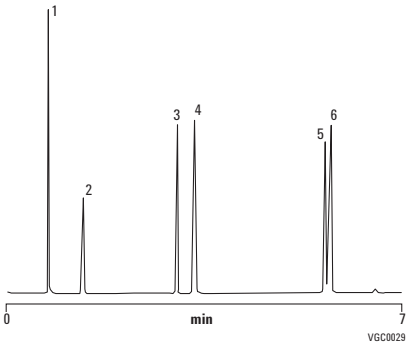
Solvent: methanol

Carrier: Helium, 50 pKa, 55 cm/s

Oven: 35 °C (0.5 min) to 240 °C, 30 °C/min

Injection: Split

Detector: MS



1. Methanol
2. IPA
3. Mono ethylene glycol
4. MMEA methyl monoethanolamine
5. Diethanolamine
6. MDEA methyl diethanolamine

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

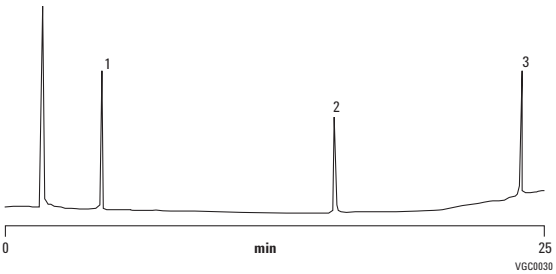
Solvent: methanol

Carrier: Helium, 50 kPa (0.5 bar, 7 psi)

Oven: 60 °C (5 min) to 220 °C, 6 °C/min

Injection: Split

Detector: FID



1. MEA (mono-ethanolamine)
2. DEA (di-ethanolamine)
3. TEA (tri-ethanolamine)

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

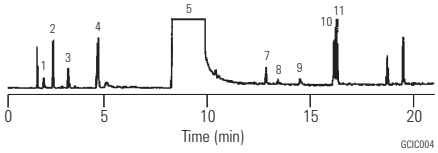
Suggested Supplies

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

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

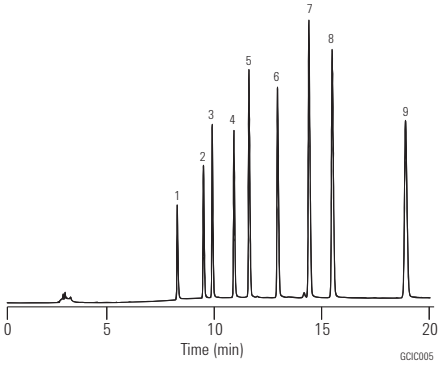
Suggested Supplies

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

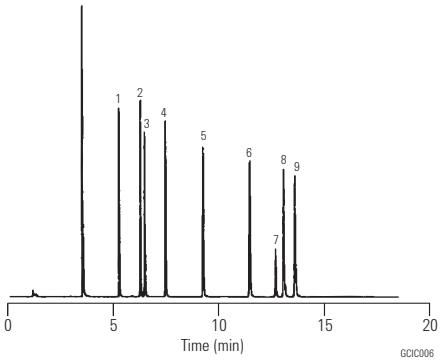
Carrier: Helium 42 cm/sec, 24 psi (120 °C)
1.8 mL/min constant flow

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-butenoic acid
8. trans-3-Pentenoic acid
9. trans-2-Pentenoic acid

Volatile Amines

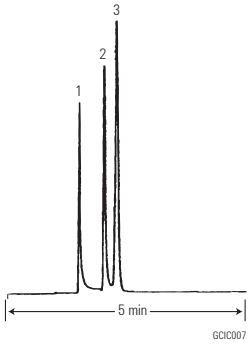
Column: **DB-1**
125-1035
30 m x 0.53 mm, 5.00 µm

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

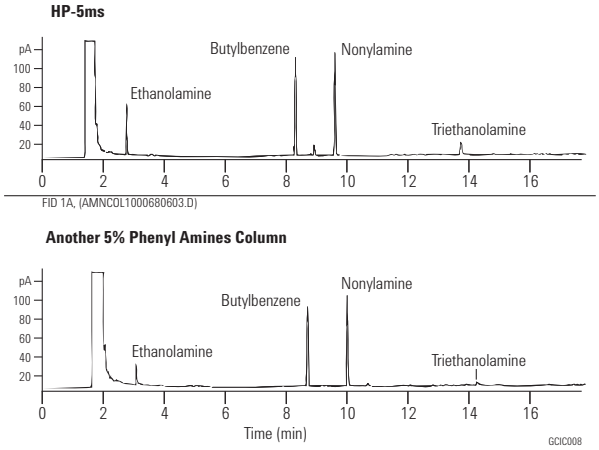
Carrier: Helium, constant pressure 9.79 psi

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



Primary Amines

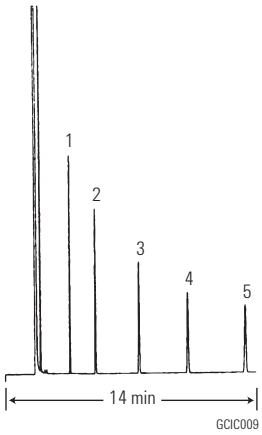
Column: **CAM**
112-2132
30 m x 0.25 mm, 0.25 µm

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. Benylamine
5. Dicyclohexylamine

Polyethyleneamines

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

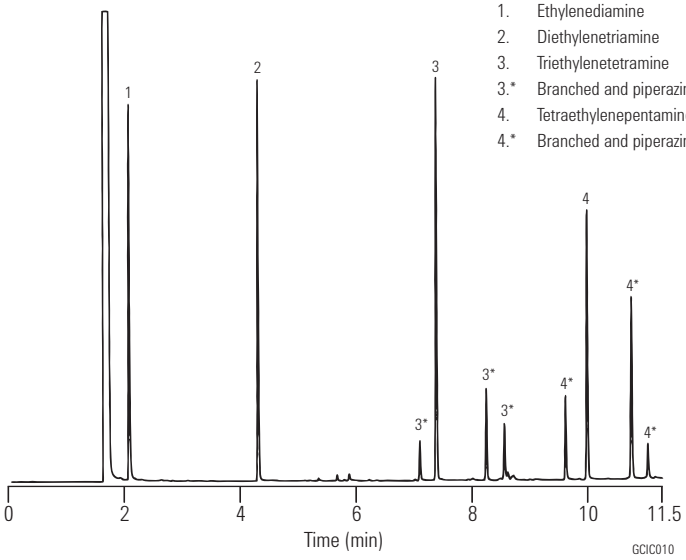
Carrier: Helium at 30 cm/sec, measured at 100 °C

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 µm

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 µL of 100 ng/µL standard in methanol

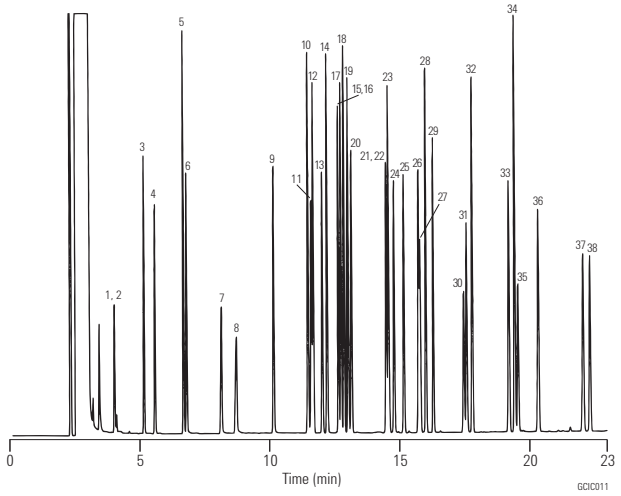
Suggested Supplies

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



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

Amines in Water

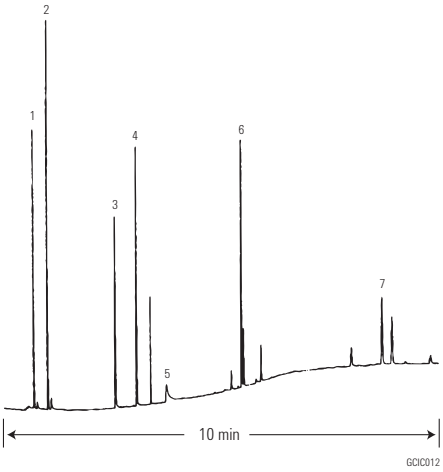
Column: **CAM**
112-2132
30 m x 0.25 mm, 0.25 µm

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

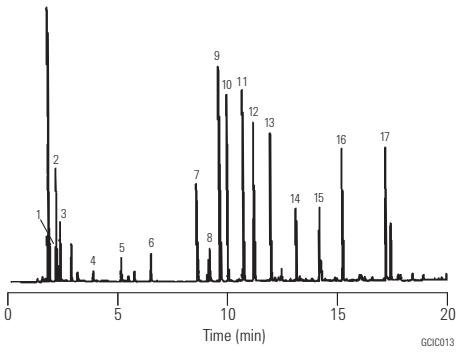
Suggested Supplies

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

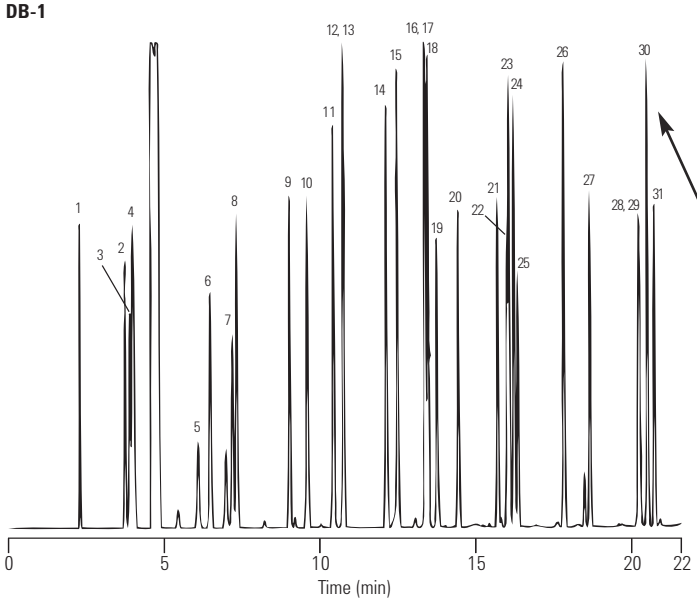
Septum: 11 mm Advanced Green septa, 5183-4759

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

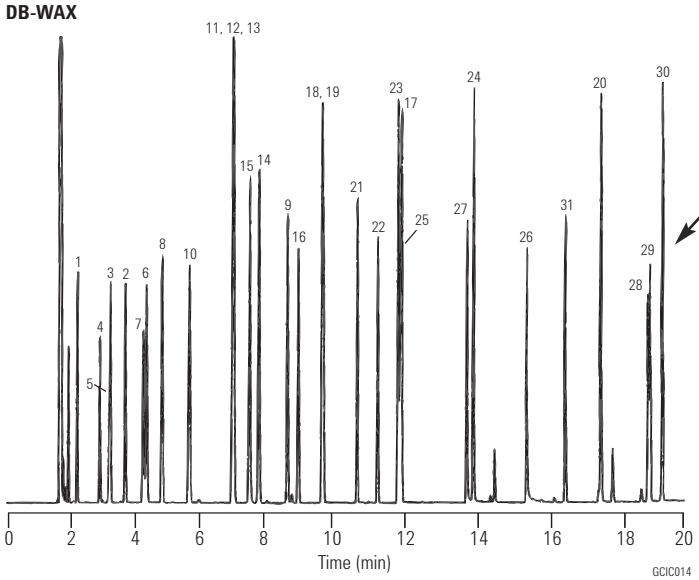
Seal: Gold plated seal, 18740-20885

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

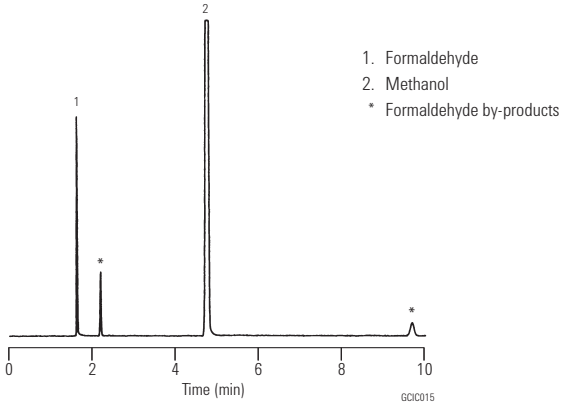
Column: **DB-WAX**
123-7033
30 m x 0.32 mm, 0.50 µm

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



1. Formaldehyde
2. Methanol
* Formaldehyde by-products

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

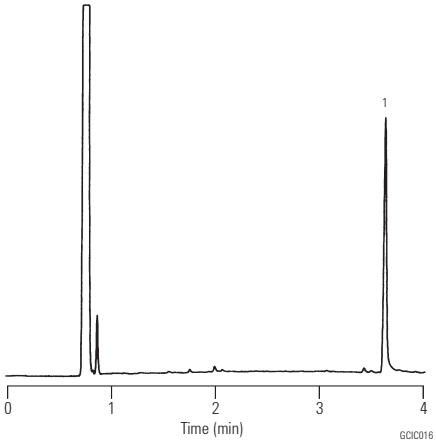
Oven: 150-250 °C at 20 °C/min

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



1. Formaldehyde-DNPH

PFBHA Derivative

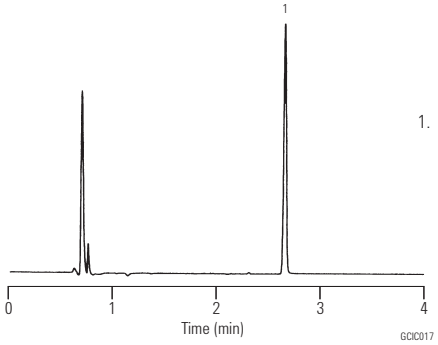
Column: **DB-1**
123-1012
15 m x 0.32 mm, 0.25 µm

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



1. Formaldehyde-PFBHA

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

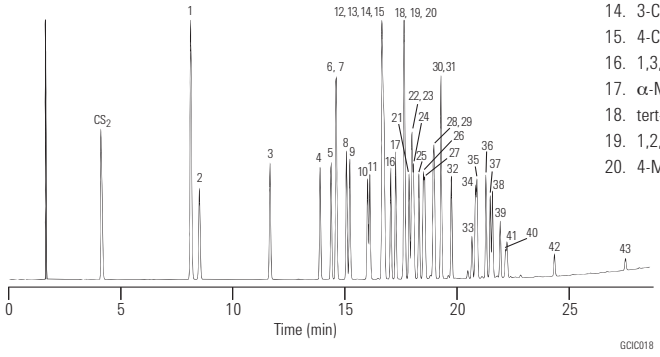
Oven: 40 °C for 5 min
40-260 °C at 10 °C/min

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

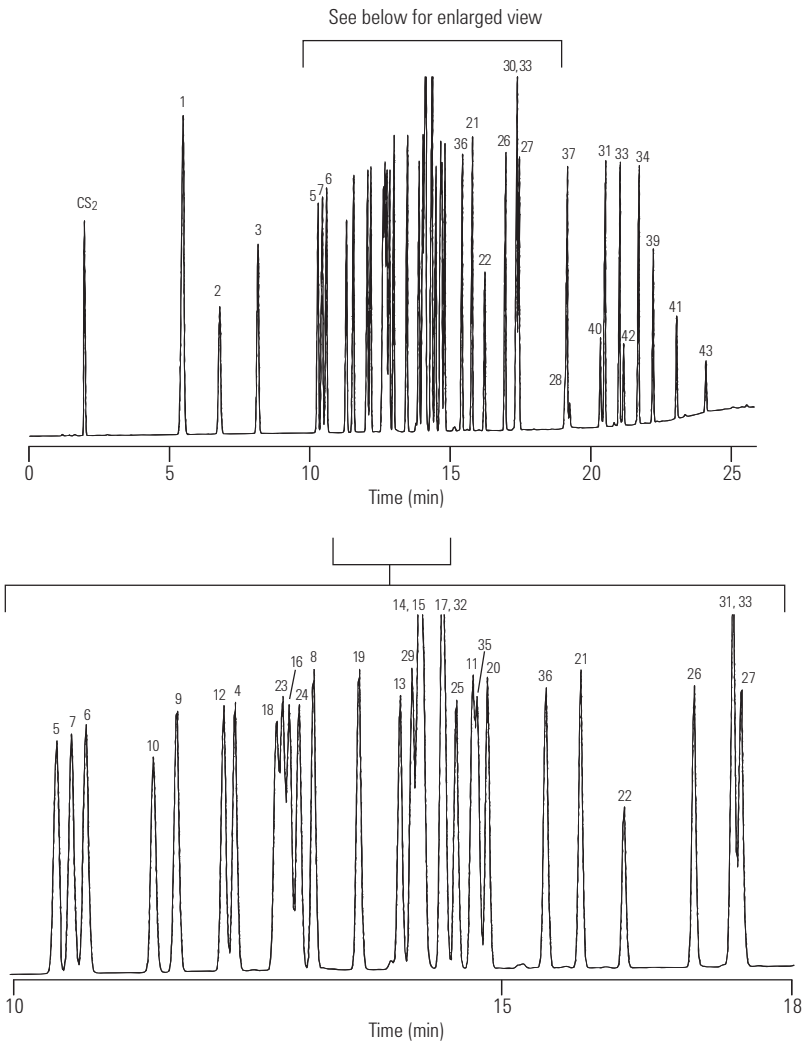
Suggested Supplies

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

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

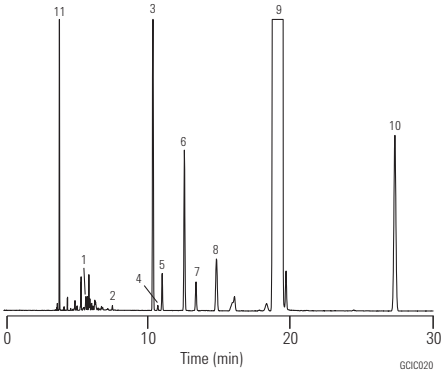
Suggested Supplies

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

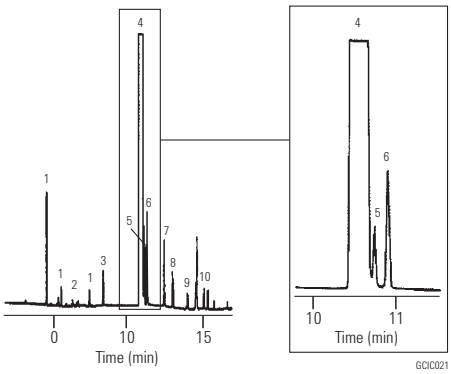
Carrier: Helium, 32 cm/sec, 19.9 psi (60 °C)
2.5 mL/min constant flow

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

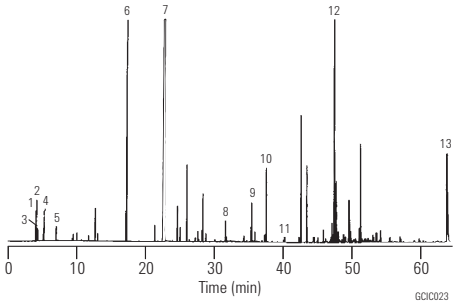
Carrier: Helium, 30 psi, 12 mL/min

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

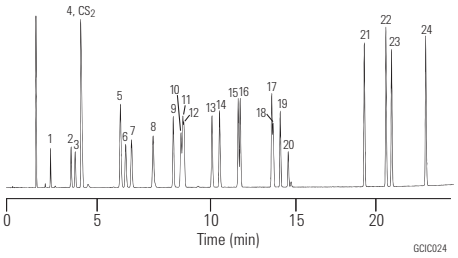
Suggested Supplies

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
2. Ethyl formate
3. Methyl acetate
4. Vinyl acetate
5. Ethyl acetate
6. Propyl formate
7. Methyl propionate
8. Isopropyl acetate
9. Ethyl acrylate
10. tert-Butyl acetate
11. Ethyl propionate
12. Propyl acetate
13. sec-Butyl acetate
14. Isobutyl acetate
15. Propyl propionate
16. Butyl acetate
17. Isoamyl acetate
18. Amyl acetate
19. 2-Ethoxyethyl acetate
20. 2-Methylbutyl acetate
21. Methyl benzoate
22. Benzyl acetate
23. Ethyl benzoate
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

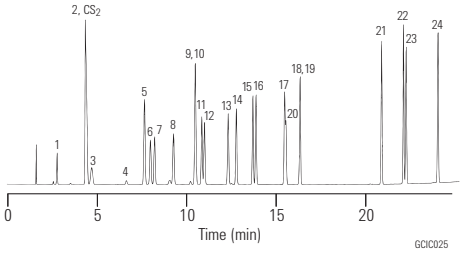
Oven: 40 °C for 5 min
40-260 °C at 10 °C/min
260 °C for 3 min

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
2. Ethyl formate
3. Methyl acetate
4. Vinyl acetate
5. Ethyl acetate
6. Propyl formate
7. Methyl propionate
8. Isopropyl acetate
9. Ethyl acrylate
10. tert-Butyl acetate
11. Ethyl propionate
12. Propyl acetate
13. sec-Butyl acetate
14. Isobutyl acetate
15. Propyl propionate
16. Butyl acetate
17. Isoamyl acetate
18. Amyl acetate
19. 2-Ethoxyethyl acetate
20. 2-Methylbutyl acetate
21. Methyl benzoate
22. Benzyl acetate
23. Ethyl benzoate
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

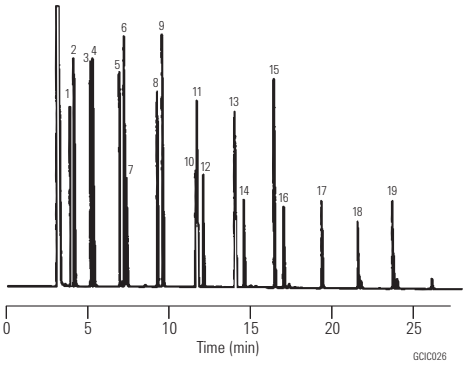
Injection: Split, 250 °C
Split ratio 25:1

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
2. Propyl acetate
3. Ethyl butyrate
4. Propyl propionate
5. Propyl butyrate
6. Ethyl valerate
7. Butyl propionate
8. Propyl valerate
9. Ethyl caproate
10. Butyl valerate
11. Propyl caproate
12. Methyl decanoate
13. Butyl caproate
14. Methyl dodecanoate
15. Butyl heptanoate
16. Methyl tetradecanoate
17. Methyl hexadecanoate
18. Methyl octadecanoate
19. Methyl eicosenoate

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

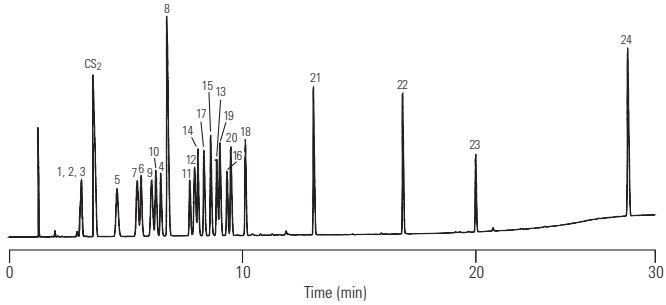
Oven: 40 °C for 5 min
40-260 °C at 10 °C/min
260 °C for 3 min

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
2. Ethyl vinyl ether
3. Ethyl ether
4. 1,3-Dioxalane
5. Methyl-tert-butyl ether (MTBE)
6. Allyl ethyl ether
7. Isopropyl ether
8. Tetrahydrofuran (THF)
9. tert-Amyl methyl ether
10. Butyl methyl ether
11. Glyme (propylene glycol dimethyl ether)
12. tert-Amyl methyl ether
13. Diglyme (diethylene glycol dimethyl ether)
14. Propyl ether
15. Allyl ether
16. 1,4-Dioxane
17. Butyl ethyl ether
18. Epichlorohydrin
19. Tetrahydropyran
20. Acetal (acetaldehyde diethyl acetal)
21. Butyl ether
22. Pentyl ether
23. Triglyme (triethylene glycol dimethyl 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

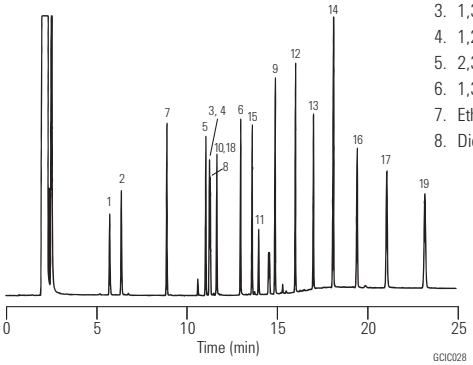
Injection: Megabore Direct, 250 °C

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
2. Ethylene glycol monoethyl ether
3. 1,3-Propanediol
4. 1,2-Propanediol (propylene glycol)
5. 2,3-Butanediol
6. 1,3-Butanediol
7. Ethylene glycol monobutyl ether
8. Diethylene glycol monomethyl ether
9. 1,4-Butanediol
10. Diethylene glycol monoethyl ether
11. Dipropylene glycol
12. 1,5-Pentanediol
13. 1,6-Hexanediol
14. 1,7-Heptanediol
15. Diethylene glycol monobutyl 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

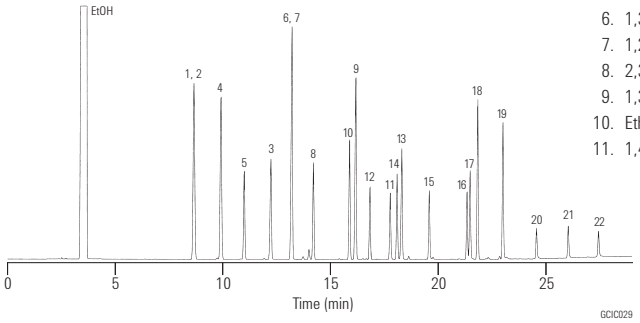
Oven: 40 °C for 5 min
40-260 °C at 10 °C/min
260 °C for 3 min

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
2. Glyme
3. Ethylene glycol
4. Diglyme
5. Ethylene glycol monoethyl ether
6. 1,3-Propanediol
7. 1,2-Propanediol (propylene glycol)
8. 2,3-Butanediol
9. 1,3-Butanediol
10. Ethylene glycol monobutyl ether
11. 1,4-Butanediol
12. Diethylene glycol monomethyl ether
13. Diethylene glycol
14. Diethylene glycol monoethyl ether
15. 1,5-Pentanediol
16. 1,6-Hexanediol
17. Diethylene glycol monobutyl ether
18. Triglyme
19. 1,7-Heptanediol
20. 1,8-Octanediol
21. 1,9-Nonanediol
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

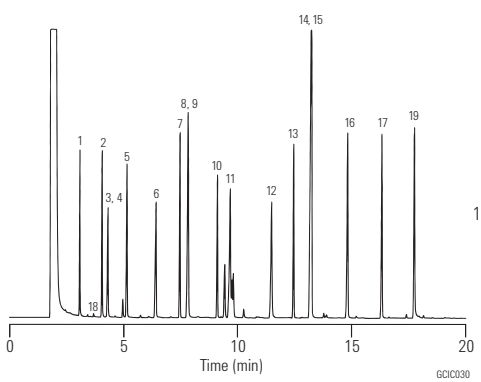
Injection: Split, 250 °C

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
2. Ethylene glycol monoethyl ether
3. 1,3-Propanediol
4. 1,2-Propanediol
5. 2,3-Butanediol
6. 1,3-Butanediol
7. Ethylene glycol monobutyl ether
8. Diethylene glycol monomethyl ether
9. 1,4-Butanediol
10. Diethylene glycol monoethyl ether
11. Dipropylene glycol
12. 1,5-Pentanediol
13. 1,6-Hexanediol
14. 1,7-Heptanediol
15. Diethylene glycol monobutyl ether
16. 1,8-Octanediol
17. 1,9-Nonanediol
18. Ethylene glycol
19. 1,10-Decanediol

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

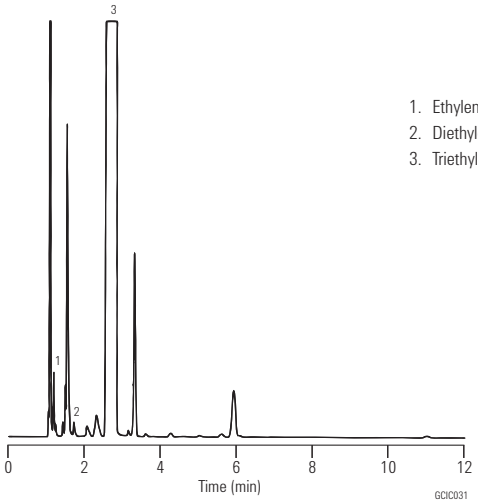
Suggested Supplies

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



1. Ethylene glycol
2. Diethylene glycol
3. Triethylene glycol

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

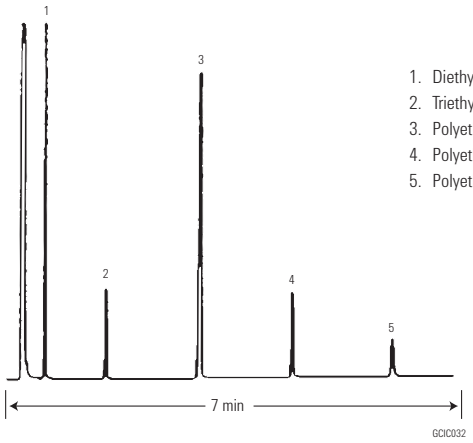
Suggested Supplies

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



1. Diethylene glycol
2. Triethylene glycol
3. Polyethylene glycol 200
4. Polyethylene glycol 400
5. Polyethylene glycol 600

Glycols/Diols

Column: **HP-1**
19095Z-023
30 m x 0.53 mm, 0.88 µm

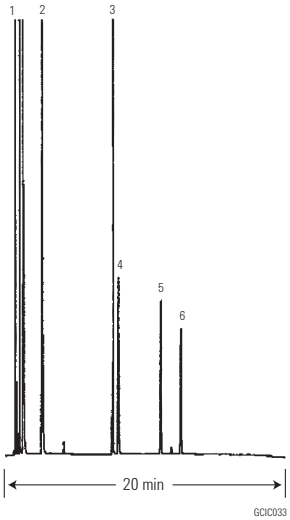
Carrier: Helium

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

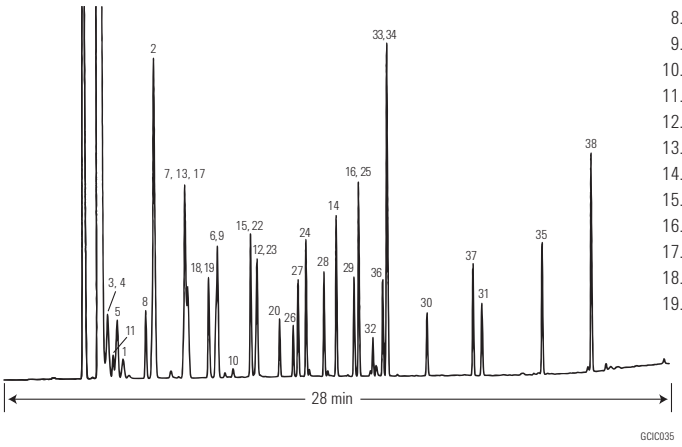
Suggested Supplies

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)
2. 1,1-Dichloroethene
3. Bromoethane (ethyl bromide)
4. Iodomethane
5. 3-Chloropropene (allyl chloride)
6. 1-Chlorobutane
7. 2,2-Dichloropropane
8. trans-1,2-Dichloroethene
9. 1,1,1-Trichloroethane
10. Carbon tetrachloride
11. Methylene chloride
12. Trichloroethene
13. Chloroform
14. Tetrachloroethene
15. 1,2-Dichloropropane
16. 1-Chlorohexane
17. Bromochloromethane
18. 1,1-Dichloroethane
19. 1,2-Dichloroethane
20. Iodoform
21. cis-1,3-Dichloropropene
22. Dibromomethane
23. Bromodichloromethane
24. 1,3-Dichloropropane
25. 1,1-Dichloropropane
26. trans-1,3-Dichloropropene
27. 1,1,2-Trichloroethane
28. 1,2-Dibromoethane (EDB)
29. 1,1,1,2-Tetrachloroethane
30. Pentachloroethane
31. Hexachloroethane
32. Bromoform
33. trans-1,4-Dichloro-2-butene
34. 1,2,3-Trichloropropane
35. Hexachlorobutadiene
36. 1,1,2,2-Tetrachloroethane
37. 1,2-Dibromo-3-chloropropane (DBCP)
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

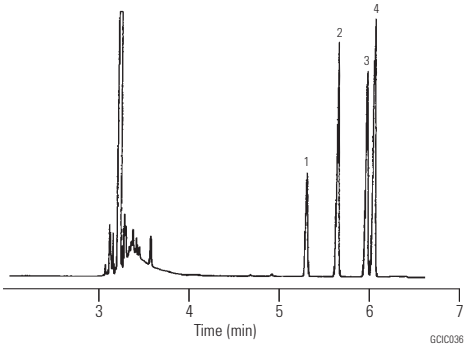
Suggested Supplies

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

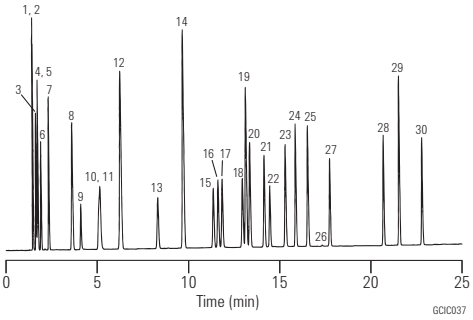
Suggested Supplies

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
2. Hexane
3. Isooctane
4. Methyl-tert-butyl ether (MTBE)
5. Heptane
6. Cyclohexane
7. Octane
8. Nonane
9. Methanol
10. Ethanol
11. Benzene
12. Decane
13. Toluene
14. Undecane
15. Ethylbenzene
16. p-Xylene
17. m-Xylene
18. Cumene
19. Dodecane
20. o-Xylene
21. Propylbenzene
22. Chlorobenzene
23. Mesitylene
24. Styrene
25. 1,2,4-Trimethylbenzene
26. Naphthalene
27. 4-Chlorotoluene
28. 1,3-Dichlorobenzene
29. 1,4-Dichlorobenzene
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

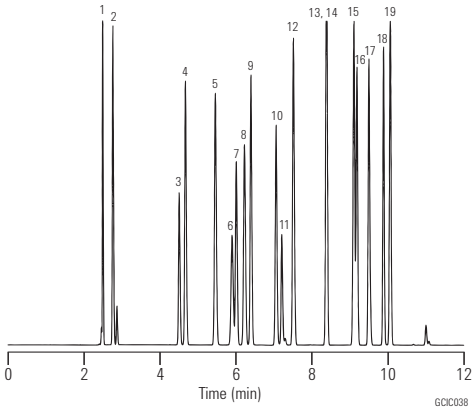
Suggested Supplies

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

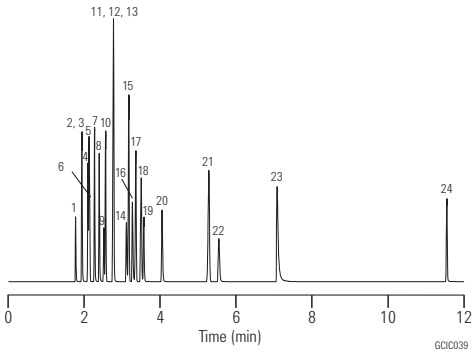
Suggested Supplies

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
2. Ethanol
3. Ethyl ether
4. Isopropanol
5. n-Hexane
6. Methylene chloride
7. tert-Butanol
8. n-Propanol
9. Chloroform
10. Cyclohexane
11. sec-Butanol
12. n-Heptane
13. Acetone
14. Acetonitrile
15. Benzene
16. Tetrahydrofuran (THF)
17. Trichloroethylene
18. n-Butanol
19. Ethyl acetate
20. Methyl ethyl ketone (MEK)
21. Toluene
22. 1,4-Dioxane
23. Pyridine
24. Dimethylformamide (DMF)

Solvents IV

Column: **HP-1**
19091Z-205
50 m x 0.20 mm, 0.50 µm

Carrier: Helium, 30 psi

Oven: 70-200 °C at 5 °C/min
200 °C for 2 min

Injection: Split

Detector: TCD

Sample: 1 µL

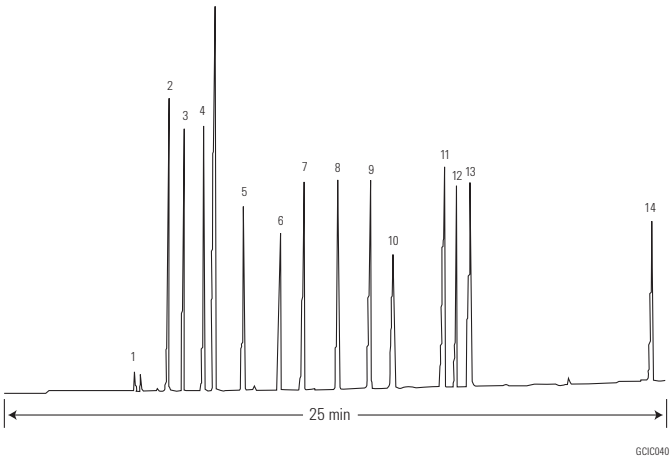
Suggested Supplies

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. 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 µm

Carrier: Helium, 35 kPa

Oven: 30-140 °C at 10 °C/min

Injection: Split ratio 200:1

Detector: IRD, 200 °C

Sample: 1 µL

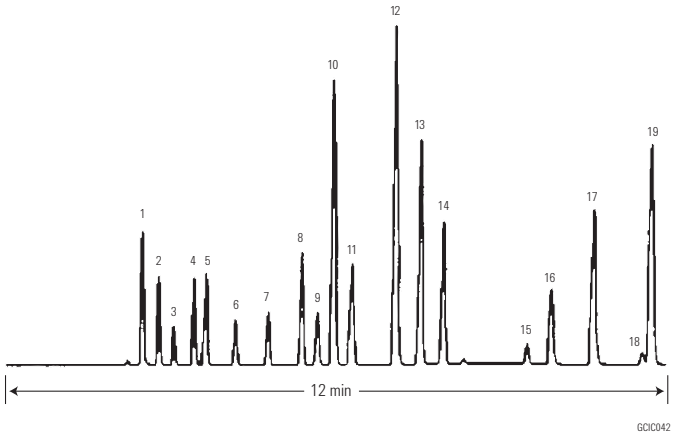
Suggested Supplies

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. 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

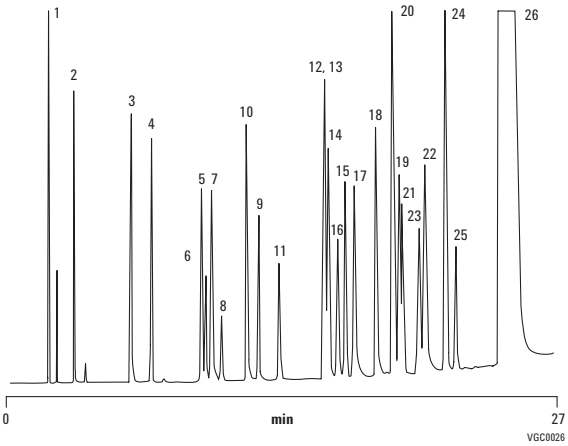
Solvent: DMSO

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. Tetrahydofuran
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

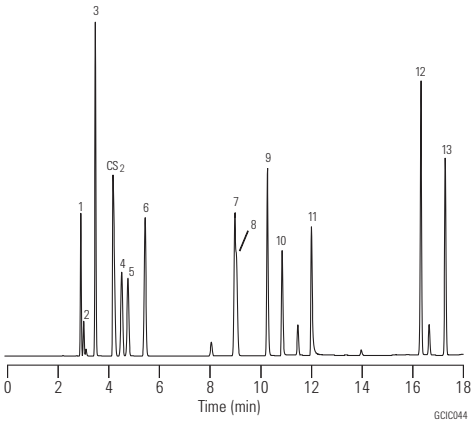
Suggested Supplies

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

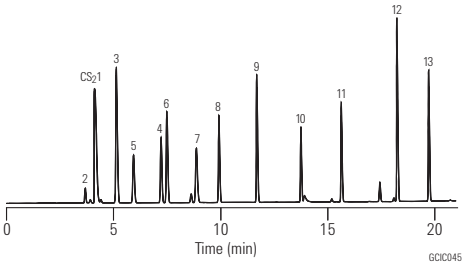
Oven: 40 °C for 5 min
40-260 °C at 10 °C/min
260 °C for 3 min

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

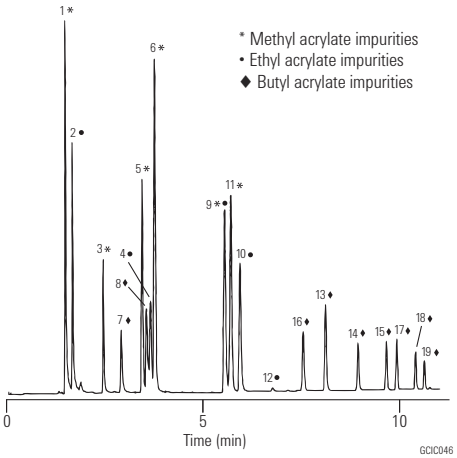
Oven: 35 °C for 5 min,
35-200 °C at 10 °C/min

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

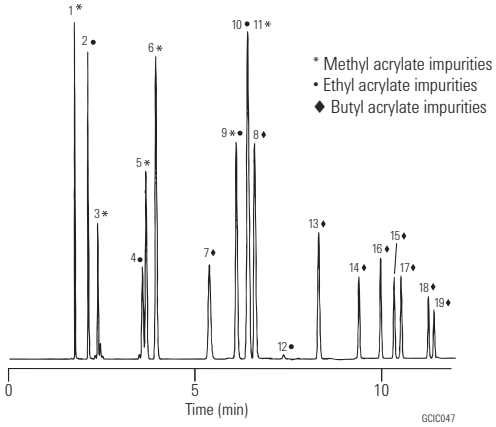
Suggested Supplies

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

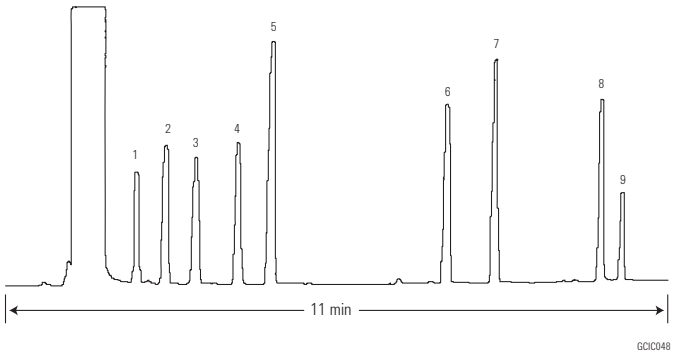
Carrier: Hydrogen

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

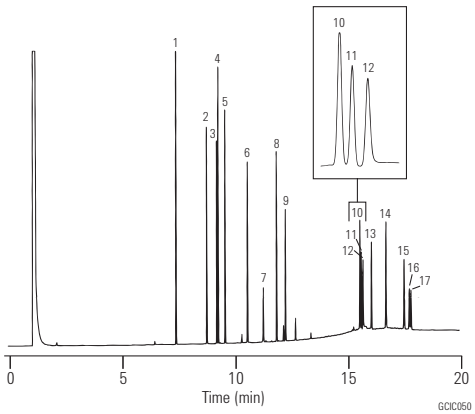
Suggested Supplies

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

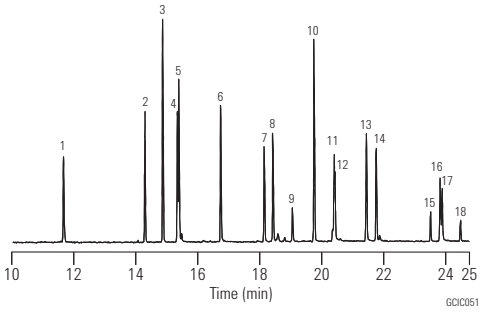
Suggested Supplies

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 µm

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 µL of 50 ng/µL standard in toluene/p-xylene

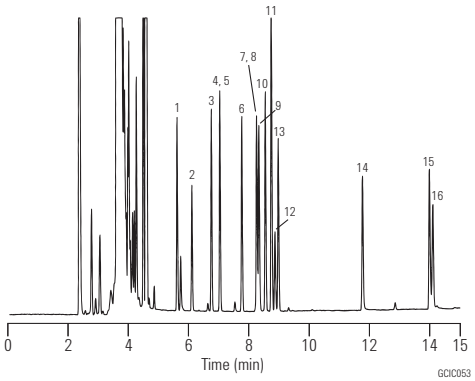
Suggested Supplies

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 µL 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 µm

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

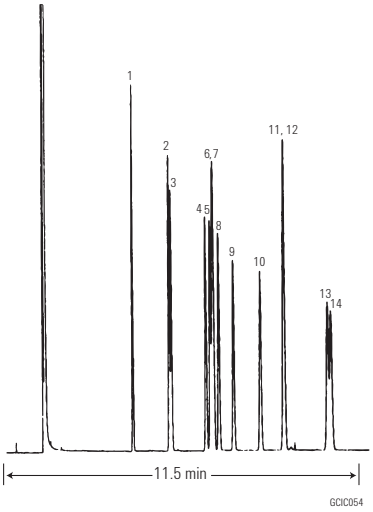
Suggested Supplies

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 µL 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

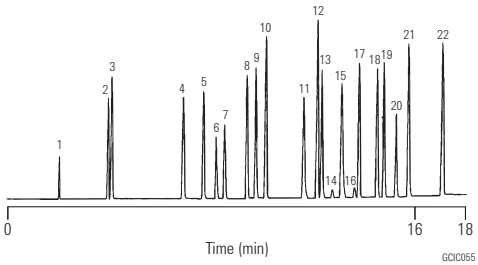
Sample: 1 µL

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
2. $CHClF_2$ (Freon 22)
3. CCl_2F_2 (Freon 12)
4. $ClCF_2\ CF_2\ Cl$ (Freon 114)
5. $CHCl_2\ F$ (Freon 21)
6. CCl_3F (Freon 11)
7. CF_2Br_2 (Freon 12B2)
8. CH_3I
9. CH_2Cl_2
10. trans-ClCH=CHCl
11. CF_3CCl_3 (Freon 113)
12. cis-ClCH=CHCl
13. $CHCl_3$
14. ? from CCl_4
15. CCl_4
16. ? from CCl_4
17. CH_3CH_2I
18. CH_2Br_2
19. $CHCl_2Br$
20. C_4F_9I
21. $CHClBr_2$
22. $CH_3CH_2CH_2I$

Ethylene Oxide

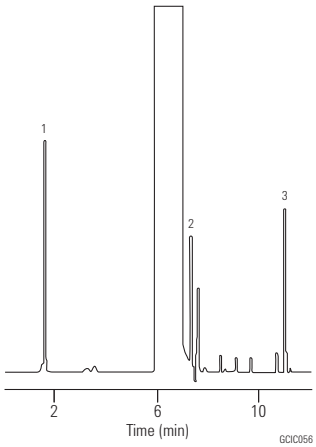
Column: **DB-WAX**
122-7032
30 m x 0.25 mm, 0.25 µm

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

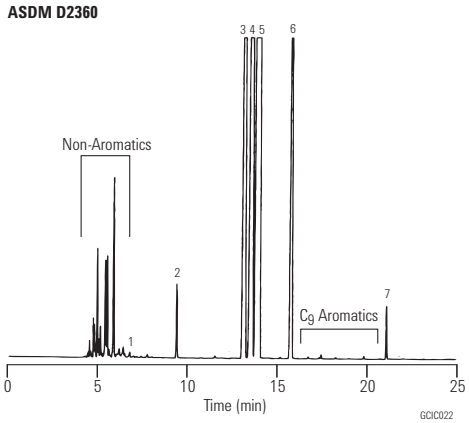
Column: **DB-WAXetr**
123-7362
60 m x 0.32 mm, 0.25 µm

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



1. Benzene
2. Toluene
3. Ethylbenzene
4. p-Xylene
5. m-Xylene
6. o-Xylene
7. n-Butylbenzene (IS)

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

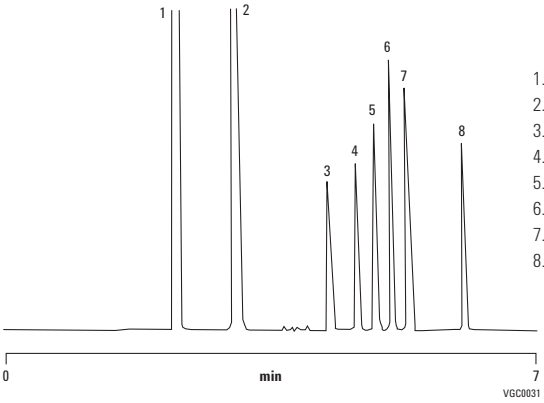
Sample Conc: 10-20%

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



1. Benzene
2. Toluene
3. Para xylene
4. Meta xylene
5. Ethyl benzene
6. Ortho xylene
7. Styrene
8. Cumene

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

1. Nitrogen
2. Halothane
3. Diethyl ether
4. Acetone

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 µm

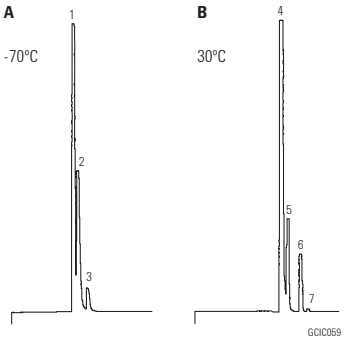
Carrier: Helium, 35 cm/sec

Oven: A: -70 °C isothermal
B: 30 °C isothermal

Injection: Split ratio 25:1

Detector: FPD, 535 µm filter

Sample: 1 µL



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. Dihydropentaborane 0.60 ppm

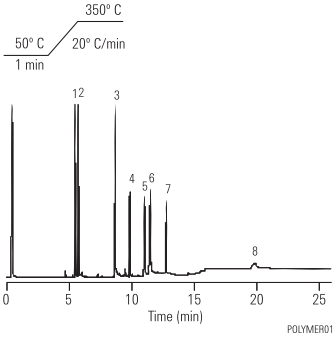
Polymer Additives

Column: **HP-35 (use only 10 meters)**
19091G-013
30 m x 0.32 mm, 0.15 µm

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 µL 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

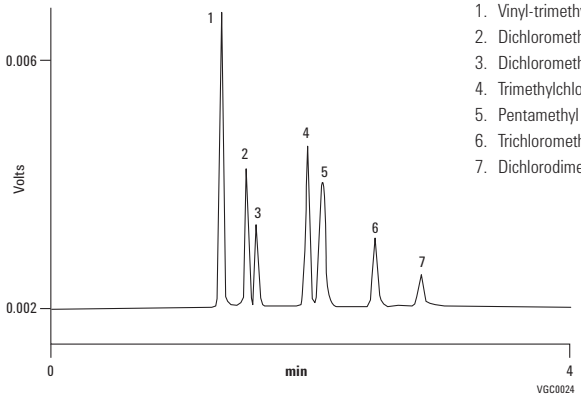
Column: **VF-200ms**
CP8860
30 m x 0.25 mm, 1.00 µm

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 µm

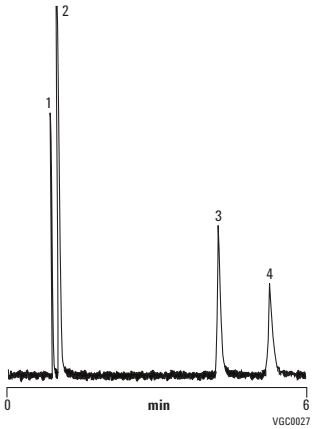
Sample: ±100 ppm

Carrier: H_2

Oven: 50 °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 Al2O3**
CP7432
50 m x 0.53 mm,

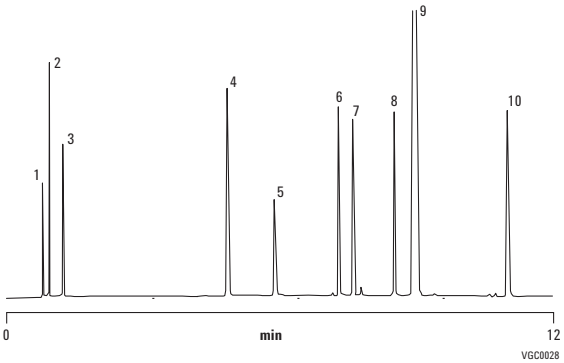
Sample Conc: Approx 100 ppm in nitrogen, synthetic standard

Carrier: Helium, 4 psig, 4 min to 11 psig, 0.5 psig/min, 2 min

Oven: 40 °C, 5 min to 160 °C, 10 °C/min to 200 °C, 20 °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 acelytene

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 um

Carrier: Helium 44 cm/s (approx. 6 mL/min) set at 40 °C, EPC-Constant Flow

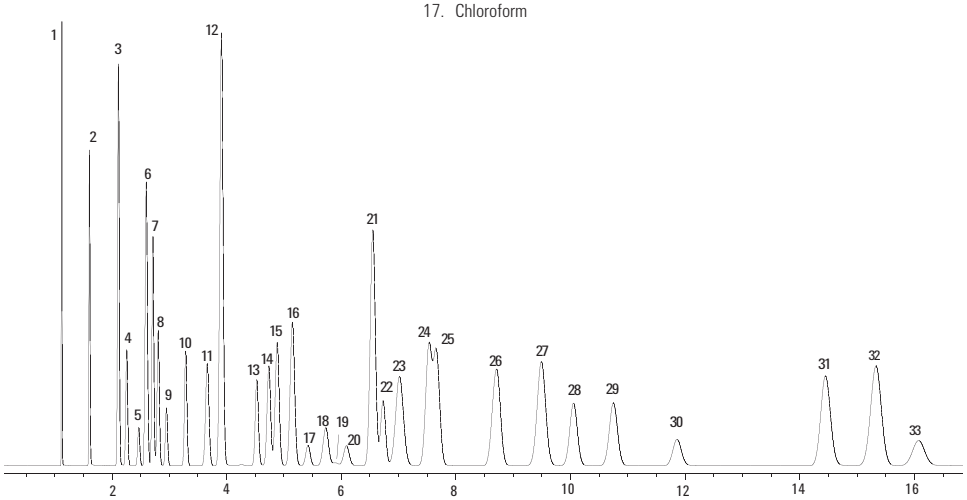
Oven: 40 °C 20 min hold, then 10°/min to170 °C

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
2. Methanol
3. Ethanol
4. Diethyl ether
5. 1,1-Dichloroethylene
6. 2-Propanol
7. Acetonitrile
8. Methyl acetate
9. Dichloromethane
10. trans-1,2-Dichloroethylene
11. n-Hexane
12. 1-Propanol
13. Nitromethane
14. cis-1,2-Dichloroethylene
15. Ethyl acetate
16. 2-Butanol
17. Chloroform
18. 1,1,1-Trichloroethane
19. Cyclohexane
20. Carbon tetrachloride
21. Benzene
22. 1,2-Dichloroethane
23. Isooctane (2,2,4-Trimethylpentane)
24. 3-Methyl-2-butanone
25. n-Heptane
26. Trichloroethylene
27. Methycyclohexane
28. 1,4-Dioxane
29. Propy acetate
30. 2-Ethoxyethanol
31. Pyridine excellent peak shape
32. Toluene
33. 3-Methy-1-butanol



Benzodiazepines I

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

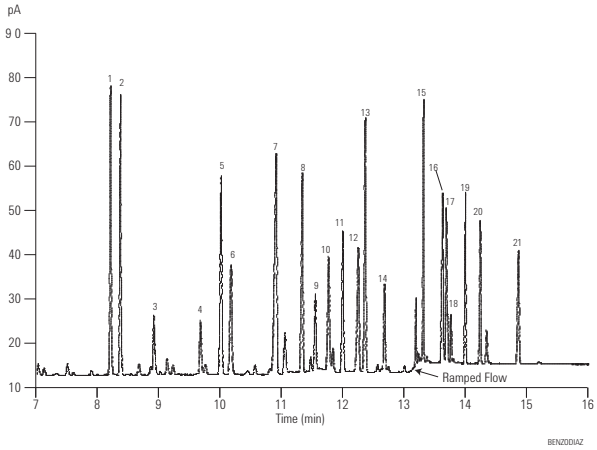
Carrier: Hydrogen, 53 cm/sec, constant flow
1.6 for 11 min
1.6 to 2.4 at 60 mL/min hold 2 min
2.4 to 5.0 at 50 mL/min hold 9 min

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. Oxazopam
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

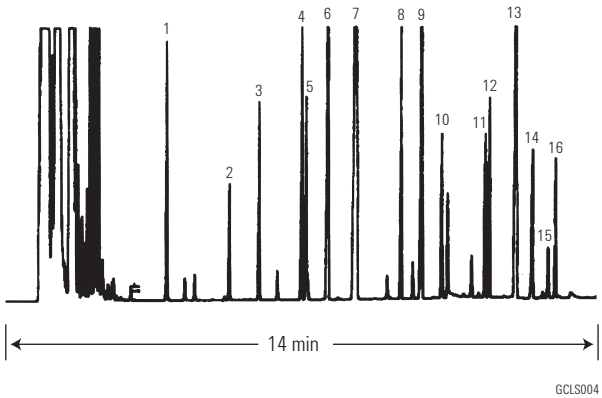
Oven: 100-240 °C at 10 °/min

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
2. Dimethylamphetamine
3. Amphetamine
4. Phentermine
5. Methamphetamine
6. Methyl ephedrine
7. Nicotinamine
8. Ephedrine
9. Phenacetin
10. 3,4-Methylenedioxyamphetamine (MDA)
11. 3,4-Methylenedioxymethylamphetamine
12. 4-Methyl-2,5-dimethoxyamphetamine (STP)
13. Phenyl ephedrine
14. 3,4-Methylenedioxyethylamphetamine (MDE; Eve)
15. Caffeine
16. Benzphetamine



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 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
150-300 °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
2. Allobarbital
3. Aprobarbital
4. Butabarbital
5. Butethal
6. Butalbital
7. Amobarbital
8. Talbutal
9. Pentobarbital
10. Methohexital
11. Secobarbital
12. Hexobarbital
13. Thiopental
14. Cyclopentylbarbital
15. Mephobarbital
16. Thiamylal
17. Phenobarbital
18. Alphenal

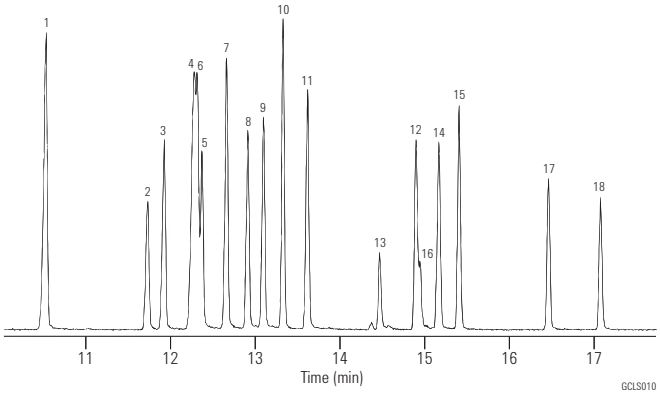
Suggested Supplies

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



Narcotics

Column: **DB-5ms**
122-5532
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
150-325 °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
2. Codeine
3. Dihydrocodeine
4. Norcodeine
5. Ethylmorphine
6. Morphine
7. Normorphine
8. 6-Acetylcodeine
9. 6-Monoacetylmorphine
10. Heroin

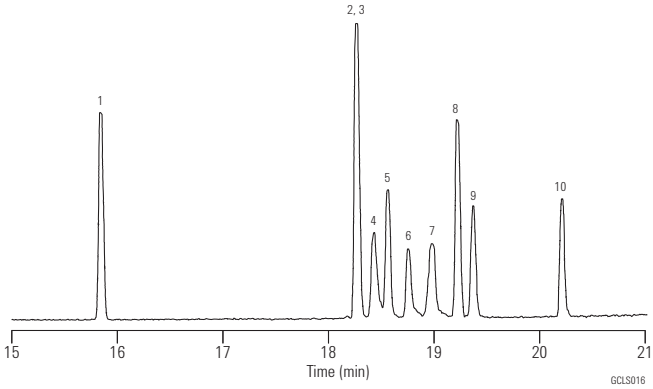
Suggested Supplies

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 µL 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

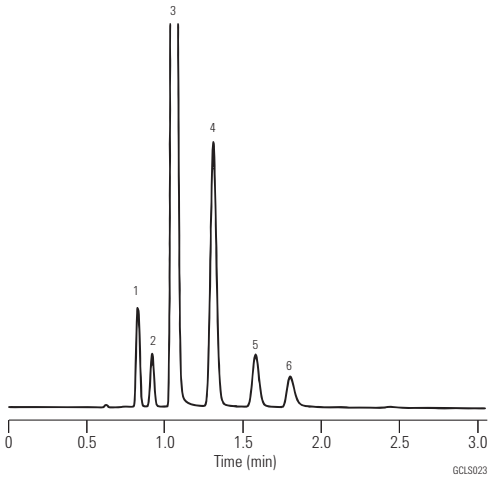
Sampler: Headspace

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

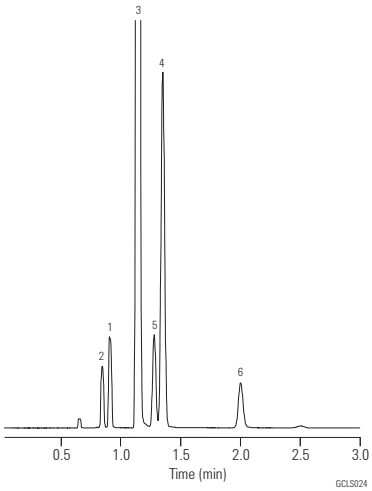
Injection: Split, 250 °C
Split ratio 1:10

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

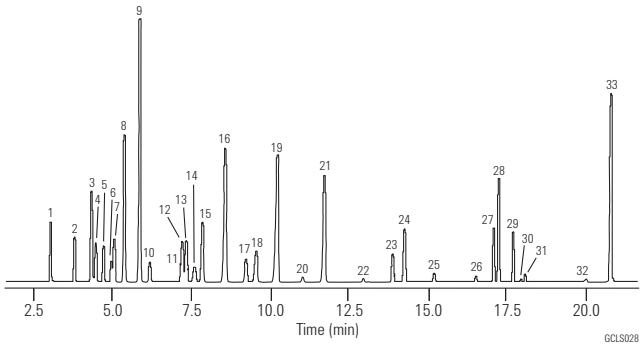
Suggested Supplies

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. Ethanol
3. Acetone
4. 2-Propanol
5. Acetonitrile
6. Methylene chloride
7. 2-Methyl-2-propanol (tert-butanol)
8. MTBE
9. Hexane
10. 1-Propanol
11. DMI impurity
12. 2-Butanone (MEK)
13. Ethyl acetate
14. 2-Butanol
15. Tetrahydrofuran
16. Cyclohexane
17. Isopropyl acetate
18. 1,2-Dimethoxyethane
19. Heptane
20. 1-Methoxy-2-propanol
21. Methylcyclohexane
22. 2-Ethoxyethanol
23. MIBK (2-Pentanone)
24. Toluene
25. 1-Pentanol
26. n,n-Dimethylformamide (DMF)
27. Ethyl benzene
28. m,p-Xylene
29. o-Xylene
30. Dimethyl sulfoxide (DMSO)
31. n,n-Dimethylacetamide
32. n-Methylpyrrolidone
33. 1,3-Dimethyl-2-imidazolidinone (DMI)



Special thanks to Julie Kancler, Brian Wallace, Teledyne.

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)

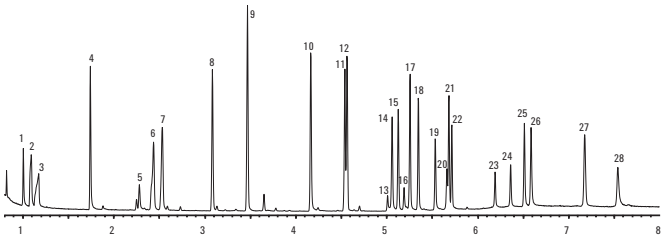
Backflush: Post run: 1 min 1 psi inlet, 75 psi aux EPC

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 H_2 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
2. Phentermine
3. Methamphetamine
4. Nicotine
5. Methylenedioxyamphetamine (MDA)
6. Methylenedioxymethamphetamine (MDMA)
7. Methylenedioxyethylamphetamine
8. Meperidine
9. Phencyclidine
10. Methadone
11. Cocaine
12. SKF-525a (RTL Compound)
13. Oxazepam
14. Tetrahydrocannabinol
15. Codeine
16. Lorazepam
17. Diazepam
18. Hydrocodone
19. Oxycodone
20. Temazepam
21. Diacetylmorphine
22. Flunitrazepam
23. Nitrazepam
24. Clonazepam
25. Alprazolam
26. Verapamil
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

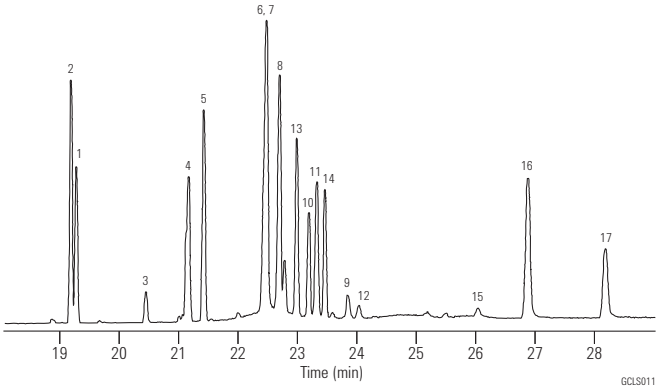
Carrier: Helium at 31 cm/sec, measured at 50 °C

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
2. Halazepam
3. Oxazepam
4. Lorazepam
5. Diazepam
6. Demoxepam
7. Desmethyldiazepam
8. Clobazam
9. Temazepam
10. Flunitrazepam
11. Delorazepam
12. Bromazepam
13. Prazepam
14. Flurazepam
15. Clonazepam
16. Alprazolam
17. Triazolam



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

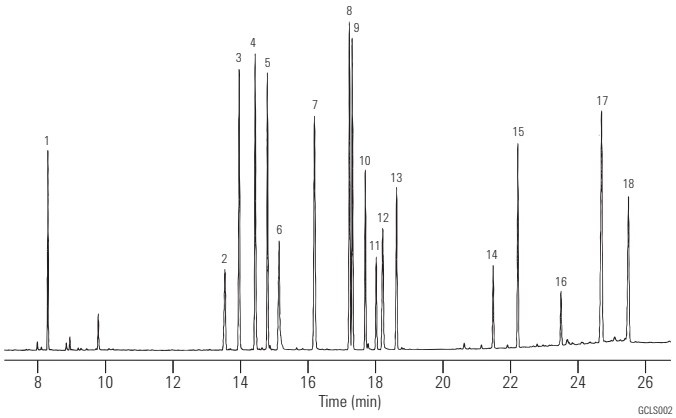
Oven: 50 °C for 1.0 min
50-125 °C at 25 °C/min
125-325 °C at 10 °C/min
325 °C for 5 min

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
2. Caffeine
3. Glutethimide
4. Lidocaine
5. PCP
6. Phenobarbital
7. Methadone primary metabolite
8. Methaqualone
9. Methadone
10. Cocaine
11. Desipramine
12. Carbazepine
13. Trimipramine
14. Heroin
15. Fentanyl
16. Ibogaine
17. Triazolam
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

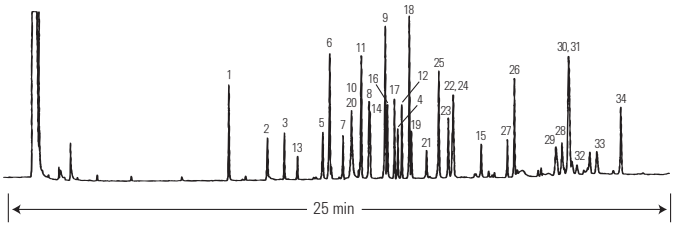
Oven: 80 °C for 1 min
80-280 °C at 10 °C/min
280 °C for 9 min

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

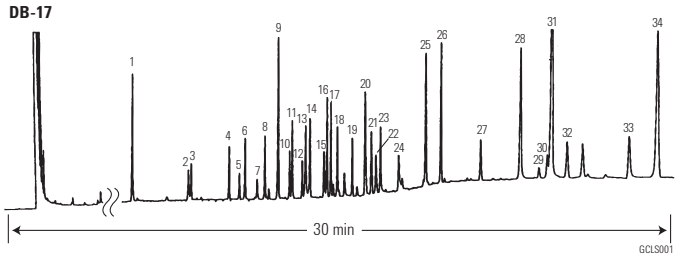
Detector: FID, 300 °C

	DB-17 Time	DB-5 Time
1. Nicotine	9.87	8.57
2. Phenmetrazine	11.8	9.95
3. Ibuprofen	12.06	10.64
4. Procaine	13.48	14.82
5. Allobarbital	13.91	12.02
6. Aprobarbital	14.14	12.27
7. Butabarbital	14.56	12.76
8. Secobarbital	14.87	14.31
9. Pentobarbital	15.41	13.73
10. Phenacetin	15.72	12.94
11. Amobarbital	15.87	13.43
12. Benzphetamine	16.14	14.96
13. Acetaminophen	16.34	11.12
14. Hydroxyphenamate	16.47	15.31
15. Dimenhydrinate	16.93	13.79
16. Meprobamate	17.12	14.44
17. Benactyzine	17.26	14.71
18. Hexobarbital	17.52	15.22
19. Doxylamine	17.69	15.87
20. Caffeine	18.05	13.11
21. Chlorpheniramine	18.47	16.35
22. Methapyrilene	18.72	16.68
23. Thenyldiamine	18.87	16.85
24. Phenobarbital	19.11	16.29
25. Bromopheniramine	19.71	17.39
26. Chlorcyclizine	20.75	19.13
27. Cocaine	21.32	18.88
28. Pyrrobutamine	22.79	20.89
29. Codeine	24.27	20.66
30. Diazepam	25.27	21.13
31. Morphine	25.36	21.12
32. Hydrocodone	25.98	21.26
33. Oxymorphone	28.27	22.21
34. Heroin	29.32	23.14

DB-5



DB-17



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

Urine Drug Screen

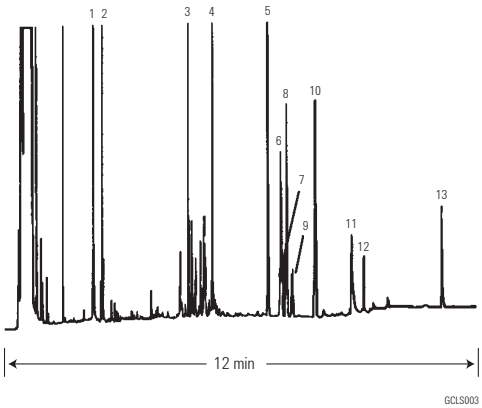
Column: **ULTRA 2**
19091B-115
50 m x 0.32 mm, 0.52 µm

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. Proposyphene
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 µm

Sample: 1 µL

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

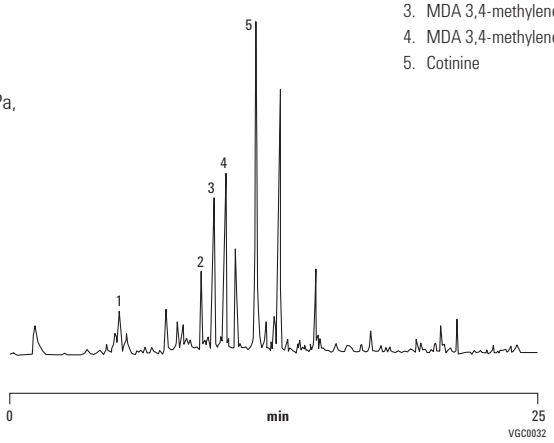
Pressure: 58.7 kPa, 2.2 min to 97 kPa, 58 kPa/min to 132 kPa,
3 kPa/min to 180 kPa, 12 kPa/min

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 µm

Carrier: Helium at 35 cm/sec, measured at 55 °C

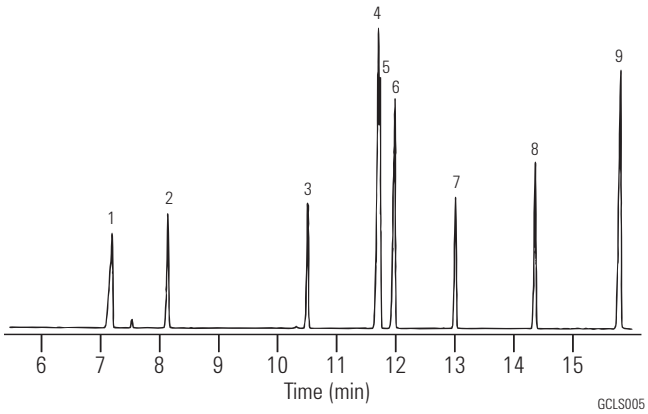
Oven: 55 °C for 1 min
55-130 °C at 25 °C/min
130-325 °C at 15 °C/min

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. Salicylamide
2. Benzocaine
3. Lidocaine
4. Procaine
5. Nefopam
6. Mepivacaine
7. Tetracaine
8. Butacaine
9. Dibucaine



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

Anticonvulsants

Column: **DB-1**
125-1032
30 m x 0.53 mm, 1.50 µm

Carrier: Helium at 8 mL/min

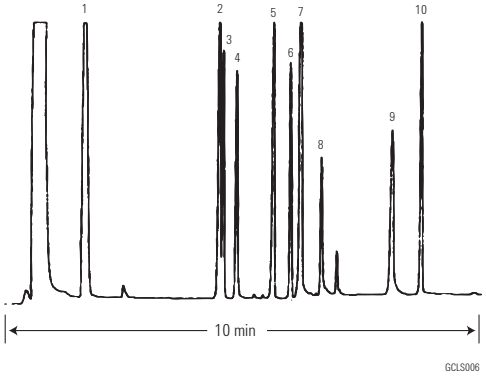
Oven: 160 °C for 2 min
160-275 °C at 15 °C/min

Injection: Megabore Direct, 250 °C

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

Sample: 1 µL of 100 ng/µL in methanol

1. Ethosuximide
2. Methsuximide
3. Phensuximide
4. N-Desmethyl methsuximide
5. Phenylethylmalonamide
6. Phenobarbital
7. Primidone
8. Carbamazepine
9. Phenytoin
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 µL 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
2. Dimenhydrinate
3. Diphenhydramine
4. Doxylamine
5. Phenyltoloxamine
6. Tripelennamine
7. Methapyrilene
8. Chlorpheniramine
9. Cyclizine
10. Carbinoxamine
11. Diphenylpyraline
12. Bromopheniramine
13. Thonzylamine
14. Chlorcyclizine
15. Pyrilamine
16. Triprolidine
17. Promethazine
18. Antazoline
19. Clemizole
20. Hydroxyzine
21. Meclizine
22. Cinnanzine
23. Buclizine

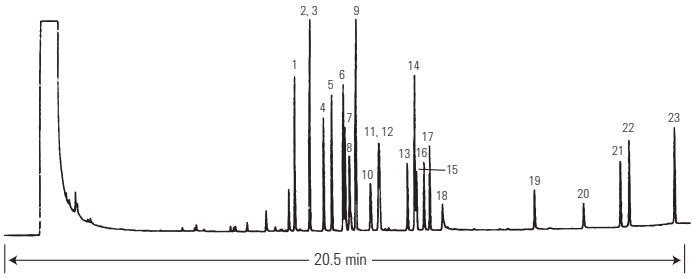
Suggested Supplies

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



GCLS007

Antiepileptic Drugs

Column: **ULTRA 2**
19091B-012
25 m x 0.32 mm, 0.17 µm

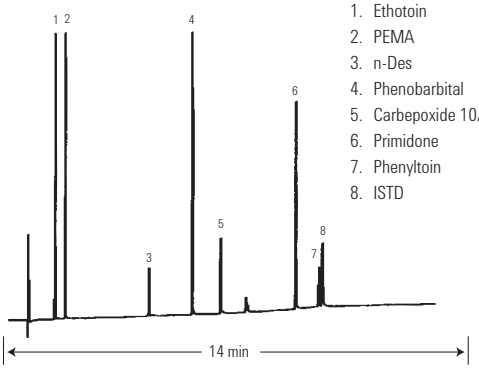
Carrier: Helium, 14 psi

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. Phenyltoin
8. ISTD



GCLS008

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

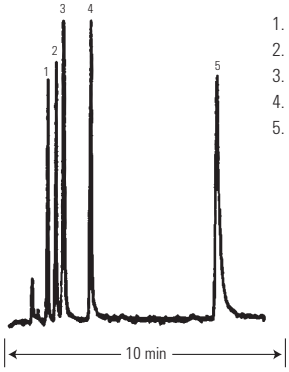
Carrier: Hydrogen, 106 cm/sec

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



GCLS009

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 µm

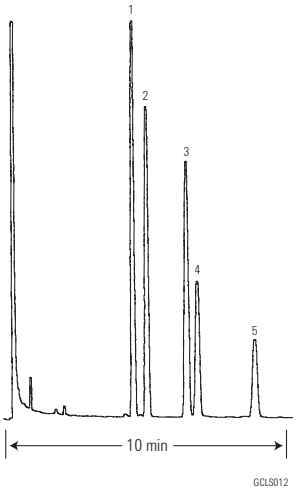
Carrier: Hydrogen at 15 mL/min

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 µL



1. Fentanyl
2. Sufentanyl
3. Carfentanyl
4. Lofentanyl
5. Alfentanyl

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

Tocopherols

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

Carrier: Helium at 40 cm/sec, measured at 150 °C

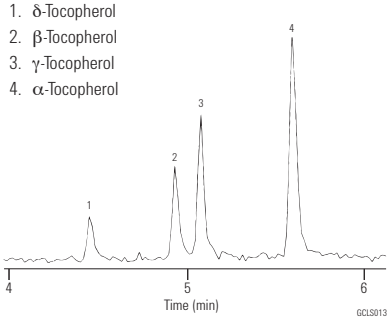
Oven: 300 °C for 1 min
300-320 °C at 25 °C/min
320 °C for 4 min

Injection: Split, 310 °C
Split ratio 1:25

Detector: MSD, 310 °C transfer line
full scan at m/z 45-550

Sample: 1 µL of 1-10 ng/µL in isooctane

1. δ-Tocopherol
2. β-Tocopherol
3. γ-Tocopherol
4. α-Tocopherol



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

Hallucinogens

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

Carrier: Helium at 30 cm/sec, measured at 50 °C

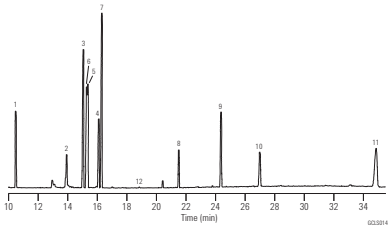
Oven: 50 °C for 0.5 min
50-125 °C at 25 °C/min
125-255 °C at 10 °C/min
255-320 °C at 25 °C/min
320 °C for 16 min

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

Detector: MSD, 300 °C transfer line
full scan at m/z 40-350

Sample: 1 µL of 10-50 ng/µL standard in methanol

1. 4-Methylaminorex
2. Mescaline
3. Dimethyltryptamine
4. Ketimine
5. TCP (Tenocyclidine)
6. Phencyclidine (PCP)
7. Diethyltryptamine
8. Bufotenine
9. Fentanyl
10. Ibogaine
11. LSD
12. Psilocin (peak not shown)



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

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. Pyrithyldione
4. Talbutal
5. Meprobamate
6. Glutethimide
7. Methaqualone
8. Propiomazine
9. Haloperidol
10. Sulpiride
11. Droperidol

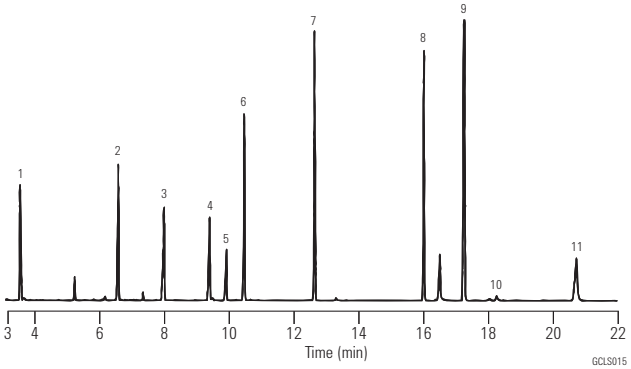
Suggested Supplies

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



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

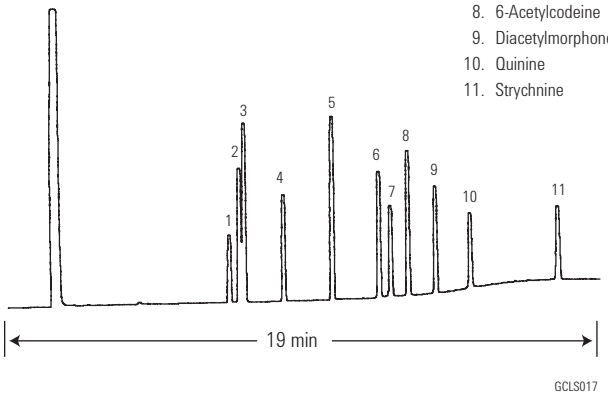
Oven: 140-320 °C at 12 °C/min
320 °C for 4 min

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. Diacetylmorphone (Heroin)
10. Quinine
11. Strychnine



Over-the-Counter Pain Killers – TMS Derivatives

Column: **DB-5**
121-5023
20 m x 0.18 mm, 0.40 µm

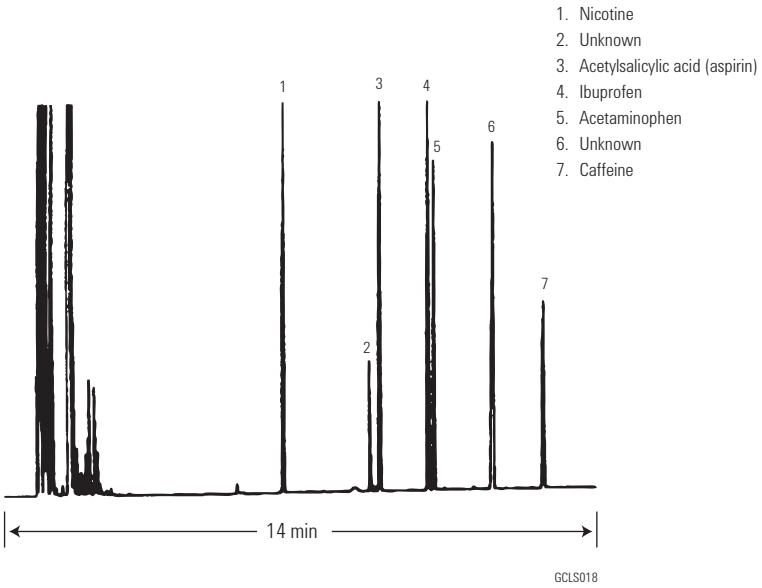
Carrier: Helium at 39 cm/sec, measured at 100 °C

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

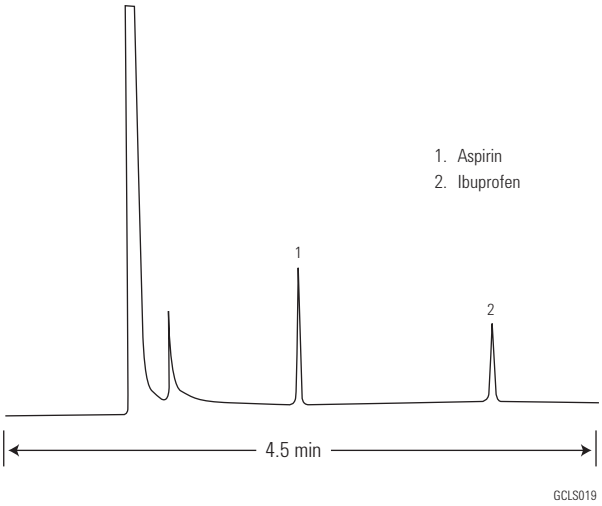
Column: **DB-FFAP**
122-3232
30 m x 0.25 mm, 0.25 µm

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 µm

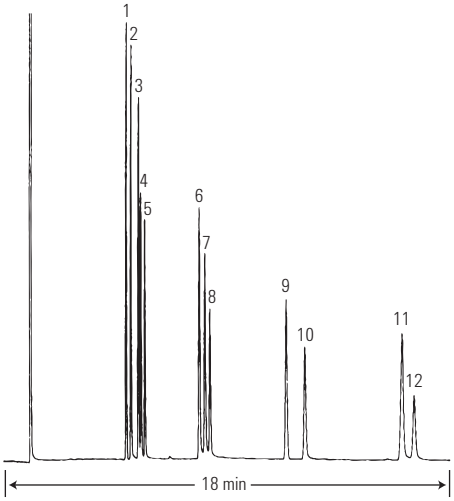
Carrier: Hydrogen at 44 cm/sec

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 µL



1. Coprostane (5-ß-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. Stigmasterol

Anabolic Steroids

Column: **DB-1**
122-1031
30 m x 0.25 mm, 0.10 µm

Carrier: Helium at 40 cm/sec, measured at 180 °C

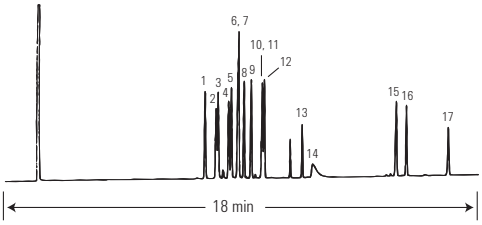
Oven: 180-320 °C at 10 °C/min
320 °C for 4 min

Injection: Split ratio 1:40

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

Sample: 2 µL of 0.125 µg/µL each in methanol

1. Dehydroisoandrosterone (Prasterone)
2. 5α-Androstan-17α-ol-3-one (Stanolone)
3. 19-Nortestosterone (Nandrolone)
4. Mesterolone
5. Testosterone



6. 1-Dehydrotestosterone (Boldenone)
7. 17α-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 (Clostebal)
14. Stanozolol
15. 1-Dehydrotestosterone benzoate
16. 19-Nortestosterone-17-decanoate
17. 1-Dehydrotestosterone undecylenate

Marijuana (Δ9-THC) and Major Metabolites – TMS Derivatives

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

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

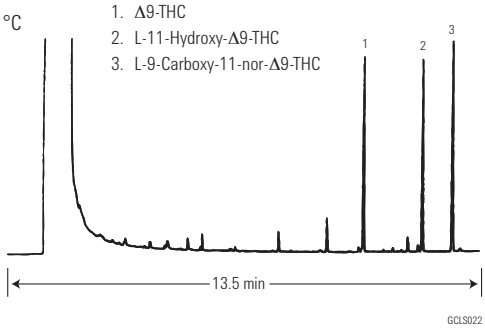
Oven: 100 °C for 1 min
100-175 °C at 30 °C/min
175-295 °C at 12 °C/min

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

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

Sample: 1 µL of 0.1 µg/µL each in pyridine

1. Δ9-THC
2. L-11-Hydroxy-Δ9-THC
3. L-9-Carboxy-11-nor-Δ9-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 µL 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

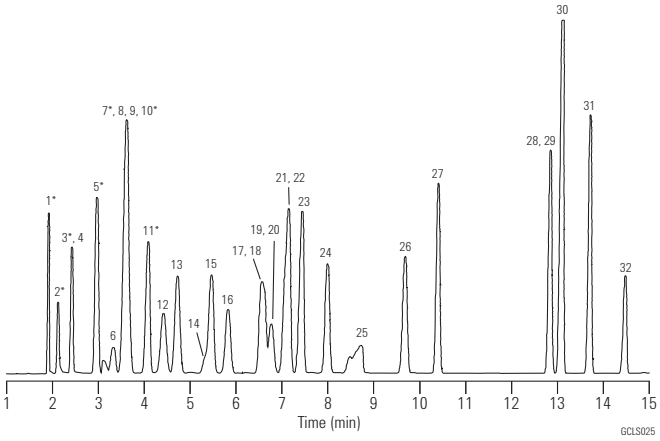
Carrier: Helium, 36 cm/sec, measured at 40 °C

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*
2. Acetaldehyde*
3. Ethanol*
4. Diethyl ether
5. Isopropyl alcohol*
6. Methylene Chloride
7. Acetone*
8. Acetonitrile
9. Ethyl formate
10. t-Butyl alcohol*
11. 1-Propanol
12. MTBE
13. Hexane
14. Chloroform
15. sec-Butyl alcohol
16. 2-Chlorobutane
17. MEK (2-Butanone)
18. Ethyl acetate
19. 1,1-Trichloroethane
20. Carbon tetrachloride
21. 1-Chlorobutane
22. Benzene
23. 1-Butanol
24. Heptane
25. Ethylene glycol
26. soamyl alcohol
27. Toluene
28. Isopropyl amine (not shown)
29. Ethylbenzene
30. m,p-Xylene
31. o-Xylene
32. DMSO



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

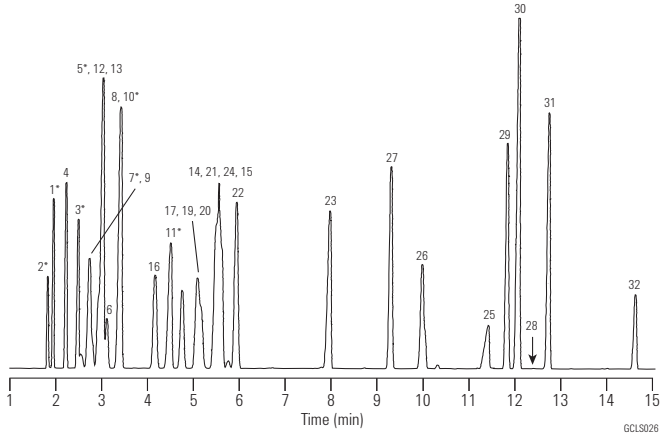
Carrier: Helium, 36 cm/sec, measured at 40 °C

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*
2. Acetaldehyde*
3. Ethanol*
4. Diethyl ether
5. Isopropyl alcohol*
6. Methylene Chloride
7. Acetone*
8. Acetonitrile
9. Ethyl formate
10. t-Butyl alcohol*
11. 1-Propanol
12. MTBE
13. Hexane
14. Chloroform
15. sec-Butyl alcohol
16. 2-Chlorobutane
17. MEK (2-Butanone)
18. Ethyl acetate
19. 1,1-Trichloroethane
20. Carbon tetrachloride
21. 1-Chlorobutane
22. Benzene
23. 1-Butanol
24. Heptane
25. Ethylene glycol
26. soamyl alcohol
27. Toluene
28. Isopropyl amine (not shown)
29. Ethylbenzene
30. m,p-Xylene
31. o-Xylene
32. DMSO



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

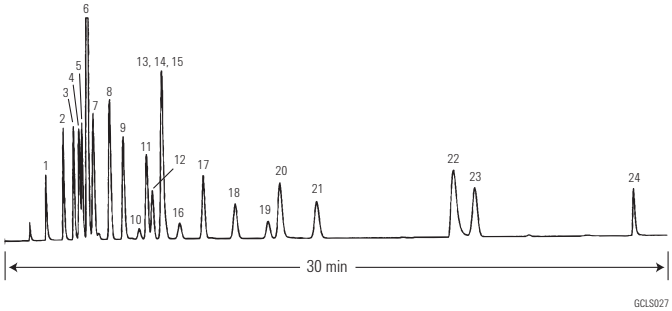
Carrier: Helium at 35 cm/sec, measured at 40 °C

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
2. Ethanol
3. Ethyl ether
4. Acetone
5. Isopropanol
6. Acetonitrile
7. Methylene chloride
8. tert-Butanol
9. n-Hexane
10. n-Propanol
11. Methyl ethyl ketone (MEK)
12. Ethyl acetate
13. Tetrahydrofuran (THF)
14. Chloroform
15. sec-Butanol
16. Cyclohexane
17. Benzene
18. n-Heptane
19. Trichloroethylene
20. n-Butanol
21. 1,4-Dioxane
22. Pyridine
23. Toluene
24. Dimethylformamide (DMF)



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.

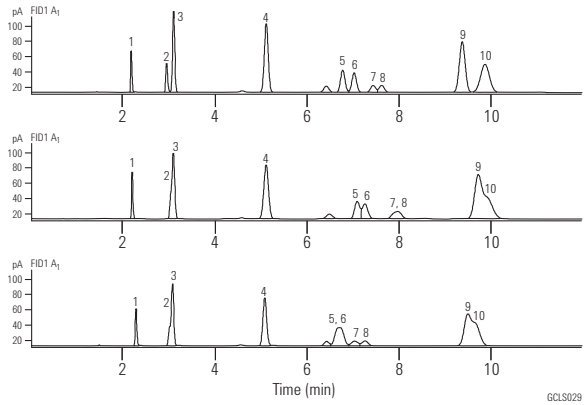
Oven: 40 °C Isothermal

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

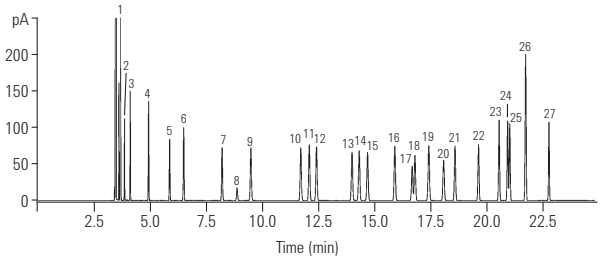
Oven: 70 °C (3 min); 45 °C/min to 145 °C (1 min)

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



Column: **HP-INNOWax**
19091N-216
60 m x 0.32 mm, 0.50 µm

Carrier: Helium at 20 psi constant pressure mode

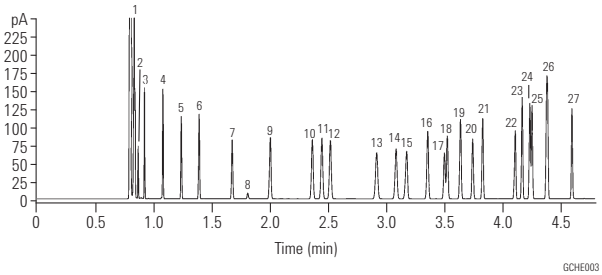
Oven: 75 °C (10 min); 3 °C/min to 100 °C (0 min)
10 °C/min to 145 °C (0 min)

Injection: Split/splitless at 250 °C
100:1 split ratio

Detector: FID at 250 °C

Sample: 1.0 µL

Optimized unified aromatic solvent method



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

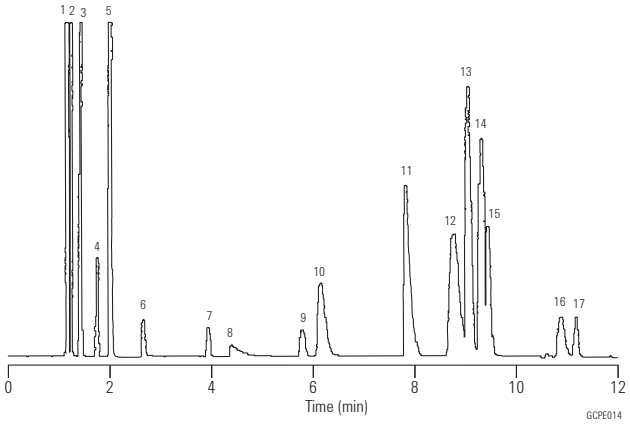
Sample: Refinery gas and others

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1. Air/CO
2. C_1
3. CO_2
4. Ethylene
5. C_2
6. H_2S
7. COS
8. H_2O
9. Propylene
10. C_3
11. MeOH
12. i-C_4
13. t-C_4
14. n-C_4
15. cis-C_4
16. i-C_5
17. n-C_5

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
0-5 0 °C at 1 °C/min
50-130 °C at 2 °C/min
130-180 °C at 4 °C/min
180 °C for 20 min

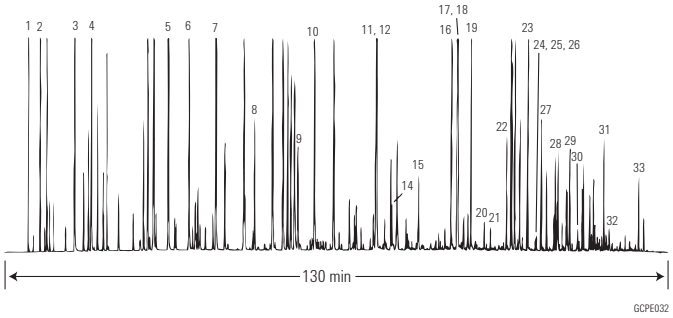
Injection: Split, 200 °C
Split ratio 1:300

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

Sample: 1 µL of neat sample

1. Methane
2. n-Butane
3. Isopentane
4. n-Pentane
5. n-Hexane
6. Methylcyclopentane
7. Benzene
8. Cyclohexane
9. Isooctane
10. n-Heptane
11. Toluene *
12. 2,3,3-Trimethylpentane
13. 2-Methylheptane
14. 4-Methylheptane
15. n-Octane
16. Ethylbenzene
17. m-Xylene **
18. p-Xylene
19. o-Xylene
20. n-Nonane
21. Isopropylbenzene
22. Propylbenzene
23. 1,2,4-Trimethylbenzene
24. Isobutylbenzene
25. sec-Butylbenzene
26. n-Decane
27. 1,2,3-Trimethylbenzene
28. Butylbenzene
29. n-Undecane
30. 1,2,4,5-Tetramethylbenzene
31. Naphthalene
32. Dodecane
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

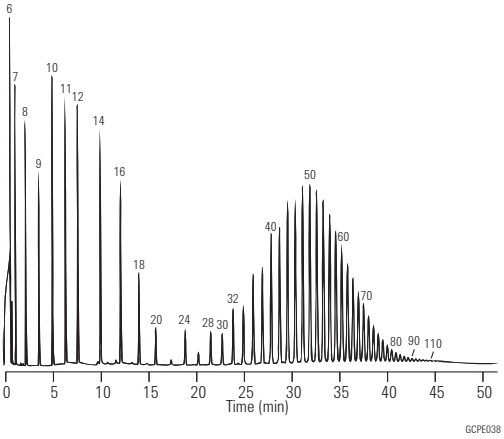
Oven: -30-430 °C at 10 °C/min

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 CS_2

Peak numbers denote carbon number



Volatile Sulfur Compounds

Column: **DB-1**
123-1035
30 m x 0.32 mm, 5.00 µm

Carrier: Helium at 23 cm/sec (H_2S at 50 °C)

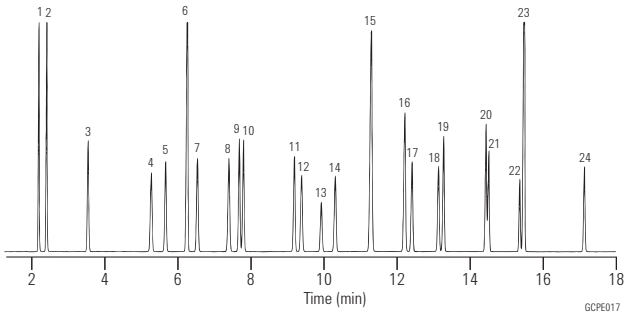
Oven: 50 °C for 4 min, 50-120 °C at 20 °C/min, 120 °C for 4 min, 120-220 °C at 25 °C/min, 220 °C for 2.5 min

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
2. Carbonyl sulfide
3. Methyl mercaptan
4. Ethyl mercaptan
5. Dimethyl sulfide
6. Carbon disulfide
7. 2-Propanethiol
8. 2-Methyl-2-propanethiol
9. 1-Propanethiol
10. Ethyl methyl sulfide
11. Thiophene
12. 2-Methyl-1-propanethiol
13. Diethyl sulfide
14. 1-Butanethiol
15. Methyl disulfide
16. 2-Methylthiophene
17. 3-Methylthiophene
18. Tetrahydrothiophene
19. 1-Pentanethiol
20. 2-Ethylthiophene
21. 2,5-Dimethylthiophene
22. 1-Hexanethiol
23. Ethyl disulfide
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)

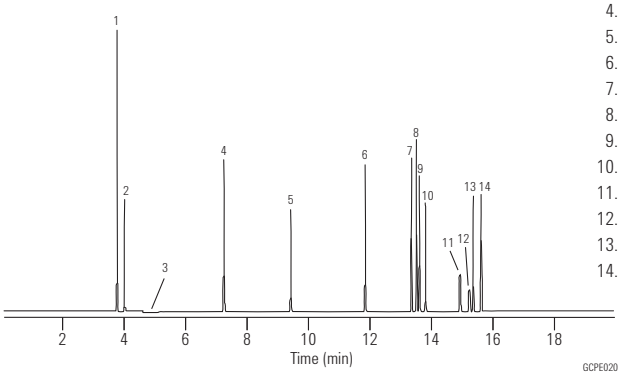
Column: **GS-GasPro**
113-4332
30 m x 0.32 mm

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. H_2S
3. Propylene
4. CS_2
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-propnaethiol
14. 1-Butanethiol

Chromatogram courtesy of OI Analytical.

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

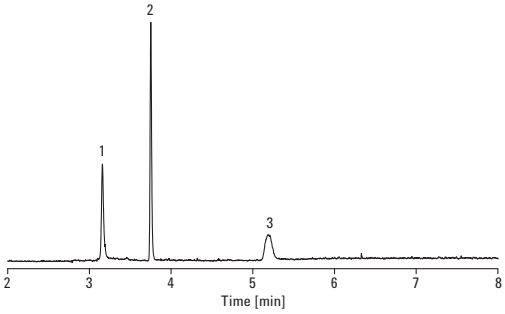
Carrier: Helium, constant flow, 2.0 mL/min

Injection: Gas sampling valve
220 °C, split 1:10

Detector: SCD, 200 °C

Sample: Polypropylene matrix containing ~300 ppb H_2S and CH_3SH, ~500 ppb COS

Injection Volume: 1 mL



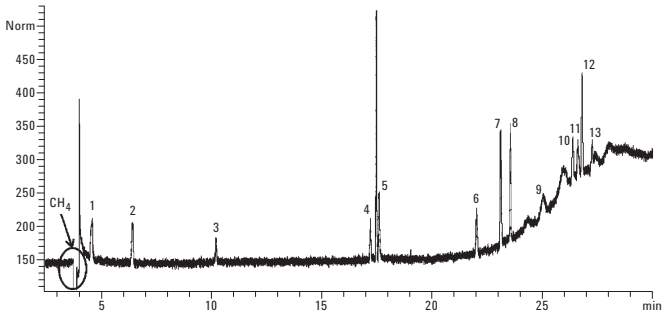
1. H_2S
2. COS
3. CH_3SH

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-Butanthiol	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,**

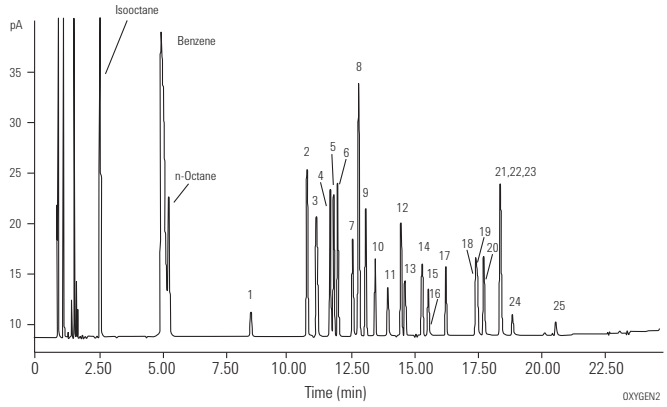
Carrier: Helium (tm = 0.96 min at 50 °C)

Oven: 50 °C for 5 min
50 °C to 240 °C

Injection: Split

Detector: FID

1. Dimethyl ether
2. Diethyl ether
3. Acealdehyde
4. Ethyl t-butyl ether
5. Methyl t-butyl ether
6. Diisopropyl ether
7. Propionaldehyde
8. Tert-amyl methyl ether
9. Propyl ether
10. Isobutylaldehyde
11. Butylaldehyde
12. Methanol
13. Acetone
14. Isovaleraldehyde
15. Valeraldehyde
16. Methyl ethyl ketone
17. Ethanol
18. n-Propanol
19. Isopropanol
20. Allyl alcohol
21. Isobutanol
22. t-Butyl alcohol
23. s-Butyl alcohol
24. n-Butyl alcohol
25. 2-methyl-2 pentanol



Selected Oxygenates

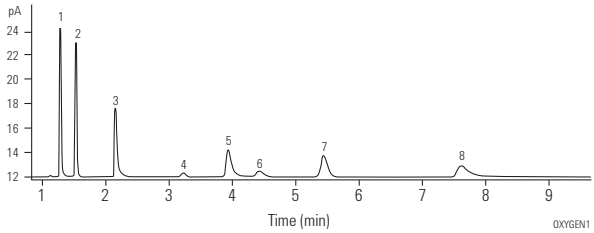
Column: **GS-OxyPLOT**
115-4912
10 m x 0.53 mm,

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

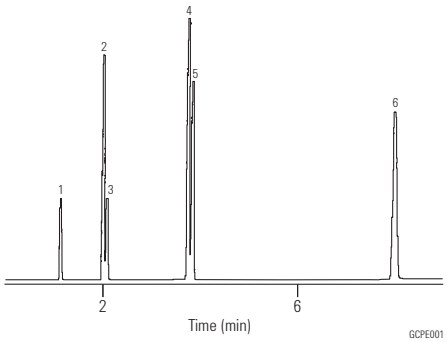
Sample: 250 µL

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

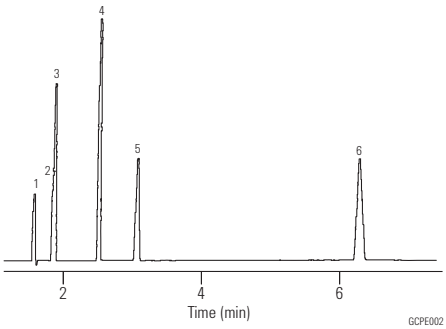
Sample: 250 µL

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, CO_2, 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

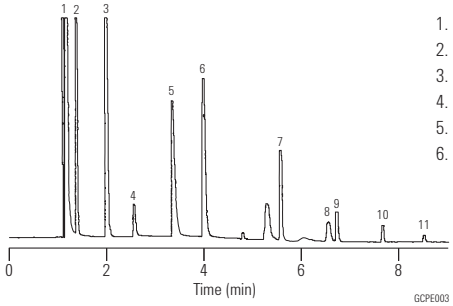
Sample: 0.25 cc natural gas sample, Methane, 80%+

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1. Air/CO
2. CO_2
3. Ethane
4. H_2S
5. Water
6. C_3
7. i-C_4/n-C_4
8. neo-C_5
9. i-C_5/n-C_5
10. C_6
11. C_7

Natural Gas

Column: **HP PLOT Al_2O_3 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

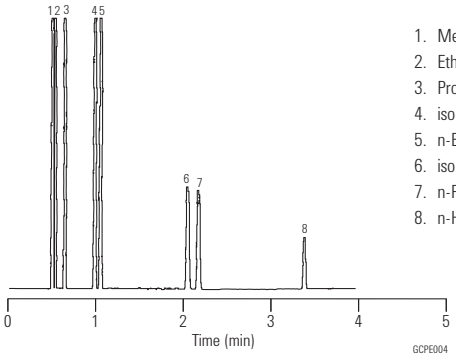
Sample: 5 µL
Natural Gas P/N 5080-8756

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1. Methane
2. Ethane
3. Propane
4. iso-Butane
5. n-Butane
6. iso-Pentane
7. n-Pentane
8. n-Hexane

Ethylene

Column: **HP PLOT Al_2O_3 S**
19095P-S25
50 m x 0.53 mm, 15.00 µm

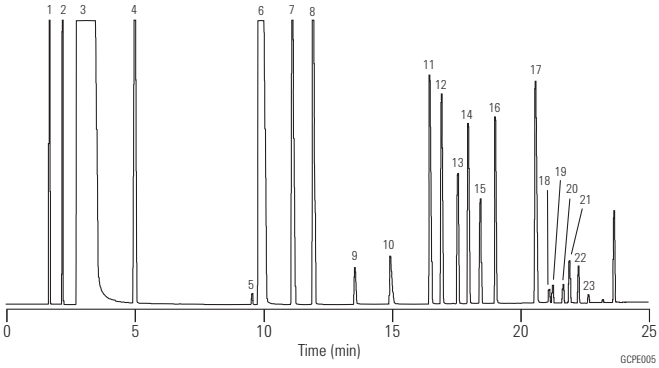
Carrier: Helium, 50 cm/sec (35 °C),
7 mL/min constant flow

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,

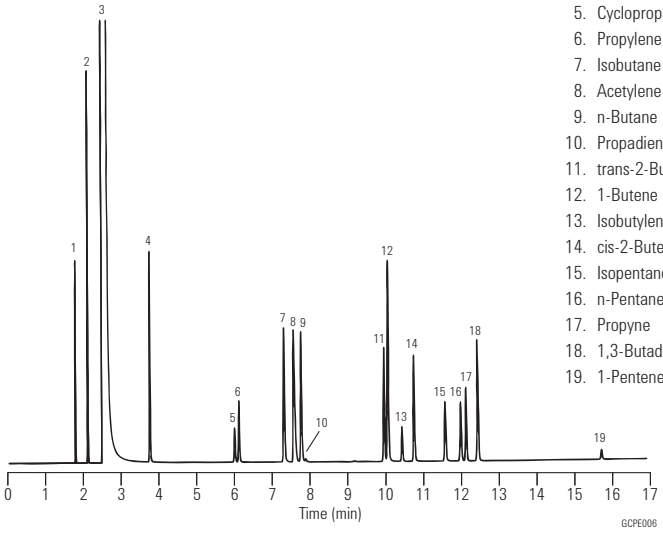
Carrier: Helium at 8 mL/min, measured at 35 °C

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

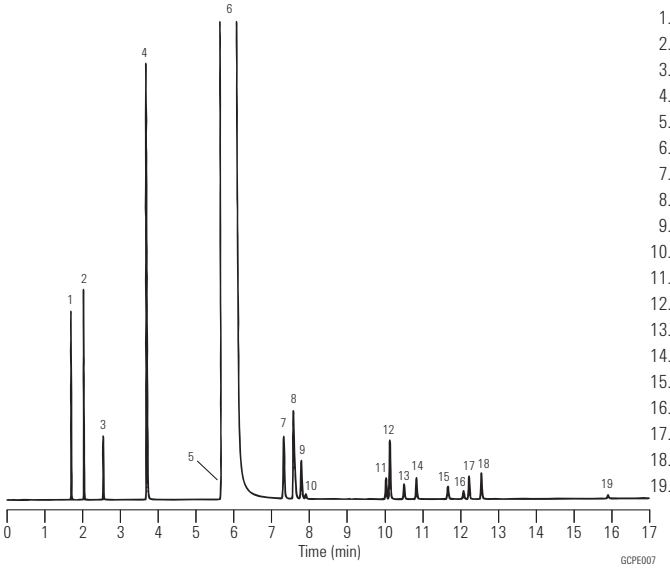
Sample: 0.2 mL of trace hydrocarbons in propylene

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



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

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

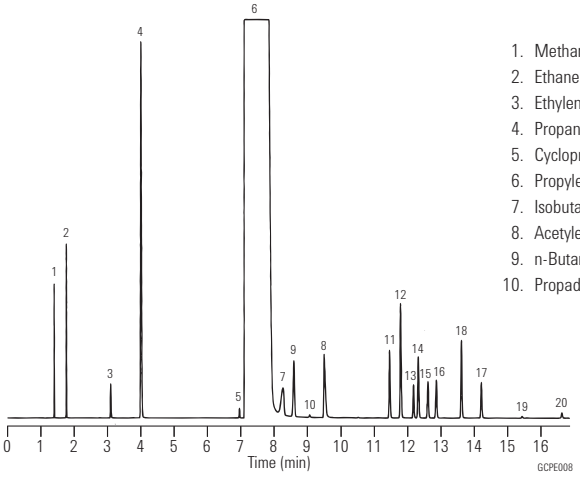
Sample: 0.2 mL of trace hydrocarbons in propylene

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. 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
20. n-Hexane

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

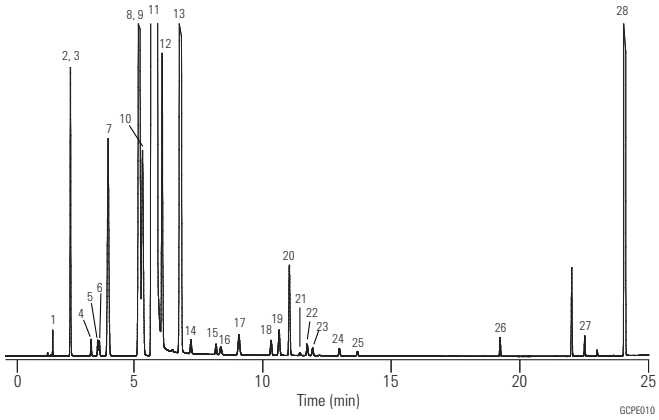
Sample: 0.5 µL

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

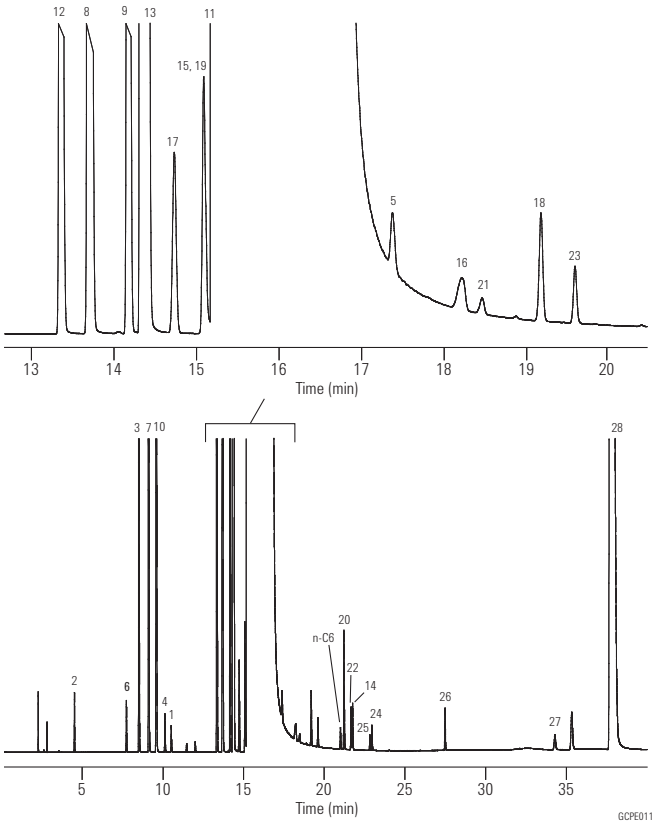
Sample: 0.5 µL

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

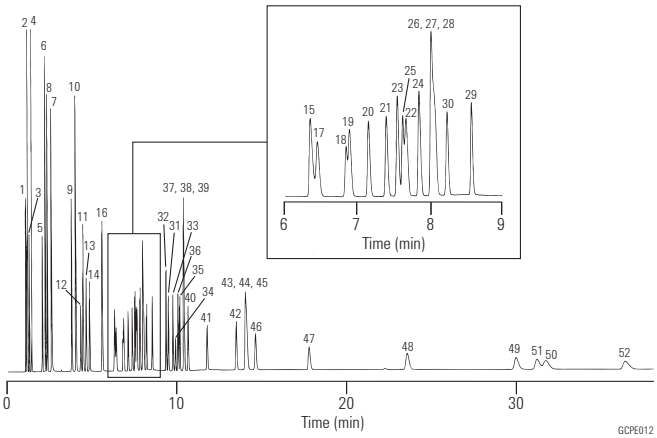
Sample: 300 µL injection of 100 ppm V SUMMA cannister mixture

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
2. Ethane
3. Ethylene
4. Propane
5. Propylene
6. Isobutane
7. Acetylene
8. n-Butane
9. trans-2-Butene
10. 1-Butene
11. cis-2-Butene
12. Cyclopentane
13. Isopentane
14. n-Pentane
15. Propyne
16. 1,3-Butadiene
17. Cyclopentene
18. 3-Methyl-1-butene
19. trans-2-Pentene
20. 2-Methyl-2-butene
21. 1-Pentene
22. cis-2-Pentene
23. Methylcyclopentane
24. 2,2-Dimethylbutane
25. Cyclohexane
26. 2,3-Dimethylbutane
27. 2-Methylpentane
28. 3-Methylpentane
29. Isoprene
30. n-Hexane
31. 4-Methyl-1-pentene
32. trans-2-Hexene
33. 2-Methyl-1-pentene
34. cis-2-Hexene
35. 2,4-Dimethylpentane
36. Methylcyclohexane
37. 2,3-Dimethylpentane
38. 2-Methylhexane
39. 3-Methylhexane
40. n-Heptane
41. Benzene
42. Isooctane (2,2,4-Trimethylpentane)
43. 2,3,4-Trimethylpentane
44. 3-Methylheptane
45. 2-Methylheptane
46. n-Octane
47. Toluene
48. n-Nonane
49. Ethylbenzene
50. m-Xylene
51. p-Xylene
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

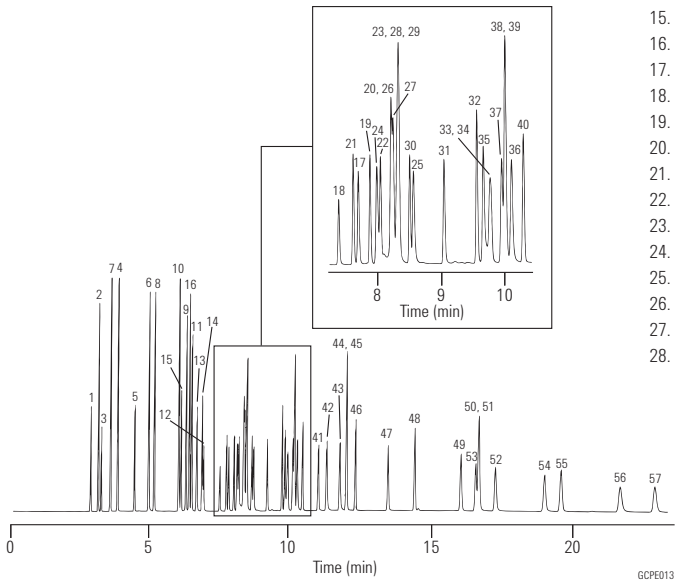
Sample: 500 µL injection of 100 ppmV SUMMA cannister mixture

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
2. Ethane
3. Ethylene
4. Propane
5. Propylene
6. Isobutane
7. Acetylene
8. n-Butane
9. trans-2-Butene
10. 1-Butene
11. cis-2-Butene
12. Cyclopentane
13. Isopentane
14. n-Pentane
15. Propyne
16. 1,3-Butadiene
17. Cyclopentene
18. 3-Methyl-1-butene
19. trans-2-Pentene
20. 2-Methyl-2-butene
21. 1-Pentene
22. cis-2-Pentene
23. Methylcyclopentane
24. 2,2-Dimethylbutane
25. Cyclohexane
26. 2,3-Dimethylbutane
27. 2-Methylpentane
28. 3-Methylpentane
29. Isoprene
30. n-Hexane
31. 4-Methyl-1-pentene
32. trans-2-Hexene
33. 2-Methyl-1-pentene
34. cis-2-Hexene
35. 2,4-Dimethylpentane
36. Methylcyclohexane
37. 2,3-Dimethylpentane
38. 2-Methylhexane
39. 3-Methylhexane
40. n-Heptane
41. Benzene
42. Isooctane (2,2,4-Trimethylpentane)
43. 2,3,4-Trimethylpentane
44. 3-Methylheptane
45. 2-Methylheptane
46. n-Octane
47. Toluene
48. n-Nonane
49. Ethylbenzene
50. m-Xylene
51. p-Xylene
52. o-Xylene
53. Styrene
54. Isopropylbenzene (Cumene)
55. n-Propylbenzene
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

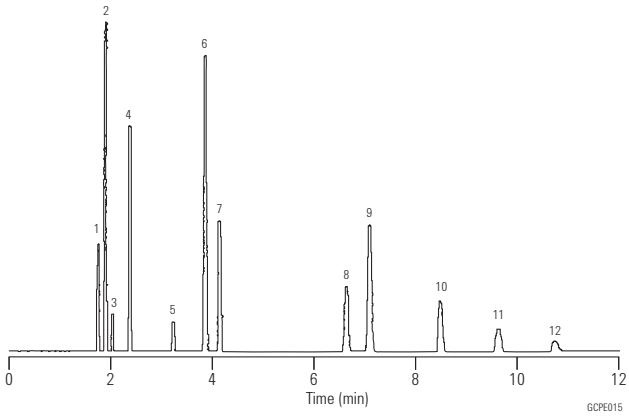
Sample: 5 µL

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

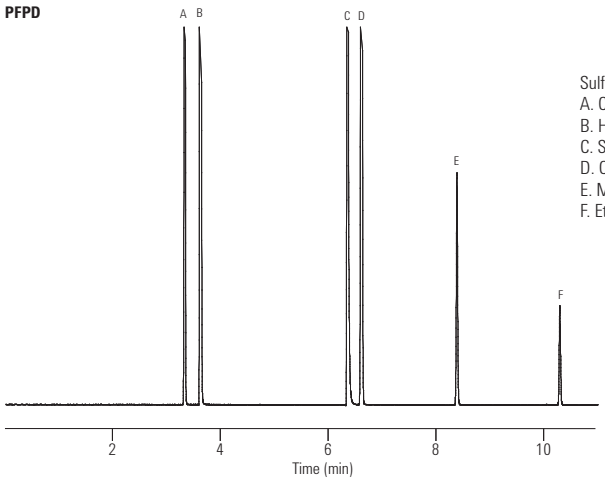
Column: **GS-GasPro**
113-4332
30 m x 0.32 mm

Carrier: Helium, 10 psig,
2.0 mL/min @ 60 °C

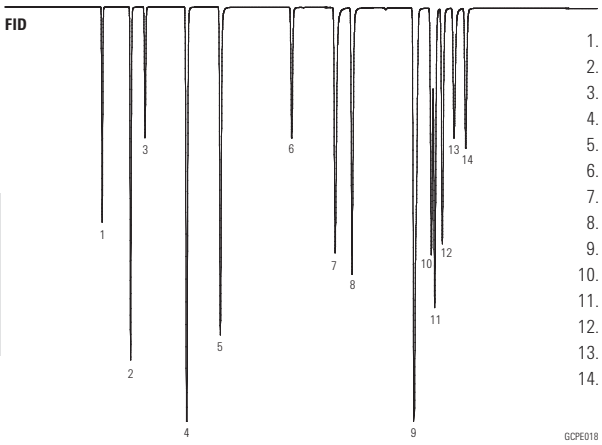
Oven: 60 °C for 2 min,
20 °C/min to 260 °C and hold

Injection: Split, 200 °C
Split ratio 1:20

Detector: Two separate analyses under identical conditions on FID and PFPD



Sulfur compounds (PFPD)
A. Carbonyl sulfide
B. Hydrogen sulfide
C. Sulfur dioxide
D. Carbon disulfide
E. Methyl mercaptan
F. Ethyl mercaptan



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

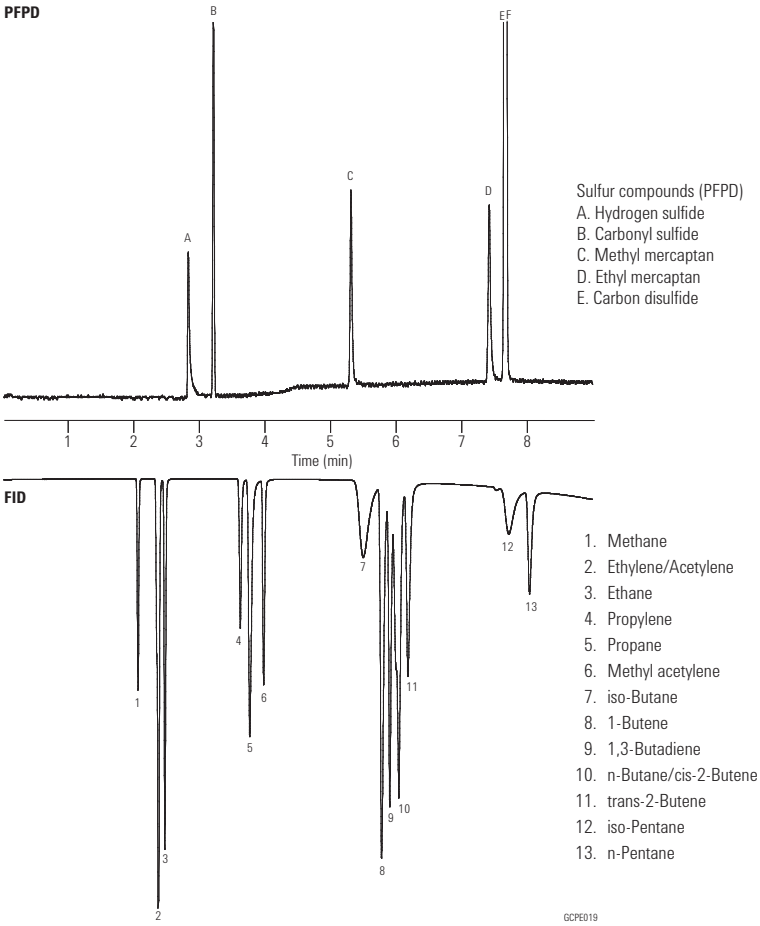
Column: **GS-Q**
113-3432
30 m x 0.32 mm, 0.20 µm

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



Sulfur compounds (PFPD)
A. Hydrogen sulfide
B. Carbonyl sulfide
C. Methyl mercaptan
D. Ethyl mercaptan
E. Carbon disulfide

1. Methane
2. Ethylene/Acetylene
3. Ethane
4. Propylene
5. Propane
6. Methyl acetylene
7. iso-Butane
8. 1-Butene
9. 1,3-Butadiene
10. n-Butane/cis-2-Butene
11. trans-2-Butene
12. iso-Pentane
13. 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 Compounds in Propylene (1 ppm)

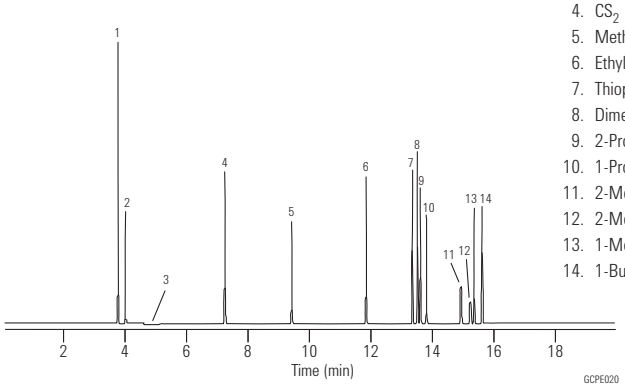
Column: **GS-GasPro**
113-4332
30 m x 0.32 mm

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. H_2S
3. Propylene
4. CS_2
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-propnaethiol
14. 1-Butanethiol

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

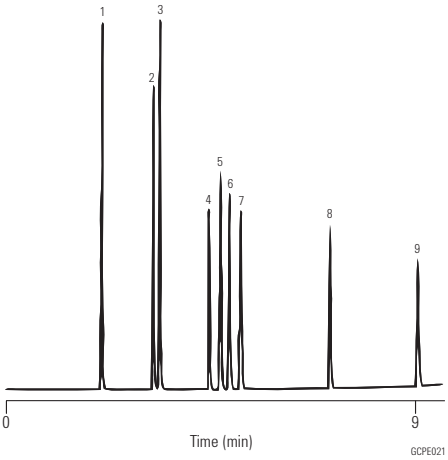
Sample: 0.2 mL

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-1propyl 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

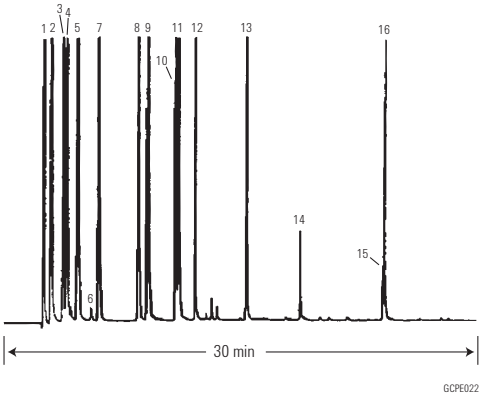
Sample: 0.5 mL

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 µm

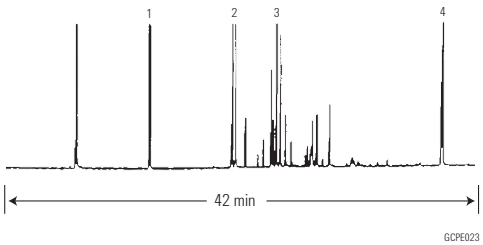
Carrier: Helium, 26 cm/sec

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 µL



1. Thiophene
2. Methyl thiophenes
3. Ethyl and dimethyl thiophenes
4. Benzothiophene

Aromatics Analysis – ASTM D16 Analytes

Column: **HP-INNOWax**
19091N-216
60 m x 0.32 mm, 0.50 µm

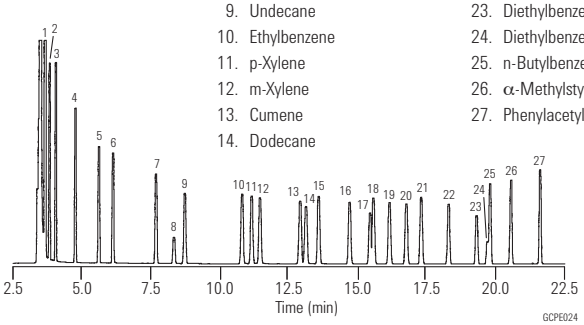
Carrier: Helium at 20 psi, constant pressure mode

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 aquisition rate at 20 Hz

1. Heptane
2. Cyclohexane
3. Octane
4. Nonane
5. Benzene
6. Decane
7. Toluene
8. 1-4-Dioxane
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. tert-Butylbenzene
20. sec-Butylbenzene
21. Styrene
22. Tridecane
23. Diethylbenzene isomer
24. Diethylbenzene isomer
25. n-Butylbenzene
26. α-Methylstyrene
27. Phenylacetylene



Aromatics Analysis – Ethylbenzene Impurities

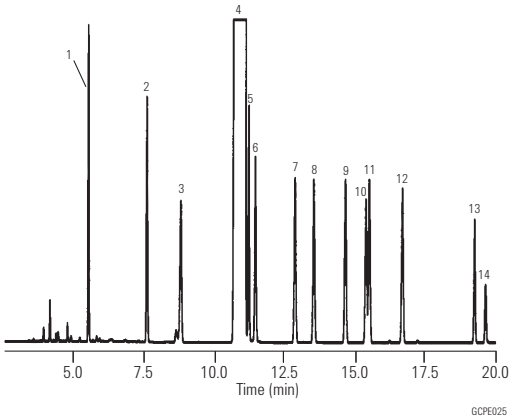
Column: **HP-INNOWax**
19091N-216
60 m x 0.32 mm, 0.50 µm

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 aquisition rate at 20 Hz



1. Benzene
2. Toluene
3. Undecane
4. Ethylbenzene
5. p-Xylene
6. m-Xylene
7. Isopropylbenzene
8. o-Xylene
9. n-Propylebenzene
10. p-Ethyltoluene
11. m-Ethyltoluene
12. s-Butylbenzene
13. Diethylbenzene
14. Diethylbenzene

Impurities in p-Xylene – ASTM D3798

Column: **HP-INNOWax**
19091N-216
60 m x 0.32 mm, 0.50 µm

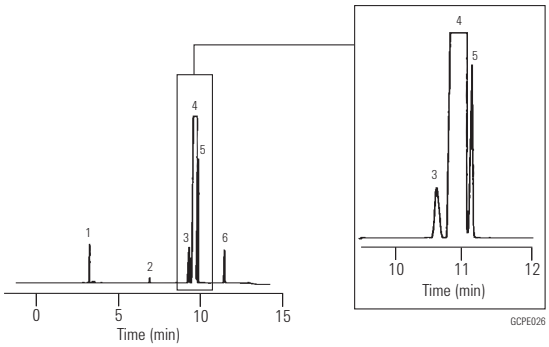
Carrier: Helium, 32 cm/sec, 19.9 psi (60 °C), 2.5 mL/min constant flow

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%+



1. Non aromatic hydrocarbon
2. Toluene
3. Ethylbenzene
4. p-Xylene
5. m-Xylene
6. o-Xylene

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

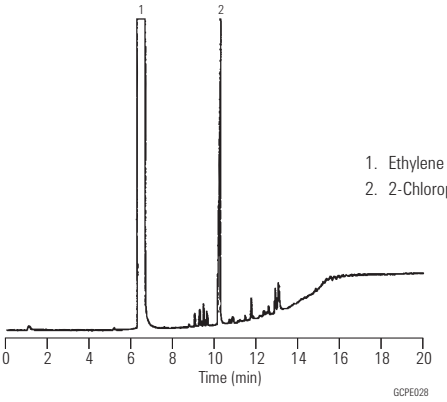
Suggested Supplies

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



1. Ethylene oxide
2. 2-Chloropropene

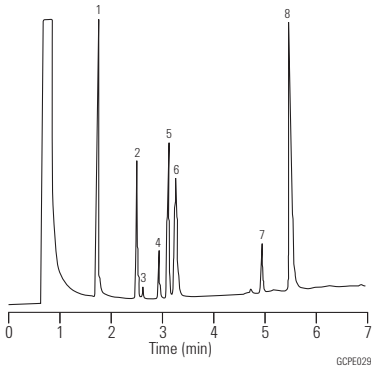
Oxygenates

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

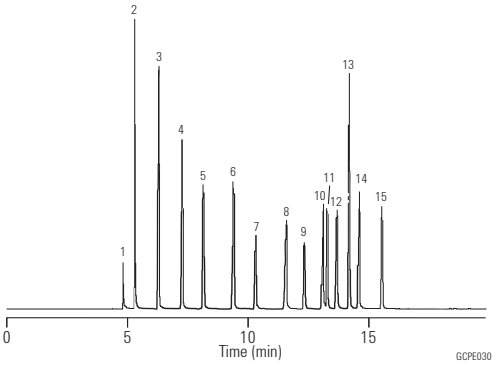
Carrier: Helium 30 cm/sec constant flow

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: Wasson 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

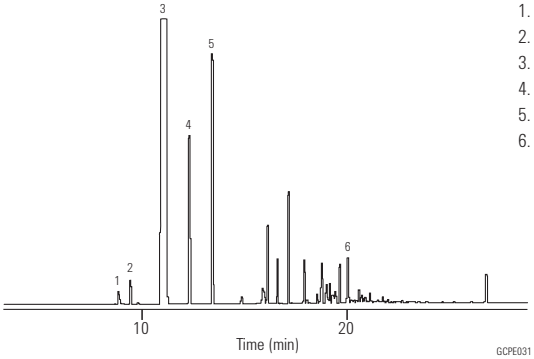
Carrier: Helium 24 cm/sec

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

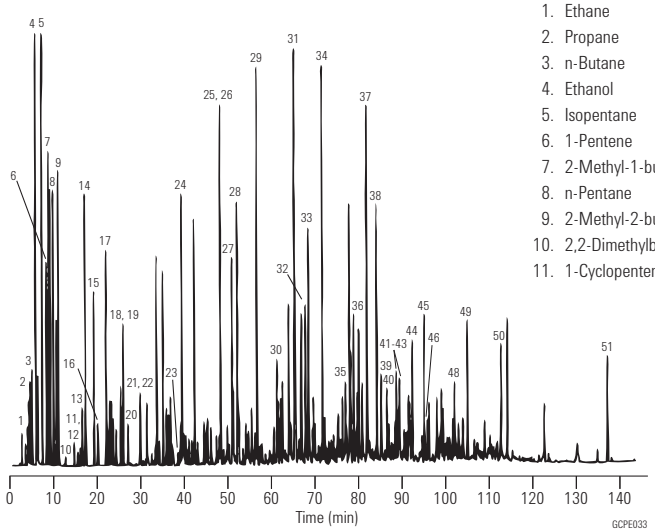
Carrier: Helium at 16.7 cm/sec, measured at 35 °C

Oven: 10 °C for 15 min
10-70 °C at 1.3 °C/min
70-250 °C at 1.7 °C/min

Injection: Split, 250 °C
Split ratio 1:200

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

Sample: 0.3 µL petroleum reformate



1. Ethane
2. Propane
3. n-Butane
4. Ethanol
5. Isopentane
6. 1-Pentene
7. 2-Methyl-1-butene
8. n-Pentane
9. 2-Methyl-2-butene
10. 2,2-Dimethylbutane
11. 1-Cyclopentene
12. Cyclopentane
13. 2,3-Dimethylbutane
14. 2-Methylpentane
15. 3-Methylpentane
16. 2-Methyl-1-pentene
17. n-Hexane
18. 2,2-Dimethylpentane
19. Methylcyclopentane
20. 2,4-Dimethylpentane
21. Benzene
22. 1-Methyl-1-cyclopentene
23. Isooctane
24. n-Heptane
25. Toluene
26. 2,3,3-Trimethylpentane
27. 2-Methylheptane
28. 3-Methylheptane
29. n-Octane
30. Ethylbenzene
31. m-Xylene
32. p-Xylene
33. o-Xylene
34. n-Nonane
35. n-Propylbenzene
36. 1,3,5-Trimethylbenzene
37. 1,2,4-Trimethylbenzene
38. n-Decane
39. 1,2,3-Trimethylbenzene
40. Indan
41. 1,3-Diethylbenzene
42. 1-Methyl-3-propylbenzene
43. 1,3-Diethyl-5-ethylbenzene
44. 1,2-Diethyl-4-ethylbenzene
45. n-Undecane
46. 1,2,4,5-Tetramethylbenzene
47. 1,2,3,5-Tetramethylbenzene
48. Naphthalene
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

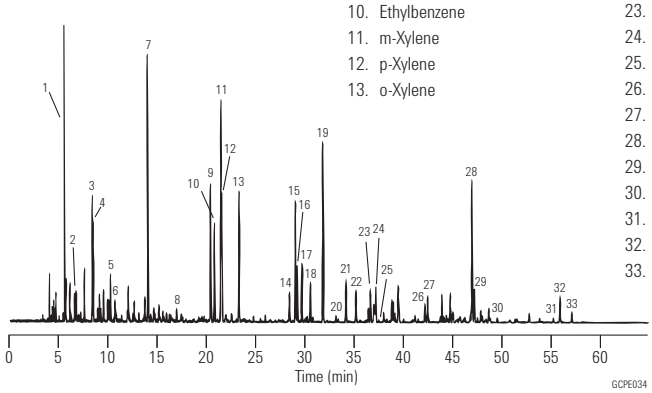
Carrier: Helium at 35 cm/sec, measured at 50 °C

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)
2. n-Hexane
3. Benzene-d6 (IS)
4. Benzene
5. Isooctane
6. n-Heptane
7. Toluene
8. n-Octane
9. Ethylbenzene-d10 (IS)
10. Ethylbenzene
11. m-Xylene
12. p-Xylene
13. o-Xylene
14. n-Propylbenzene
15. 1-Methyl-3-ethylbenzene
16. 1-Methyl-4-ethylbenzene
17. 1,3,5-Trimethylbenzene
18. 1-Methyl-2-ethylbenzene
19. 1,2,4-Trimethylbenzene
20. n-Decane
21. 1,2,3-Trimethylbenzene
22. Indan
23. 1,4-Diethylbenzene
24. n-Butylbenzene (valley)
25. 1,2-Diethylbenzene
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 µm

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

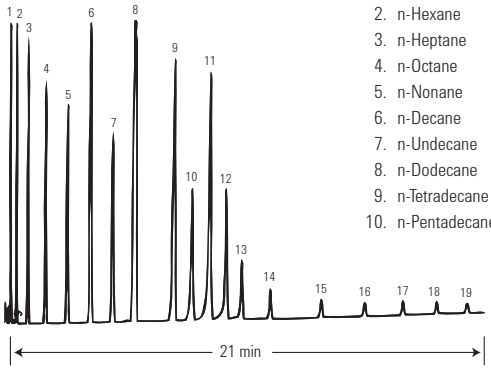
Suggested Supplies

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



1. n-Pentane
2. n-Hexane
3. n-Heptane
4. n-Octane
5. n-Nonane
6. n-Decane
7. n-Undecane
8. n-Dodecane
9. n-Tetradecane
10. n-Pentadecane
11. n-Hexadecane
12. n-Heptadecane
13. n-Octadecane
14. n-Eicosane
15. n-Tetracosane
16. n-Octacosane
17. n-Dotriacontane
18. n-Hexatriacontane
19. n-Tetracontane

Reference Gas Oil

Column: **DB-2887**
125-2814
10 m x 0.53 mm, 3.00 µm

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

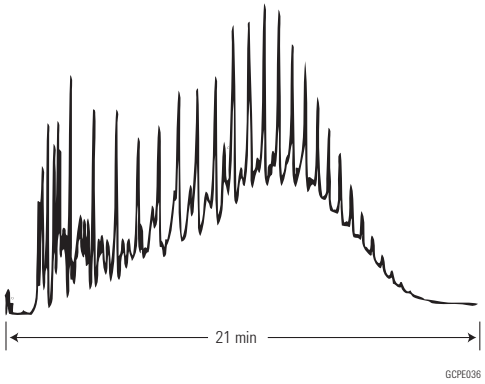
Suggested Supplies

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 µL 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 µm**

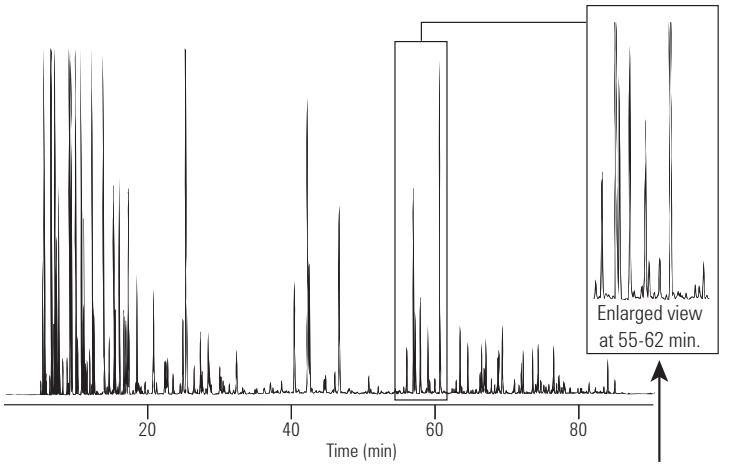
Carrier: Hydrogen at 31 cm/sec

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 µL



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 µm**

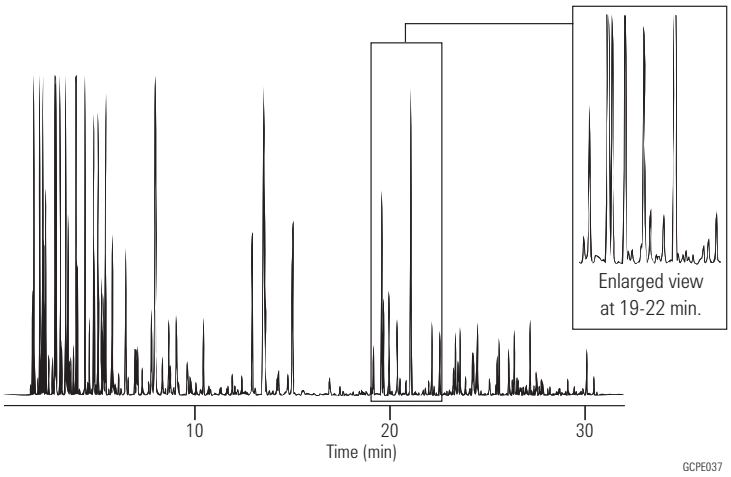
Carrier: Hydrogen at 34.8 cm/sec

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 µL



Gasoline Unleaded ASTM D 5769

Column: **CP-Sil PONA CB**
CP7530
100 m x 0.25 mm, 0.50 µm

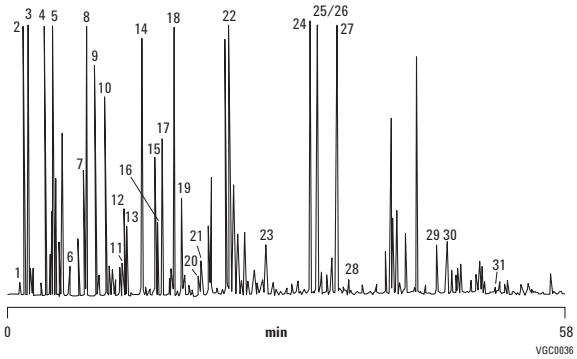
Sample: 0.1 µL

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-Dimethylbutnae
7. 2,3-Dimethylbutane
8. 2-Methylpantane
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. Ethylbenzane
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 µm

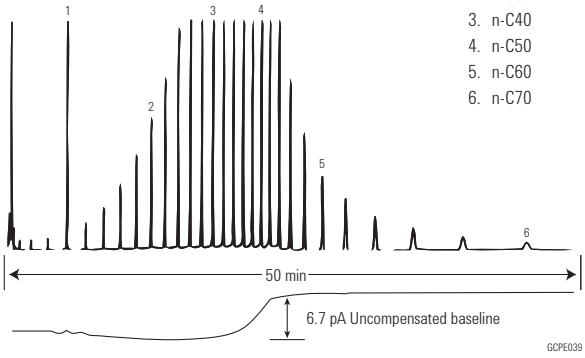
Carrier: Helium at 8 mL/min

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 µL
3% Solution in CS_2



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

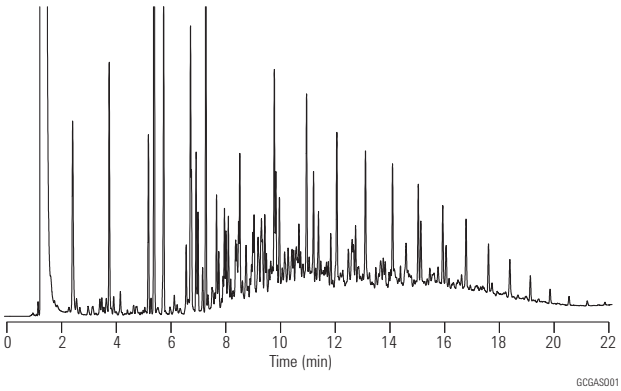
Column: **DB-TPH**
124-1632
30 m x 0.45 mm, 1.00 µm

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



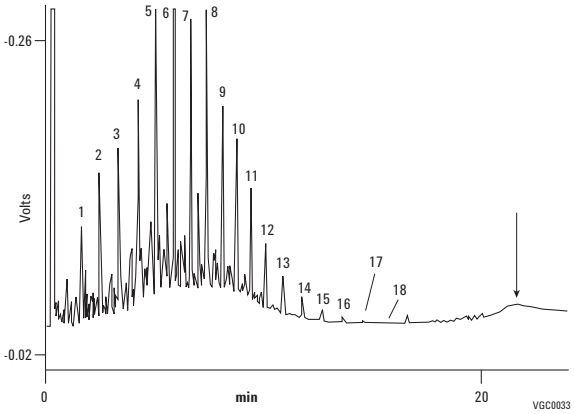
Diesel Analysis

Column: **VF-5ht Fused Silica**
CP9047
15 m x 0.32 mm, 0.10 µm

Carrier: H_2, 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



1. C10
2. C11
3. C12
4. C13
5. C14
6. C15
7. C16
8. C17
9. C18
10. C19
11. C20
12. C21
13. C22
14. C23
15. C24
16. C25
17. C26
18. C27

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: Ciclohexano

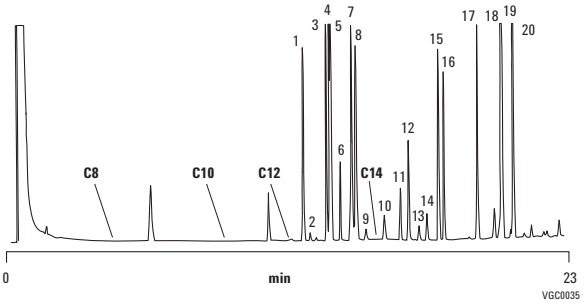
Carrier: He, 28.8 kPa (0.288 bar, 4.1 psi)

Oven: 50 °C (5 min) to 240 °C, 10 °C/min

Injection: Split, T=250 °C

Detector: FID, T=250 °C

1. Acetaldehyde
2. Diethyl ether
3. Ethyl tert-butyl ether
4. Methyl tert-butyl ether
5. Diisopropyl ether
6. Propionaldehyde (propanol)
7. Tert-amyl methyl ether
8. Dipropyl ether
9. Isobutyraldehyde
10. Butyraldehyde
11. Methanol
12. Acetone
13. Isovaleraldehyde
14. Valeraldehyde
15. 2-Butanone
16. Ethanol
17. 1-Propanol
18. 2-Methyl-1-propanol (isobutanol)
19. 2-Methyl-2-propanol (tert-butanol)
20. 1-Butanol



Analysis of Gases C1 to C4

Column: **PoraPLOT Q**
CP7554
25 m x 0.53 mm, 20.00 µm

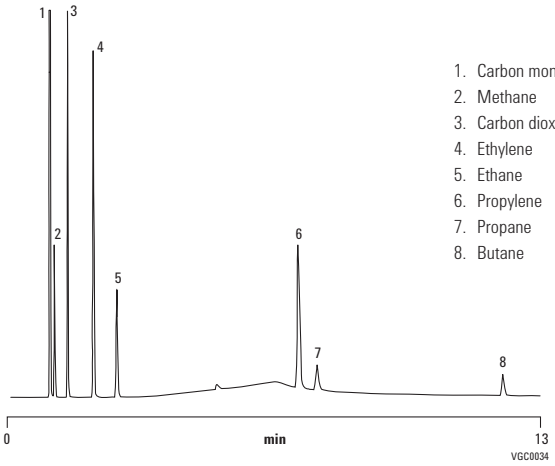
Sample: 50 µL

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



1. Carbon monoxide
2. Methane
3. Carbon dioxide
4. Ethylene
5. Ethane
6. Propylene
7. Propane
8. Butane

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 µm

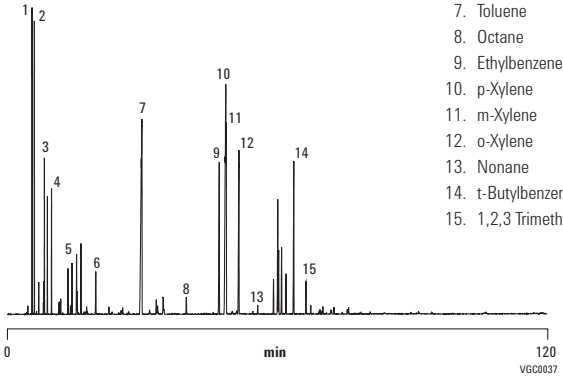
Sample: 0.2 µL

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



1. i-Pentane
2. Pentane
3. Cyclopentane
4. Hexane
5. Benzene
6. Heptane
7. Toluene
8. Octane
9. Ethylbenzene
10. p-Xylene
11. m-Xylene
12. o-Xylene
13. Nonane
14. t-Butylbenzene
15. 1,2,3 Trimethylbenzene

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