



GC AND GC/MS

Your Essential Resource for Columns & Supplies

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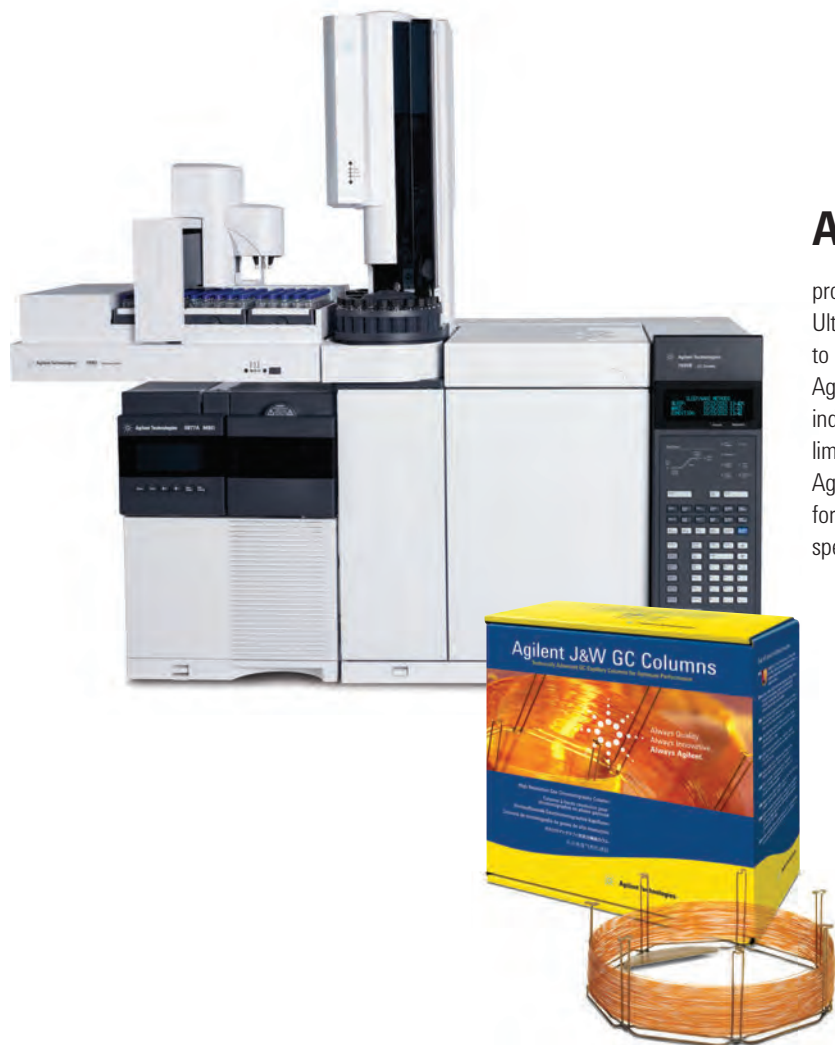


Agilent Technologies

GC AND GC/MS

Achieve excellent, reproducible performance for difficult samples

For over 40 years, Agilent has broken new ground with innovations in Gas Chromatography. We continue our leadership tradition by offering the industry's broadest selection of GC and GC/MS columns and supplies. All are manufactured to Agilent's exact specifications to minimize downtime and ensure consistent, high-quality results that you can rely on.



Agilent Ultra Inert solutions

provide the flow path inertness vital to analytical success. Ultra Inert split and splitless liners are manufactured and tested to our highest level of scrutiny to ensure quality and consistency. Agilent J&W Ultra Inert GC columns are tested with the industry's most demanding test probe to reduce detection limits and produce more accurate data for difficult analytes. Agilent GC and GC/MS instruments bring together all elements for trace-level analysis, dramatically improving MS resolution, spectral integrity, and detection limits.

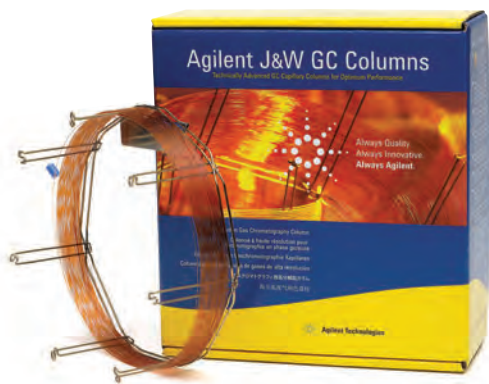


GC and GC/MS supplies

More samples, lower detection levels, with fewer analysts. These demands challenge laboratories to maximize the productivity and performance of their instrumentation. To help you stay ahead, Agilent is continuously improving our extensive portfolio of innovative, award winning GC columns and supplies, designed to help you resolve many of the day to day setbacks encountered in your lab. You can avoid downtime and your time can be better spent on meeting your analytical and business challenges.

For labs pushing the detection limits of trace level analysis on very active compounds, **Agilent Inert Flow Path solutions** ensure a reliably inert flow path for higher sensitivity, accuracy, and reproducibility. Install industry leading Agilent J&W GC columns with new proprietary design GC column nuts and ferrules to simplify your day yet maximize your GC and GC/MS systems output.

- Inert Flow Path components – Ultra Inert GC columns, Ultra Inert liners, Ultra Inert gold seals, UltiMetal Plus Capillary Flow Technology devices with Flexible Metal ferrules – have Agilent proprietary deactivation chemistries to ensure sample integrity.
- "Better Connectivity" with products such as Self Tightening column nuts, UltiMetal Plus Flexible Metal ferrules, and Ultra Inert liners in Touchless packaging improves productivity with ease of use and convenience.
- Full portfolio of premium GC products to support your lab needs – including Agilent CrossLab brand and Agilent Bulk supplies packaging.



Agilent J&W GC columns

deliver the best inertness for acids, bases, and mixed functional compounds, the lowest bleed levels, and the tightest column-to-column reproducibility. Mass Spec Grade GC columns (VF-ms, DB-ms and HP-ms) give you robust performance, low column bleed, and a wide range of selectivity. LTM column modules combine a fused silica capillary GC column with heating and temperature-sensing components for efficient column heating and cooling. What's more, integrated guard columns protect your analytical columns from non-volatile compounds in the sample matrix.

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PUT MORE THAN 40 YEARS OF RELENTLESS INNOVATION BEHIND YOUR EVERY RESULT

By continually raising the standards for technologies that support your routine analyses, Agilent's R&D efforts have led to breakthroughs such as:

- **New GC columns** that help you achieve higher levels of inertness and column-to-column reproducibility
- **LC column choices** that deliver the sensitivity and reliability you need for demanding applications
- **Cutting-edge sample preparation products** that promote reliable extraction and concentration
- **Fresh atomic and molecular spectroscopy ideas** for identifying and confirming targets and unknowns

Longtime Agilent customers have experienced our commitment firsthand. And now, we look forward to demonstrating how Agilent's approach to relentless innovation can work to your advantage, too.



CHEMICAL ANALYSIS SOLUTIONS

Food

From high-volume pesticide screening in food products to rapid identification of pathogens, Agilent understands the analytical needs of food producers, shippers, and regulators. Utilizing our easy-to-use analyzers and updated screening libraries, customers can quickly develop robust and reliable methods. Agilent's leading gas chromatography and mass spectrometry systems are widely regarded as valuable food testing techniques for an array of different analyses.

Environmental

Agilent offers more than 40 years of environmental testing and regulatory expertise. We help government and private labs with the full range of assays, from routine testing of soils for heavy metals to detection of pharmaceuticals in groundwater, in concentrations down to parts per trillion.

Energy & Chemicals

Agilent collaborates closely with process industry customers to offer analytical systems that meet their needs for separation, detection, throughput, and support. We'll even preconfigure custom or standard analyzers so they arrive at the lab ready-to-go. From crude oil, natural gas, and refining, to specialty chemicals and alternative fuels, Agilent provides the latest technologies and solutions to increase quality, safety, and profitability for energy and chemical labs, while meeting the industry's stringent quality requirements. Agilent leads the way in ASTM collaborations that have evolved – and will continue to evolve – into industry standards.

Forensics

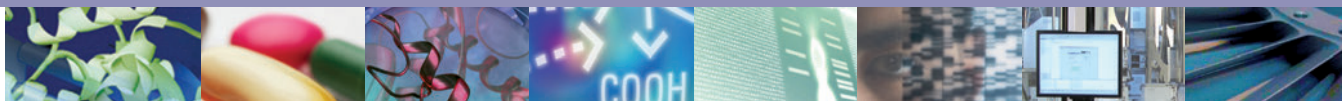
Whether testing for poisons in a forensics investigation, screening athletes for performance enhancing drugs, analyzing samples for recreational drugs, or checking a crime scene for explosive residue – lives and professions may be dependent on the accuracy of your equipment. Agilent Technologies leads the industry with a comprehensive portfolio of workflow solutions that provide the ability to identify, confirm and quantify thousands of substances.

Lab Informatics

The ways labs capture, analyze and share data profoundly affect their efficiency. Agilent offers a rich, integrated suite of software products built on customer-driven architectural values with the Agilent OpenLAB Software Suite. OpenLAB delivers superior performance and connection across multiple systems, providing open systems integration and investment protection. Our commitment is to deliver more value across each step in the life cycle of scientific data – from data collection and analysis to interpretation and management.

Materials Science

Agilent offers a newly expanded portfolio of instruments used for the research, manufacturing and testing of advanced materials, from precision optics to pulp and paper. Tools for atomic spectroscopy, molecular spectroscopy, chromatography, and X-ray crystallography all support continuous progress in materials science.



LIFE SCIENCE SOLUTIONS

Biopharmaceutical

Biotherapeutics have enormous potential to improve human health, with growing numbers of protein and antibody therapeutics to address unmet medical needs. At every development stage, from disease research to QA/QC and manufacturing, Agilent can help you make the right choices for moving therapeutics to market. We understand the biopharmaceutical workflow so our product families work together seamlessly, as engines of research, discovery, and development. Agilent columns deliver complete characterization of biomolecules using reversed-phase, size exclusion, ion exchange, and affinity chromatography. Our bio-inert supplies ensure that every part of your workflow delivers the performance you need to optimize your bio-separation.

Pharmaceutical

You need the most efficient processes to evaluate drug candidates, determine efficacy, and ensure safety and compliance during development and manufacture. Agilent has worked with pharma companies for many years to ensure reliability and reproducibility for regulatory compliance, from lab-to-lab and around the world. Our pharma solutions provide high-throughput capability at every stage of the product lifecycle, with automated sample prep, industry-leading U/HPLC systems, the largest family of Fast LC columns, open access LC/MS, spectroscopy, and automated dissolution. A complete family of LC supplies and lamps help optimize every analysis and take day-to-day lab efficiency one step further.

Proteomics

Research into how large sets of proteins affect the health of an organism requires special sets of analytical tools. Agilent has built a formidable arsenal of liquid chromatograph/mass spectrometers, bioinformatics systems, multiple affinity protein removal columns, and OFFGEL electrophoresis for protein identification and protein biomarker discovery. Accurate-Mass mass spectrometry and the microfluidic HPLC-Chip/MS are two Agilent innovations speeding the work of proteomics researchers around the globe.

Metabolomics

Collections of small molecules are increasingly being seen as rich sources of biomarkers, but studying metabolites presents many challenges. The need for speed, accuracy, and powerful interpretation capabilities in looking at chemical profile snapshots is underscored because molecules are constantly entering, leaving or changing within the metabolome. Agilent's GC, LC, and MS portfolios, along with our excellent bioinformatics offerings, user-customizable METLIN metabolite database for LC/MS, and the industry's first commercial GC/MS retention time locked metabolite library align well with the needs of metabolomics researchers.

Genomics

Agilent is a global leader in microarrays, scanners, and NGS reagents used in a wide variety of genomic-based disease research experiments. Our SureSelect and HaloPlex Target Enrichment Systems dominate the category, streamlining next generation sequencing studies. Agilent offers a wide range of catalog CGH and gene expression microarrays and a highly-developed capability to produce custom arrays using our free online design tool, SureDesign. All Agilent microarrays feature highly sensitive, selective 60-mer probes, and, with as many as eight arrays printed on a slide, the cost per sample is cost-efficient.

Life Science Informatics

Mirroring its extensive instrument portfolio, Agilent offers the industry's most extensive suite of bioinformatics software, helping users derive knowledge from complex genomic, proteomic, metabolomic and other biological data. SureCall and CytoGenomics software analyzes NGS and aCGH data and the GeneSpring suite provides multi-omic analysis and visualization capabilities to help compare complex datasets to explore biological questions from multiple perspectives. The GeneSpring suite includes the GX module for microarray-based gene expression and genotyping data, the PA module for Pathway Analysis and multi-omic analysis and the MPP software, which analyzes mass spec data from proteomics and metabolomics experiments.

Lab Automation

To meet the skyrocketing demand for more throughput and automation, Agilent has substantially expanded its lab automation offerings. The Agilent line of liquid handlers and microplate processors are designed to streamline high-volume life science workflows. Agilent is also continually upgrading its advanced autosamplers for LC, GC, LC/MS and GC/MS, adding functionality and speed to reflect the performance of its advanced instruments.

Vacuum Technology

Agilent works with customers to solve vacuum challenges from experiments in high-energy physics to developing systems for nanotechnology. Agilent manufactures vacuum systems used in its own mass spectrometry instruments as well as those of other manufacturers. Agilent's vacuum technology has been proven by the most powerful physics experiment ever built, CERN's Big Bang machine, which was used in the discovery of the Higgs boson.



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Should your instrument require service while covered by an Agilent Advantage service agreement, we guarantee repair or we will replace your instrument for free.

No other company offers this level of commitment to keep your lab up and running at peak efficiency.

Agilent Service and Support for Instrument Systems

Focus on what you do best

For over 40 years, Agilent has been building and maintaining the instruments you count on to stay competitive and successful. Trust us to protect your investment with a broad portfolio of services, backed by a global network of experienced service professionals dedicated to the productivity of your lab.

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Agilent offers a flexible range of service plans so that you can choose the level of coverage that is best for your lab.

- **Agilent Advantage Gold** – Priority-one coverage for ultimate uptime and productivity
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- **Agilent Advantage Bronze** – Total repair coverage at a fixed annual price
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And for Agilent-quality service on analytical instruments from other leading manufacturers, Agilent CrossLab services offer the same quality coverage you have come to expect from the expert Agilent engineers you know and trust.

Laboratory decision makers and users ranked Agilent as their first choice for general laboratory compliance services.

Agilent Compliance Services

Equipment qualification that meets the most stringent requirements

Enterprise Edition Compliance was developed to streamline qualification delivery compliance across your entire lab. Used worldwide in regulated labs, including standards organizations and regulatory agencies, Enterprise Edition enables you to:

- Improve qualification efficiency by harmonizing protocols across platforms to ensure greater efficiency and minimize regulatory risk
- Standardize your entire compliance operation with robust test designs that work with all your instruments
- Add, remove or reconfigure tests based upon your unique user requirements
- Reduce staff review time significantly with consistently formatted, computer generated, tamper-proof reports

Agilent Education and Consulting Services

Our best minds, working for you

Make the most of your instrument with training and consulting from the same experts who designed the instruments, software and processes you use every day.

- Classroom, online, and on-site training in instrument operation, troubleshooting and maintenance
- Customized consulting services to meet your lab's unique needs

The Agilent Value Promise – 10 Years of Guaranteed Value

In addition to continually evolving products, we offer something else unique to the industry – our 10-year value promise guarantee. The Agilent Value Promise guarantees you at least 10 years of instrument use from your date of purchase, or we will credit you with the residual value of the system toward an upgraded model. Not only does Agilent ensure a reliable purchase now, but we also ensure that your investment is just as valuable in the future.

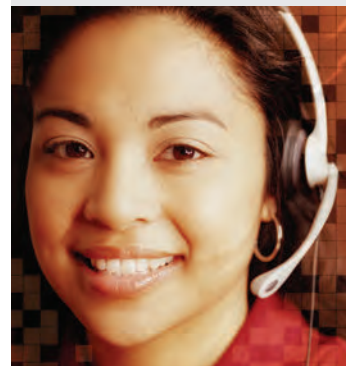
For more detailed information, please go to www.agilent.com/chem/services or contact your local Agilent Services and Support representative.



Technical Support at work for you

Have a hardware, software, application, instrument repair or troubleshooting question? Agilent's technical experts are available to answer your questions. With years of laboratory experience, our technical support specialists can provide in-depth knowledge and experience.

For questions pertaining to supplies found in this catalog, contact your local Agilent office or Authorized Agilent Distributor or visit www.agilent.com/chem/techsupport



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- Locate your nearest Agilent office or distributor for expert technical support.
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- Receive email assistance using our convenient online forms.



GC and GC/MS 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 501.**

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 554.**

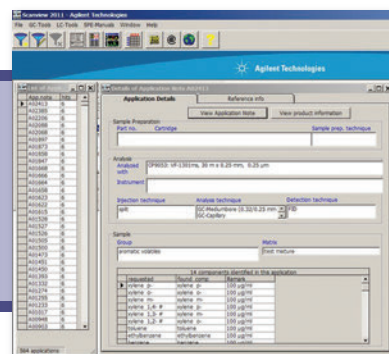
Energy and Fuels – here you'll find applications – such as the analysis of sulfur compounds in propylene – that you can use right away to meet regulatory requirements, improve efficiency, and maintain good environmental stewardship. **Turn to page 576.**

Industrial Chemical – 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 602.**

Forensic Toxicology and Pharma – 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 635.**

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

Unleaded Gasoline

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

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

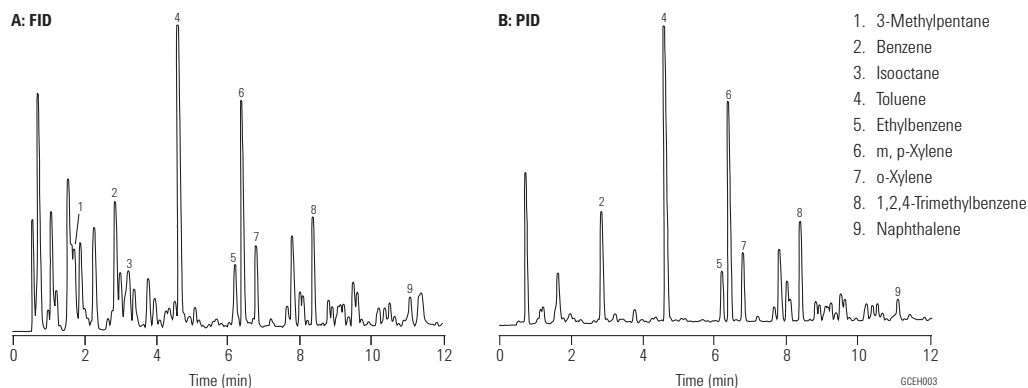
Oven: 40 °C for 2 min,
40-200 °C at 12 °C/min,
200 °C for 5 min

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



Determination of Chlorophenols in Water and Soil

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

Oven: 60 °C, 30 °C/min to 300 °C

Carrier: He 80 kPa, 0.8 bar, 5.7 psi

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

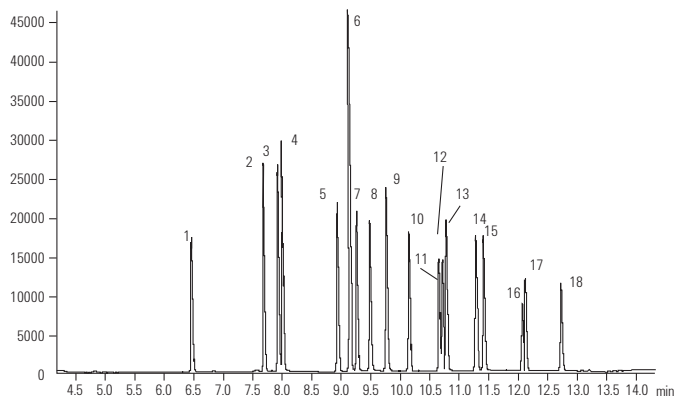
Detector: MS
280 °C

Sample: Isohexane

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

Dr. Weßling, Laboratorien GmbH

- | | |
|---------------------------|-------------------------------|
| 1. Phenol | 10. 2,4,6-Trichlorophenol |
| 2. 2-Chlorophenol | 11. 2,3,6-Trichlorophenol |
| 3. 3-Chlorophenol | 12. 2,3,5-Trichlorophenol |
| 4. 4-Chlorophenol | 13. 2,4,5-Trichlorophenol |
| 5. 2,6-Dichlorophenol | 14. 2,3,4-Trichlorophenol |
| 6. 2,4+2,5-Dichlorophenol | 15. 3,4,5-Trichlorophenol |
| 7. 3,5-Dichlorophenol | 16. 2,3,5,6-Tetrachlorophenol |
| 8. 2,3-Dichlorophenol | 17. 2,3,4,6-Tetrachlorophenol |
| 9. 3,4-Dichlorophenol | 18. 2,3,4,5-Tetrachlorophenol |



PBDEs by ECD

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

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

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

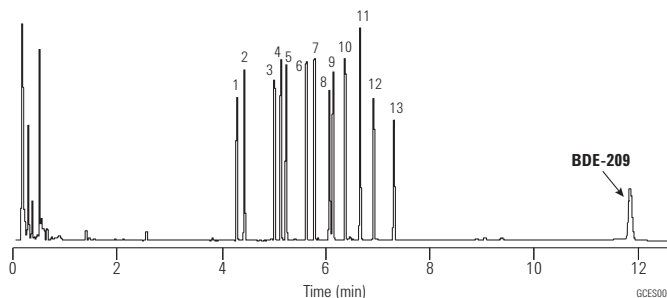
Injection: Split, 250 °C
Split ratio 20:1

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

Sample: 1 µL

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

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



Diesel Fuel

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

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

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

Injection: Direct, 280 °C

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

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

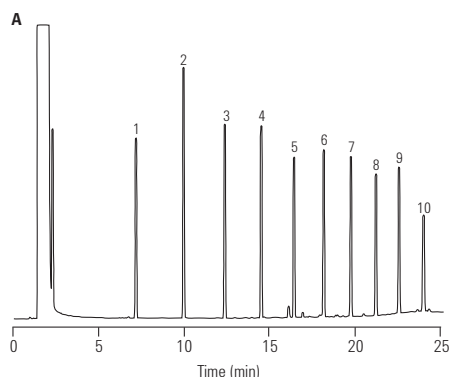
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

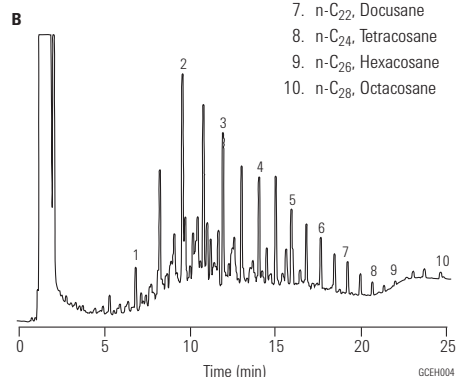
Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730

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

**Diesel fuel standard
50 ng/component**



**Diesel fuel
0.6 mg/mL**



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

Analysis of Polycyclic Aromatic Hydrocarbons

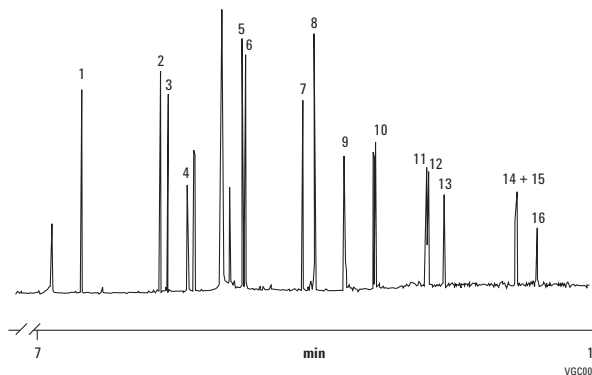
Column: VF-Xms
CP8805
30 m x 0.25 mm, 0.10 µm

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

Carrier: Helium, 60 kPa

Injection: Split, T=275 °C

Detector: Agilent Ion Trap MS



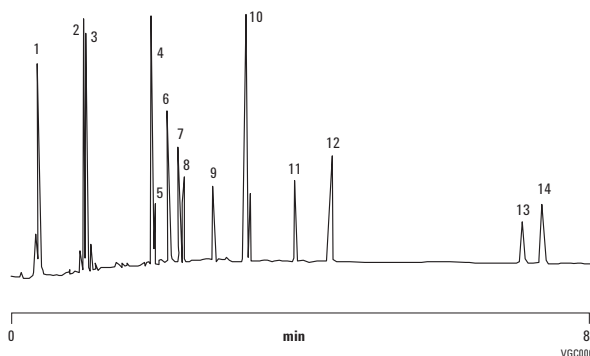
1. Naphthalene
2. Acenaphthylene
3. Acenaphthene
4. Fluorene
5. Phenanthrene
6. Anthracene
7. Fluoranthene
8. Pyrene
9. Chrysene
10. Benzo[a]anthracene
11. Benzo[k]fluoranthene
12. Benzo[b]fluoranthene
13. Benzo[a]pyrene
14. Indeno[1,2,3-cd]pyrene
15. Dibenzo[a,h]anthracene
16. Benzo[g,h,i]perylene

Dioxins and Dibenzofurans

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

Sample: 1.0 µL Toluene
Sample Conc: 100-400 pg/µL
Carrier: Helium, 170 kPa (1.7 bar, 24 psi)
Oven: 100 °C to 180 °C to 230 °C, 3 °C/min
Injection: Splitless
Detector: MSD

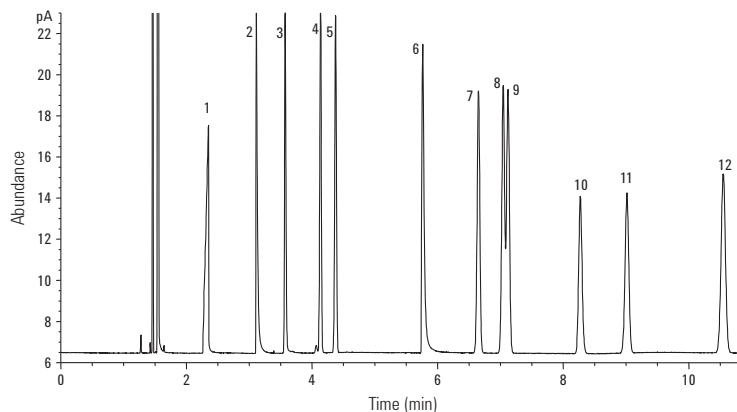
1. 2,3,7,8-TCDD
2. 2,3,7,8-TCDF
3. 1,2,3,7,8-PeCDF
4. 1,2,3,4,7,8-HxCDF
5. 1,2,3,6,7,8-HxCDF
6. 2,3,4,7,8-PeCDF
7. 1,2,3,4,7,8-HxCDD + 1,2,3,7,8-PeCDD
8. 1,2,3,6,7,8-HxCDD
9. 1,2,3,7,8,9-HxCDD
10. 1,2,3,4,6,7,8-HxCDF
11. 2,3,4,6,7,8-HpCDD
12. 1,2,3,4,6,7,8-HpCDD
13. 1,2,3,4,6,7,8,9-OCDF
14. 1,2,3,4,6,7,8,9-OCDD



78 Semi-volatile Components on an Agilent J&W DB-UI 8270D

Column: DB-UI 8270D
122-9732
30 m x 0.25 mm, 0.25 µm

Instrument: Agilent 7890 Series GC
Carrier: Helium, 1.2 mL/min constant flow, septum, purge 3 mL/min, purge time on 0.7 min 50 mL/min, gas saver off
Oven: 30 °C (1.0 min), 15 °C/min to 100 °C, 20 °C/min to 240 °C (0.5 min), 15 °C to 325 °C (6.7 min)
Inlet: MMI in nonpulsed splitless mode, 1 µL at 275 °C
Inlet liner: Dual taper direct connect liner
Sampler: Agilent 7693, 10.0 µL syringe (p/n G4513-80216)
Detector: MSD: 325 °C Transfer line, 280 °C source, 150 °C quad, 35-500 amu range

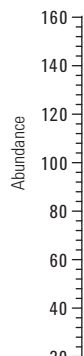


Example total ion chromatogram of a 78 component semi-volatile standard injection with a 10 ng on-column loading for each component.

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, quadrupole at 150 °C, transfer line at 300 °C, scan range 200-1000 amu



Suggested Supplies

Liner: Direct connect, dual taper, deactivated, 4 mm id, G1544-80700
Syringe: Autosampler syringe, 0.5 µL, 23 g, cone, 5188-5246

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

15+1 EU Priority PAHs

Resolution of Critical Pairs on an Agilent J&W DB-EUPAH Column

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

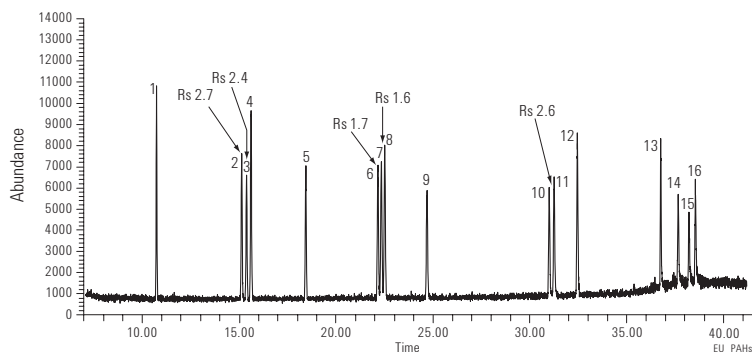
Instrument: Agilent 6890N/5975B MSD
Sampler: Agilent 7683B, 5.0 µL syringe, 0.5 µL splitless injection, injection speed 75 µL/min
Carrier: Helium, ramped flow 1.0 mL/min (0.2 min), 5 mL/min² to 1.7 mL/min
Inlet: 325 °C splitless, purge flow 60 mL/min at 0.8 min
Oven: 45 °C (0.8 min) to 200 °C (45 °C/min), 2.5 °C/min to 225 °C, 3 °C/min to 266 °C, 5 °C/min to 300 °C, 10 °C/min to 320 °C (4.5 min)
Detector: MSD source at 300 °C, quadrupole at 180 °C, transfer line at 330 °C, scan range 50-550 amu

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 dibenzo[a,h]anthracene. This application demonstrates that the DB-EUPAH column can provide excellent sensitivity and selectivity for the analysis of EU regulated PAHs.

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct connect, dual taper, deactivated, 4 mm id, G1544-80700
Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273

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



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, 0.50 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

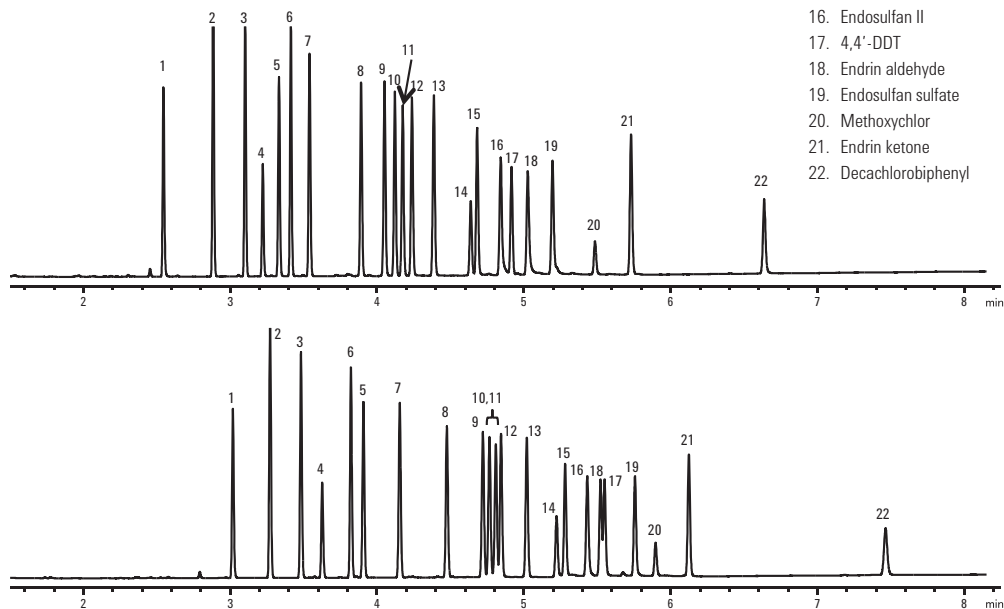
Sampler: Agilent 7693

Injection: 1 µL splitless

Detector: µECD at 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



**EPA Method 504.1 – 1,2 dibromoethane (EDB),
1,2-dibromo-3-chloropropane (DBCP),
and 1,2,3-trichloropropane (123TCP)**

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, 0.50 µm

Carrier: Helium, constant flow, 3.75 mL/min

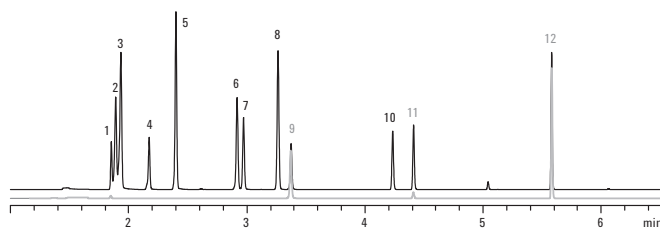
Oven: 50 °C, hold 1.5 min, 20 °C/min to 95 °C,
40 °C/min to 175 °C, hold 1.25 min

Injection: 2 µL, splitless, 200 °C

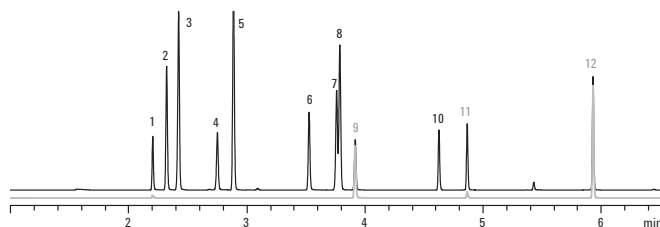
Detector: µECD, 300 °C

Sample: 100 ng/mL EPA 504.1 analytes, 100 ng/mL
chlorinated solvents + trihalomethanes

- | | |
|--------------------------|--|
| 1. Chloroform | 7. 1,1,2-Trichloroethane |
| 2. 1,1,1-Trichloroethane | 8. Dibromochloromethane |
| 3. Carbon tetrachloride | 9. 1,2-Dibromoethane (EDB) |
| 4. Trichloroethane | 10. Bromoform |
| 5. Bromodichloromethane | 11. 1,2,3-Trichloropropane (123TCP) |
| 6. Tetrachloroethane | 12. 1,2-Dibromo-3-chloropropane (DBCP) |



**100 ng/mL chlorinated solvents + THMs
100 ng/mL EPA 504.1 analytes**



**100 ng/mL chlorinated solvents + THMs
100 ng/mL EPA 504.1 analytes**

Agilent J&W DB-CLP1/DB-CLP2 columns analyze 1,2-dibromoethane (EDB), 1,2-dibromo-3-chloropropane (DBCP), and 1,2,3-trichloropropane (123TCP) according to EPA Method 504.1 with cooler analysis temperatures allowing a faster GC cycle time.

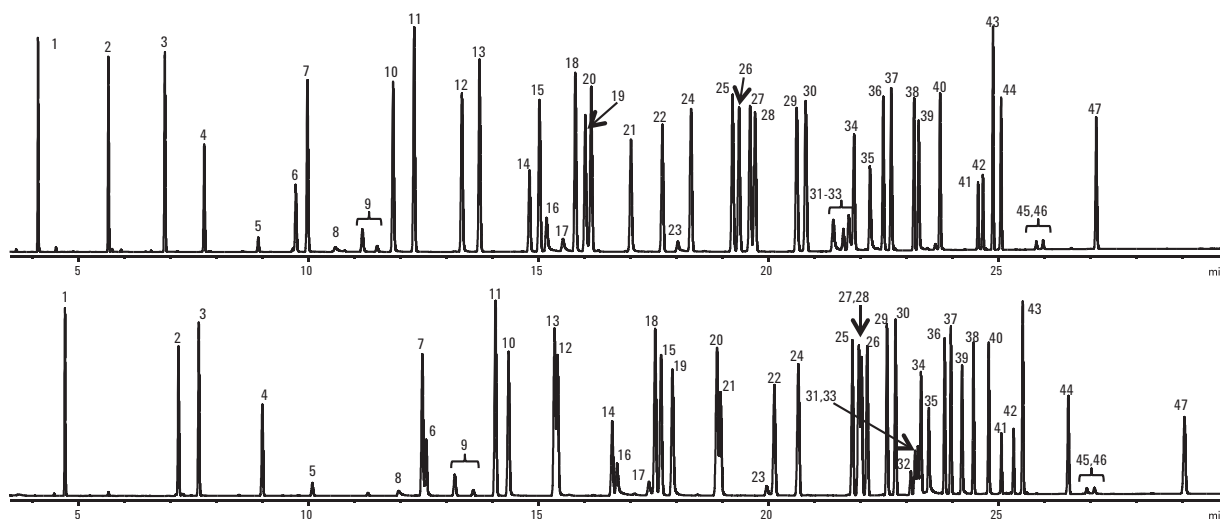
Organochlorine Pesticides, EPA Method 8081B

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/s (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 at 325 °C
Sample: 50 ng/mL 8081B analytes

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



DB-624UI Organic Acid Performance

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

Column: Non-Agilent 624, 30 m x 0.32 mm, 1.8 µm

Carrier: Hydrogen, 4 mL/min constant flow

Oven: 70 °C (1 min), then 20 °C/min to 260 °C

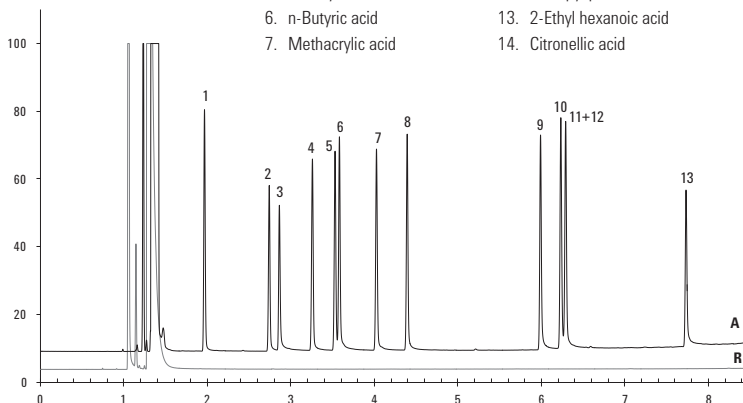
Inlet: 250 °C, 1 µL, split 1:200

Inlet liner: 4 mm, glass wool

Detector: FID at 260 °C

Organic acid mix C₁-C₁₀ (6 to 17 ng) on a DB-624UI column (A) and a traditional non-Agilent 624 column (R) after conditioning at 260 °C for 1 h.

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



EPA Method 551 – Chlorinated Solvents, Trihalomethanes (THMs), and Disinfection Byproducts (DBPs)

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

Carrier: Helium, constant flow, 45 cm/s

Oven: 35 °C, hold 5.75 min, 20 °C/min to 95 °C, 40 °C/min to 200 °C, hold 1.25 min

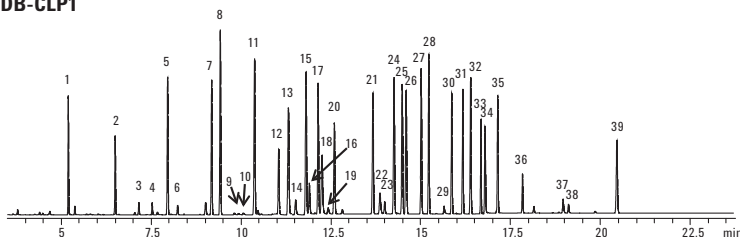
Column: DB-CLP2
123-8336
30 m x 0.32 mm, 0.50 µm

Injection: 2 µL splitless, 200 °C

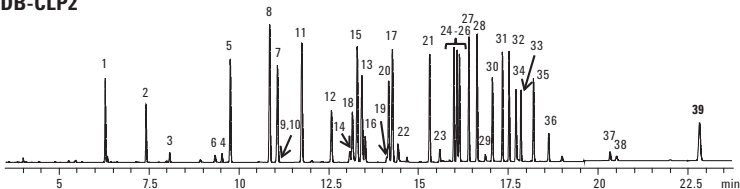
Detector: µECD, 300 °C

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

DB-CLP1



DB-CLP2



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

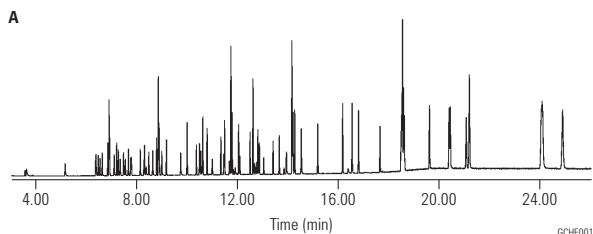
Carrier: He constant flow mode, 1.1 mL/min

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

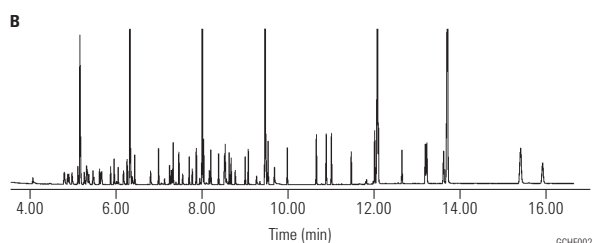
Injection: Splitless 0.5 µL injected at 300 °C,
QuickSwap pressure 5.0 psi during acquisition,
80.0 psi during backflush with inlet set to
1.0 psi during backflush

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.



US 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



US 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



TIPS & TOOLS

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



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/s (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 s purge activation time

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

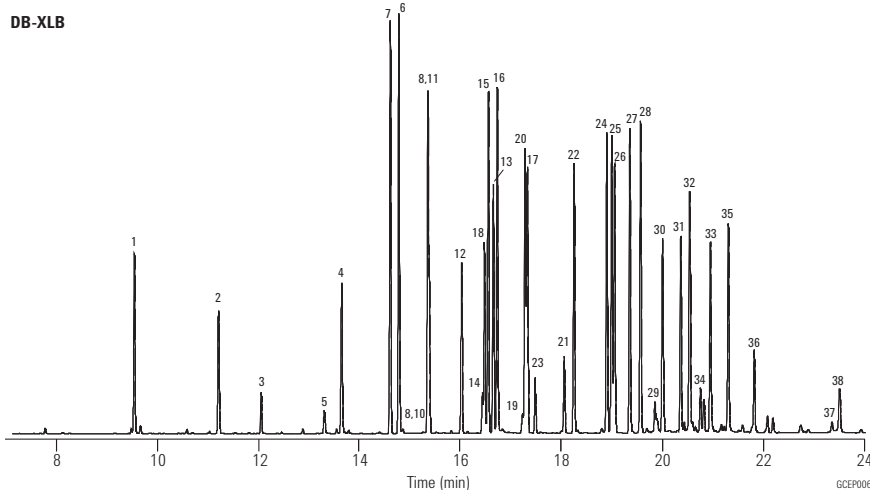
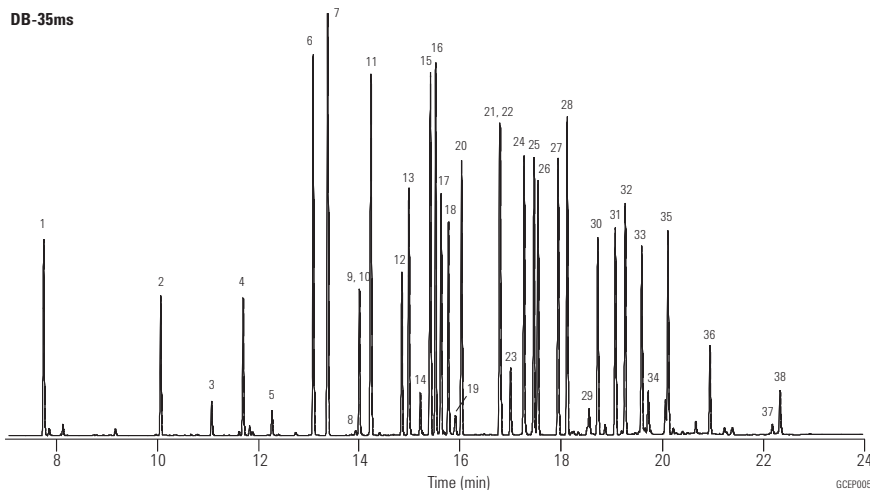
Sample: 50 µg per component

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/s (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 s purge activation time

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

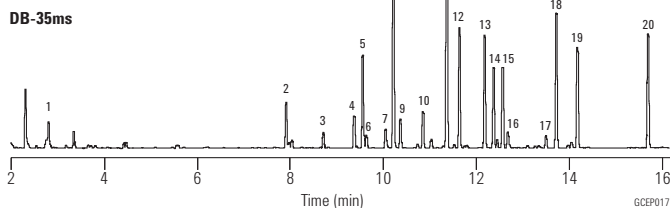
Sample: 50 pg per component

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. Acifluorfen

**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

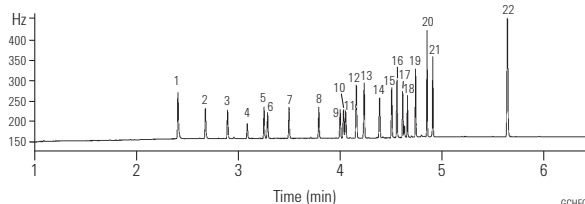
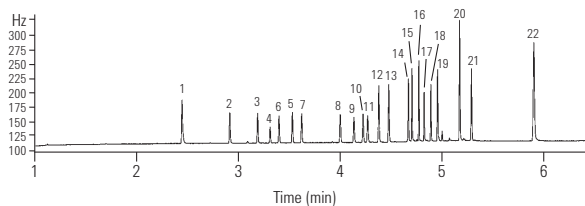
Carrier: Hydrogen (69 cm/s at 120 °C,
ramped at 99 mL/min to
106 cm/s at 4.4 min)

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 min, gas saver flow
20 mL/min on 3 min)

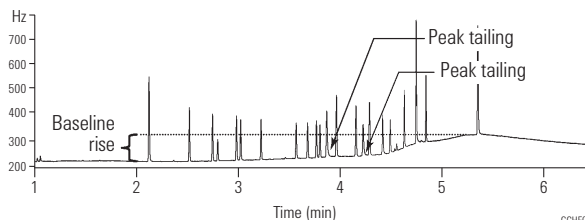
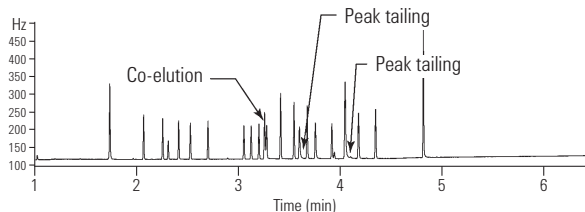
Detector: µECD 320 °C; nitrogen makeup;
constant column + makeup flow 60 mL/min

**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**



The DB-17ms primary column and DB-XLB confirmatory column sufficiently resolved all the peaks of interest in less than six 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

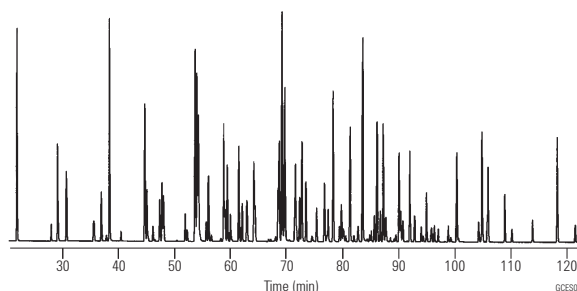
Carrier: Helium at 37 cm/s, measured at 150 °C

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 isoctane, 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

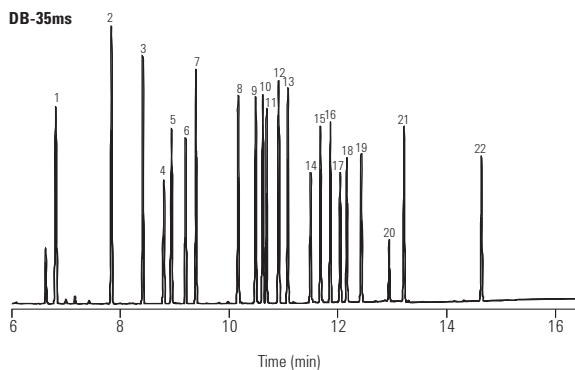
Carrier: Helium at 45 cm/s
(EPC in constant flow mode)

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

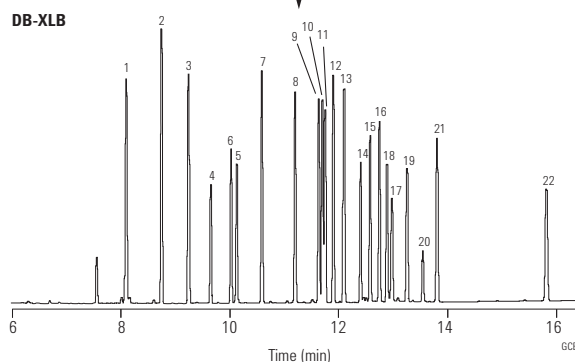
Injection: Splitless, 250 °C
30 s purge activation time

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

Sample: 50 pg per component



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

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

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/s (1.5 mL/min)

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

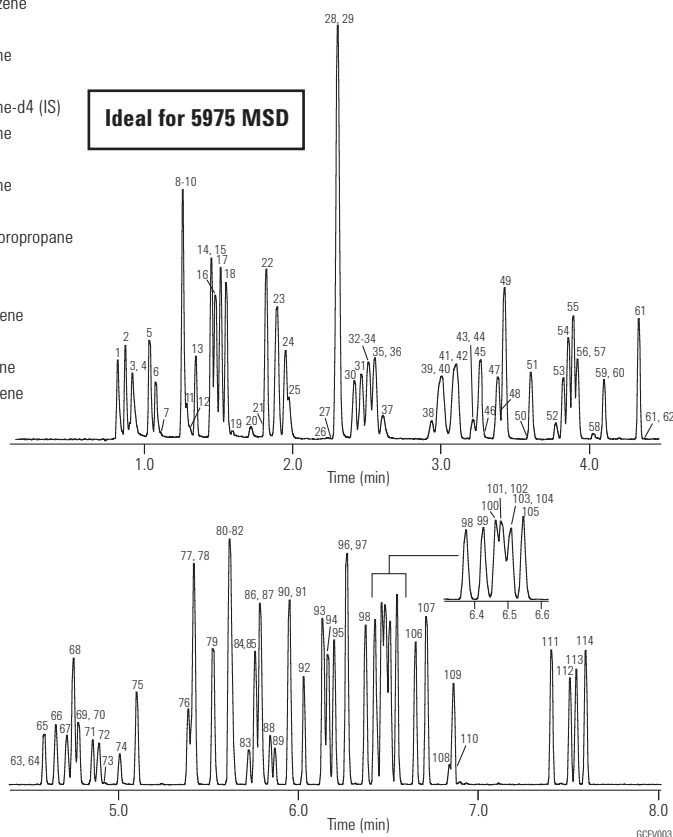
Oven: 45 °C for 3.0 min
45-190 °C at 36 °C/min
190-225 °C at 20 °C/min
225 °C for 0.5 min

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

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

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

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



Suggested Supplies

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

PBDEs

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

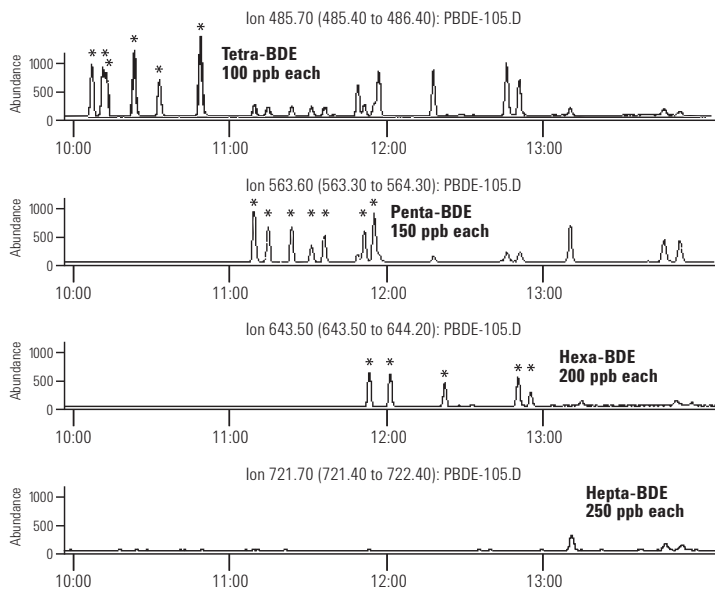
Carrier: Helium at 38 cm/s at 100 °C (1.2 mL/min),
constant flow mode

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 "Literature" from the 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/s, 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

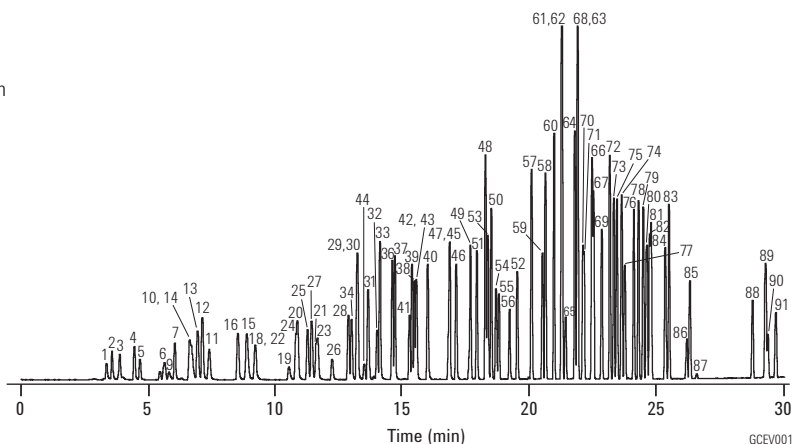
Detector: MSD, 235 °C transfer line
Full scan 35-260 amu (m/z 44 subtracted)

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

EPA Method 525.2

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

Carrier: Helium at 32 cm/s, 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

Suggested Supplies

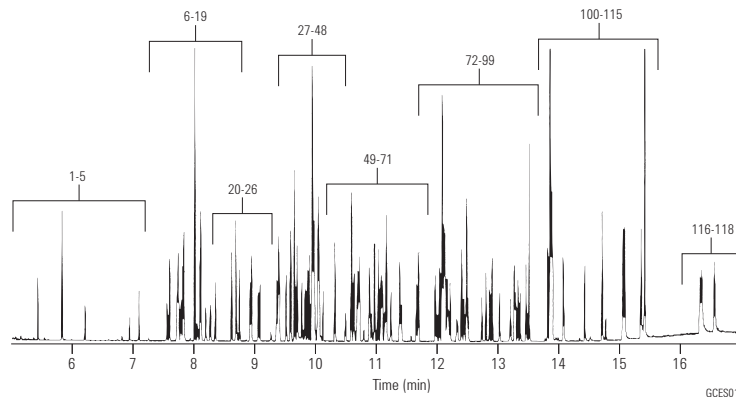
Septum: 11 mm Advanced Green septa, 5183-4759

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

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

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

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



Pesticides and Fire Retardants (US EPA 527)

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

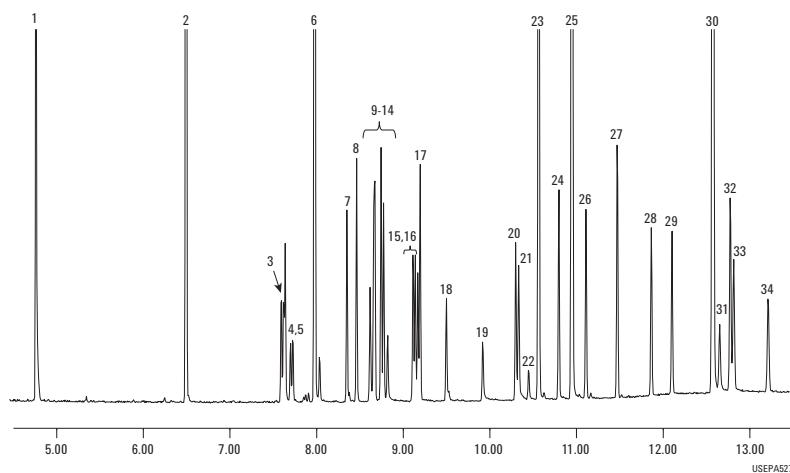
Carrier: Helium, 52 cm/s, constant flow

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 at 1 min,
gas saver 80 mL/min on at 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 | 18. Fenamiphos |
| 2. Acenaphthalene-D10 | 19. Nitrophen |
| 3. Dimethoate | 20. Norflurazon |
| 4. Atrazine | 21. Kepone |
| 5. Propazine | 22. Hexazinone |
| 6. Anthracene-D10 | 23. Triphenyl phosphate |
| 7. Vinclozoline | 24. Bifenthrin |
| 8. Prometryn | 25. Chrysene-D12 |
| 9. Bromacil | 26. BDE-47 |
| 10. Malathion | 27. Mirex |
| 11. Thiazopyr | 28. BDE-100 |
| 12. Dursban | 29. BDE-99 |
| 13. Benthicarb | 30. Perylene-D12 |
| 14. Parathion | 31. Fenvalerate |
| 15. Terbufos sulfone | 32. Esfenvalerate |
| 16. Bioallethrin | 33. Hexabromobiphenyl |
| 17. Oxychlorane | 34. BDE-153 |

**EPA Method 508.1 –
Chlorinated Pesticides and Herbicides**

**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, 0.50 µm**

Carrier: Helium, constant flow, 35 cm/s

Oven: 80 °C, hold 0.5 min, 26 °C/min to 175 °C, 6.5 °C/min to 235 °C, 15 °C/min to 300 °C, hold 6 min

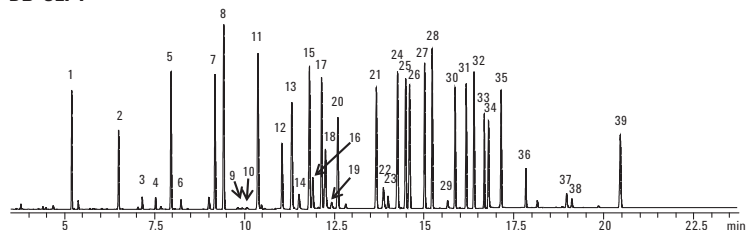
Injection: 2 µL, splitless, 250 °C

Detector: µCED, 340 °C

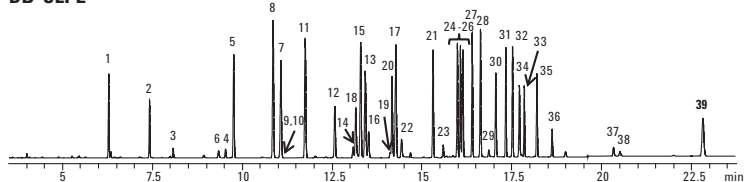
Sample: 100 ng/mL EPA 508.1 analytes,
100 ng/mL pesticide surrogate mix

- | | |
|--|---|
| 1. Hexachlorocyclopentadiene | 20. DCPA |
| 2. Etridiazole | 21. Heptachlor epoxide |
| 3. Chloroneb | 22. Cyanazine |
| 4. Trifluralin | 23. Butachlor |
| 5. Tetrachloro-m-xylene (surrogate standard) | 24. γ-Chlordane |
| 6. Propachlor | 25. α-Chlordane |
| 7. Hexachlorobenzene | 26. Endosulfan I |
| 8. α-BHC | 27. 4,4'-DDE |
| 9. Atrazine | 28. Dieldrin |
| 10. Simazine | 29. Chlorobenzilate |
| 11. γ-BHC | 30. Endrin |
| 12. β-BHC | 31. 4,4'-DDD |
| 13. Heptachlor | 32. Endosulfan II |
| 14. Alachlor | 33. 4,4'-DDT |
| 15. δ-BHC | 34. Endrin aldehyde |
| 16. Chlorothalonil | 35. Endosulfan sulfate |
| 17. Aldrin | 36. Methoxychlor |
| 18. Metribuzin | 37. cis-Permethrin |
| 19. Metolachlor | 38. trans-Permethrin |
| | 39. Decachlorobiphenyl (surrogate standard) |

DB-CLP1



DB-CLP2



The DB-CLP1 column separates all chlorinated pesticide and herbicide analytes according to EPA Method 505.

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/s (80 °C) constant flow

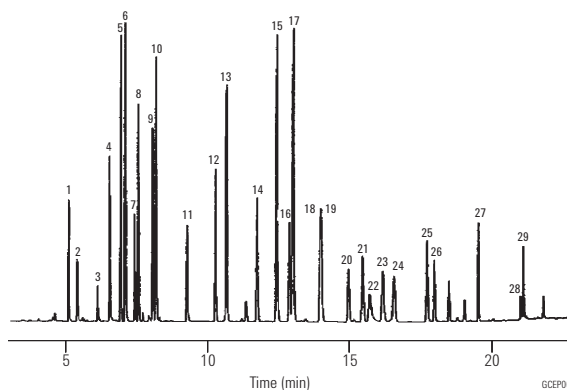
Oven: 80 °C for 1 min
80-180 °C at 30 °C/min
180-205 °C at 3 °C/min
205 °C for 4 min
205-290 °C at 2 °C/min
290 °C for 2 min

Injection: Splitless
1 min purge delay

Detector: ECD, 320 °C
Nitrogen makeup gas at 60 mL/min
Anode purge 3 mL/min

Sample: 1 µL

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



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

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

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

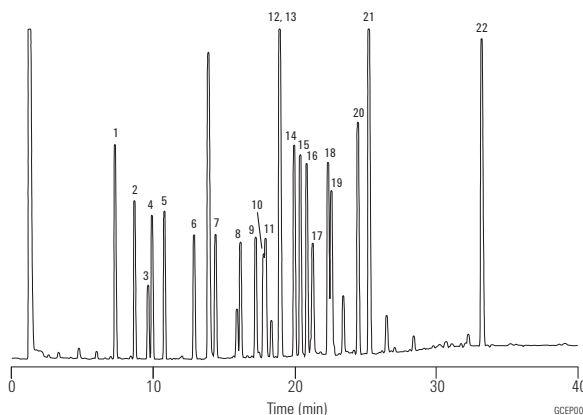
Oven: 150-275 °C at 4 °C/min
275 °C for 30 min

Injection: Splitless, 250 °C

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

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

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



Suggested Supplies

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

Organochlorine Pesticides III

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

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

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

Injection: Splitless, 250 °C

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

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

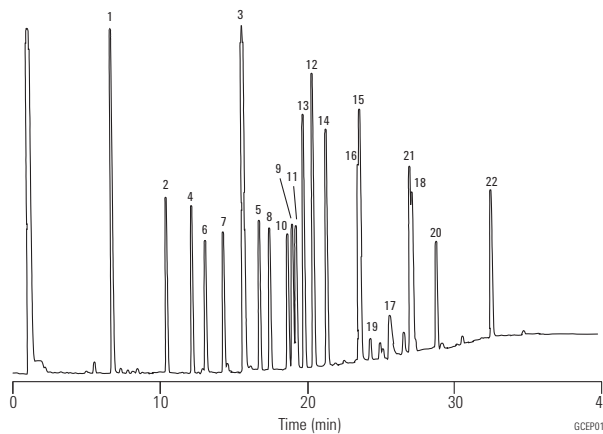
- | | |
|--------------------------------------|-----------------------------|
| 1. 2,4,5,6-Tetrachloro-m-xylene (IS) | 12. Dieldrin |
| 2. α-BHC | 13. p,p'-DDE |
| 3. β-BHC | 14. Endrin |
| 4. γ-BHC | 15. Endosulfan II |
| 5. δ-BHC | 16. p,p'-DDD |
| 6. Heptachlor | 17. Endrin aldehyde |
| 7. Aldrin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

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

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

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



Organochlorine Pesticides IV

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

Carrier: Helium at 30 cm/s (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 μ L of 100 μ g/ μ L standard in isooctane

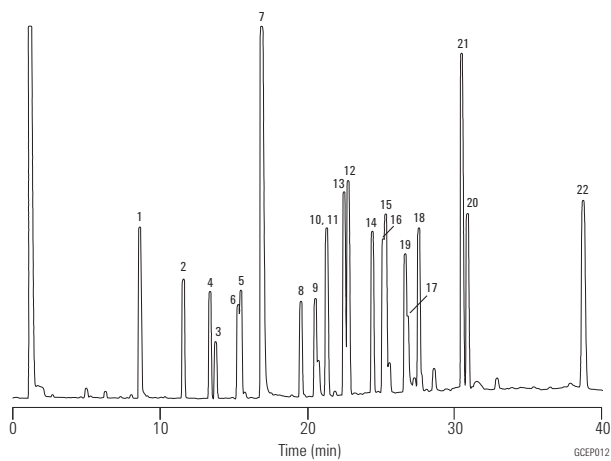
- | | |
|--------------------------------------|-----------------------------|
| 1. 2,4,5,6-Tetrachloro-m-xylene (IS) | 12. Dieldrin |
| 2. α -BHC | 13. p,p'-DDE |
| 3. β -BHC | 14. Endrin |
| 4. γ -BHC | 15. Endosulfan II |
| 5. δ -BHC | 16. p,p'-DDD |
| 6. Heptachlor | 17. Endrin aldehyde |
| 7. Aldrin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

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

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

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



Organochlorine Pesticides, DB-5/DB-1701P

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

Carrier: Helium at 29.2 cm/s, 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

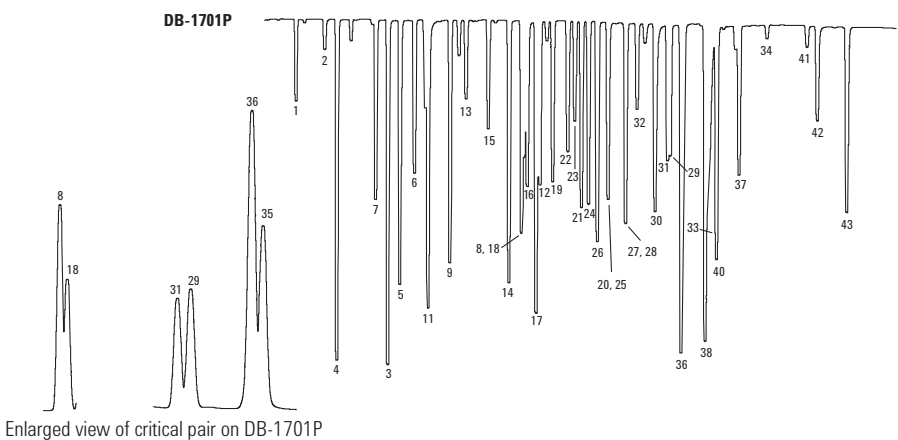
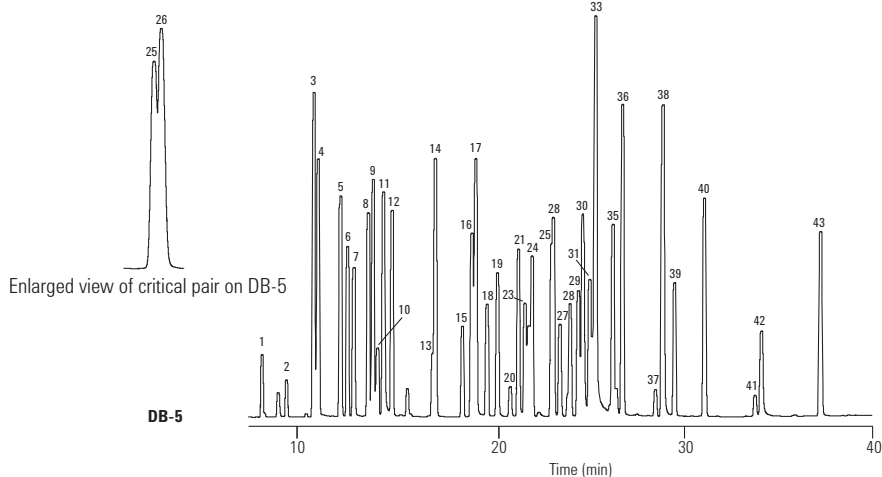
Column: DB-1701P
123-7732
30 m x 0.32 mm, 0.25 µm

Injection: Splitless, 200 °C

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

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

Sample: 2.0 µL, 20-200 pg/µL

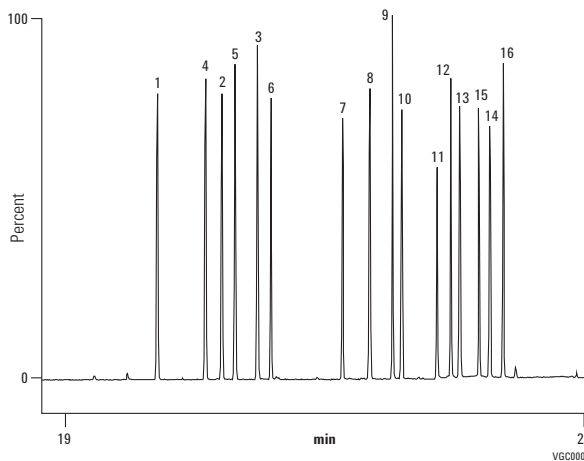


1. Etridiazole
2. Chloroneb
3. Propachlor
4. Tetrachloro-m-xylene (IS)
5. Trifluralin
6. α-BHC
7. Hexachlorobenzene
8. β-BHC
9. γ-BHC
10. Pentachloronitrobenzene
11. p,p'-Dichlorobiphenyl
12. δ-BHC
13. Heptachlor
14. Alachlor
15. Aldrin
16. Chlorpyrifos
17. DCPA
18. Isodrin
19. Heptachlor epoxide
20. 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. Carbofenthothion
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. Heptachlor epoxide
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

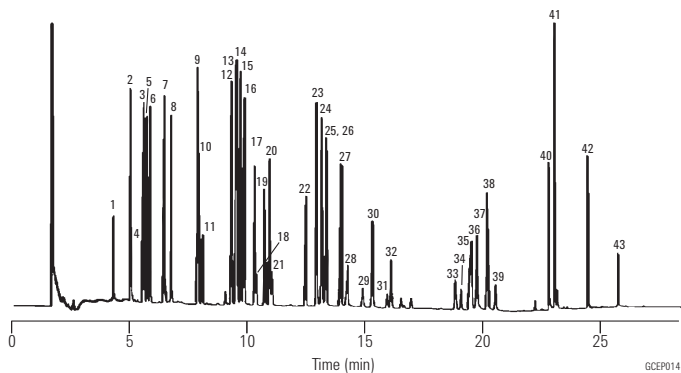
Nitrogen/Phosphorus Containing Pesticides, EPA Method 507

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

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

Herbicides I

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

Carrier: Helium at 32 cm/s, 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 s purge activation time

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

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

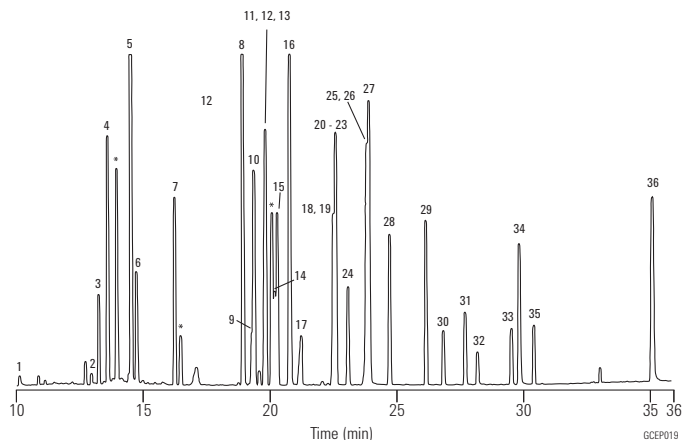
Suggested Supplies

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



* Impurity

Herbicides II

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

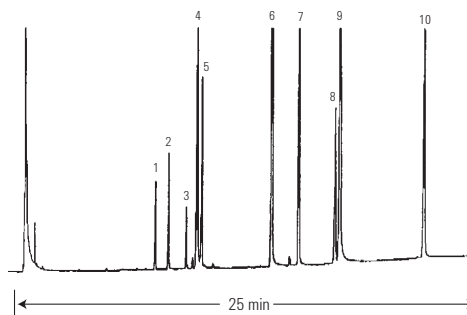
Carrier: Helium at 35 cm/s

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 |



C₁ and C₂ Halocarbons (Freons)

Column: GS-GasPro
113-4362
60 m x 0.32 mm

Carrier: Helium at 35 cm/s, 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

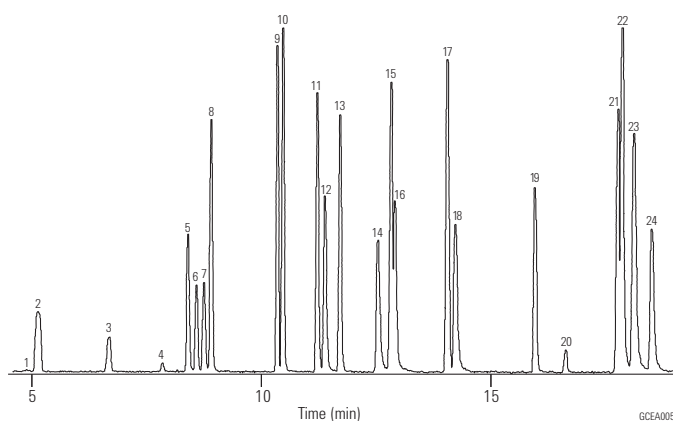
Injection: Splitless, 250 °C
0.20 min purge activation time

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

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



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

*Peak not shown

Nitrogen Containing Herbicides (EPA Method 507)

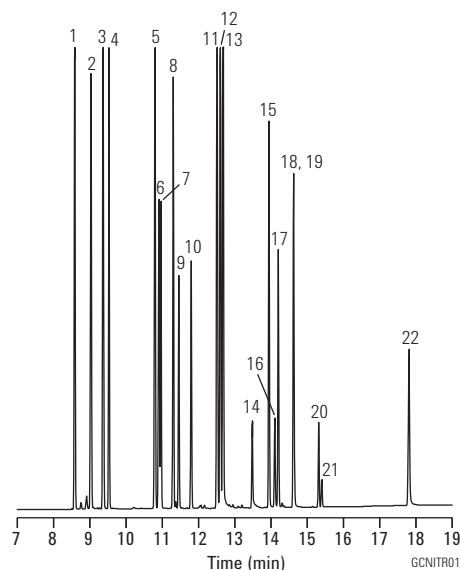
Column: DB-35
125-1937
30 m x 0.53 mm, 0.50 µm

Carrier: Helium at 38 cm/s (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. Paarlant
18. Prowl
19. Bromacil
20. Oxadiazon
21. GOAL
22. Hexazinone

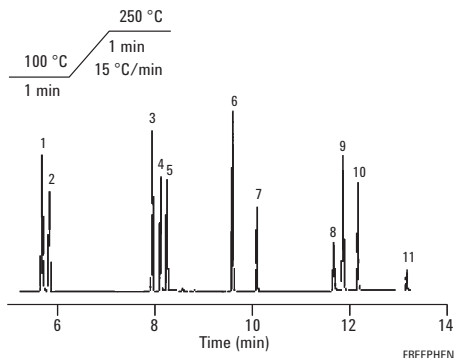
Free Phenols

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

Carrier: Hydrogen, constant flow 45 cm/s

Injection: Split, 100:1

Detector: FID, 300 °C



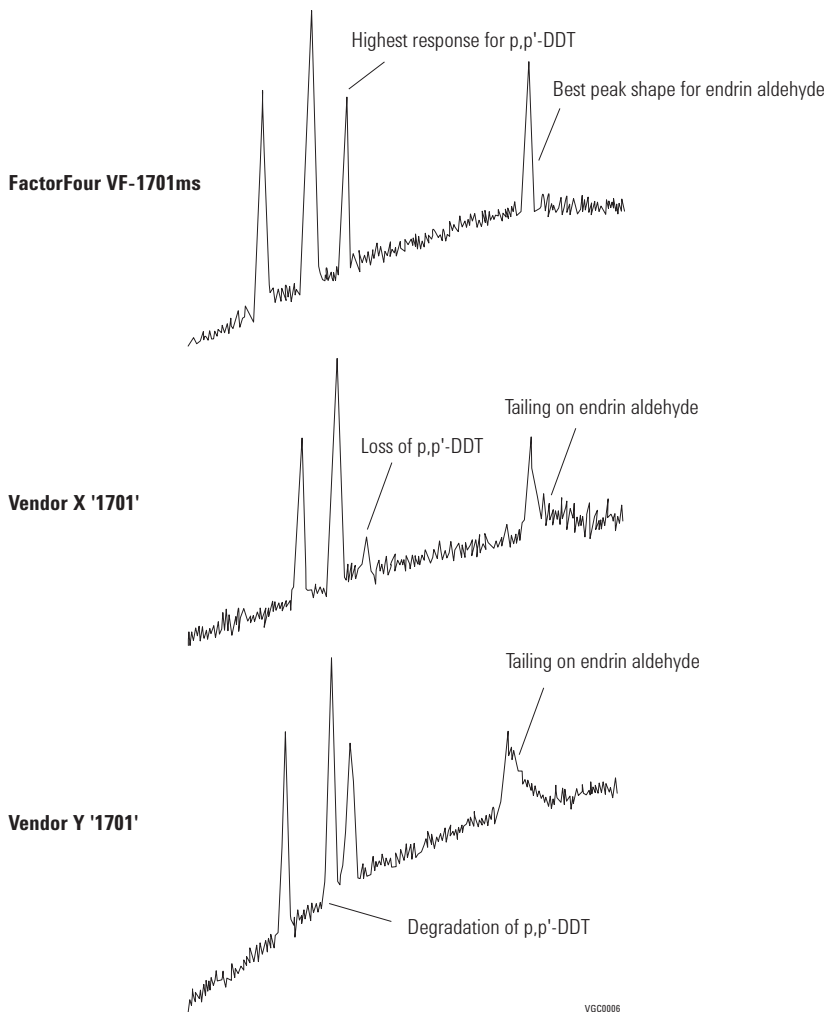
1. Phenol
2. 2-Chlorophenol
3. 2,4-Dimethylphenol
4. 2-Nitrophenol
5. 2,4-Dichlorophenol
6. 4-Chloro-3-methylphenol
7. 2,4,6-Trichlorophenol
8. 2,4-Dinitrophenol
9. 4-Nitrophenol
10. 2-Methyl-4,6-dinitrophenol
11. Pentachlorophenol

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

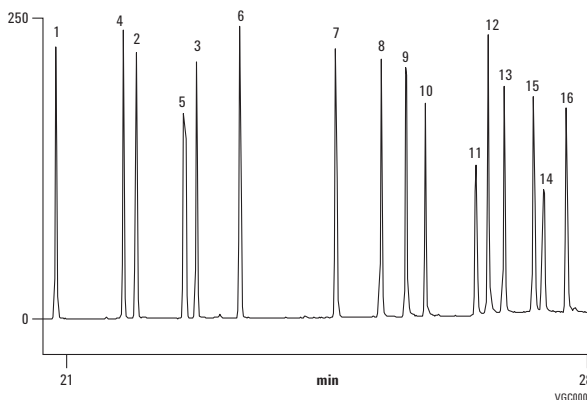
Column: VF-35ms
CP8877
30 m x 0.25 mm, 0.25 µm

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. Heptachlor epoxide
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

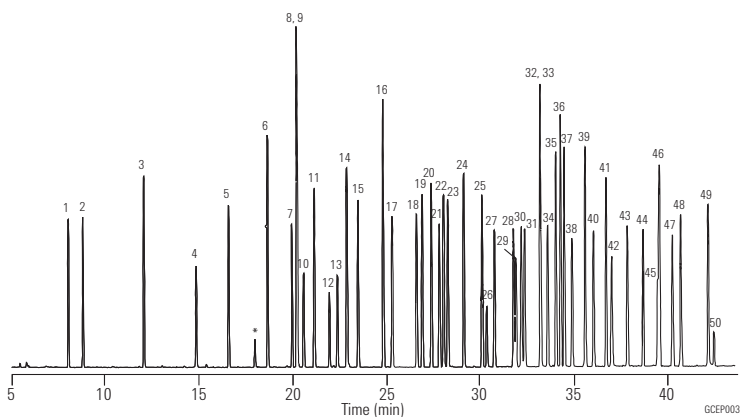
Carrier: Helium at 35 cm/s, measured at 50 °C

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 s purge activation time

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

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



1. 1,2-Dibromo-3-chloropropane
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. Dibutyl chlorendate (SS)
45. Captafol
46. Methoxychlor
47. Endrin ketone
48. Mirex
49. cis-Permethrin
50. trans-Permethrin

* Breakdown Products
SS - Surrogate Standard
IS - Internal 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

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

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/s, 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 s purge activation time

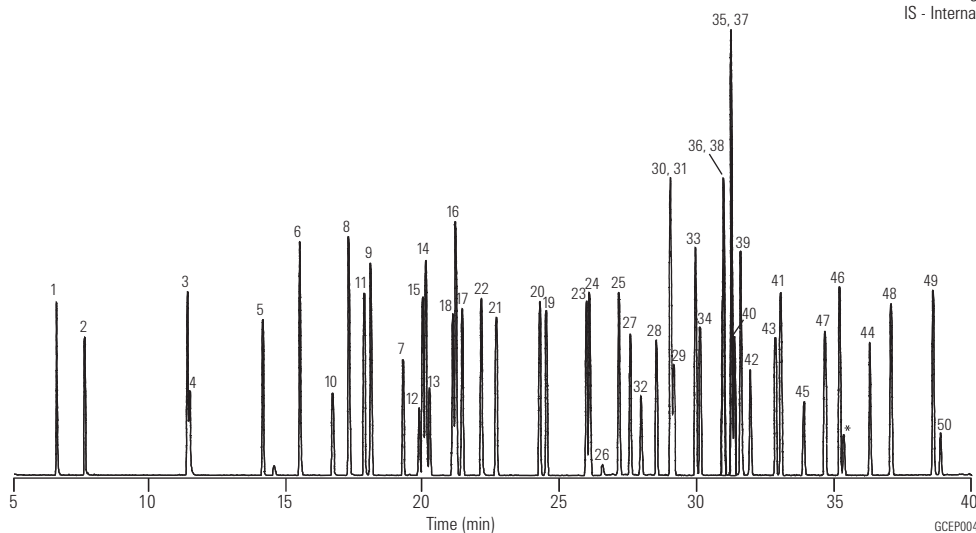
Detector: MSD, 300 °C transfer line
Full scan at m/z 50-500

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

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

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

* Breakdown Products
SS - Surrogate Standard
IS - Internal Standard



Organophosphorus Pesticides in Apple Matrix

Column: DB-35ms Ultra Inert
121-3822UI
20 m x 0.18 mm, 0.18 μ m

Instrument: Agilent 7890 GC/Agilent 5975C Series GC/MSD

Sampler: Agilent 7683B automatic liquid sampler,
5.0 μ L syringe (p/n 5181-1273)

CFT Device: Purged 2-way splitter (p/n G3180B)
Split Ratio MSD:FPD = 3:1

MSD Restrictor: 1.2 m x 0.15 mm id deactivated fused silica tubing

FPD Restrictor: 1.4 m x 0.15 mm id deactivated fused silica tubing

PCM 1: 3.8 psi constant pressure

Inlet: 1 μ L splitless; 250 °C, purge flow 60 mL/min
at 0.25 min, gas saver on at 2 min 20 mL/min

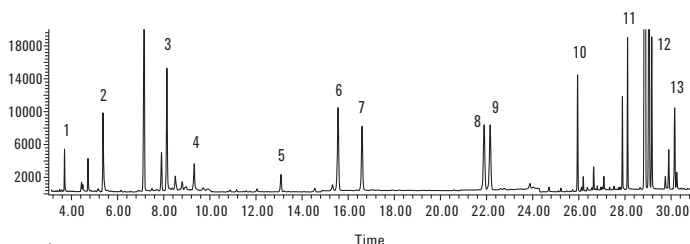
Carrier: Helium, constant pressure 43.5 psi at 95 °C

Oven: 95 °C (1.3 min), 15 °C/min to 125 °C, 5 °C/min to
165 °C, 2.5 °C/min to 195 °C, 20 °C/min to 280 °C
(3.75 min)

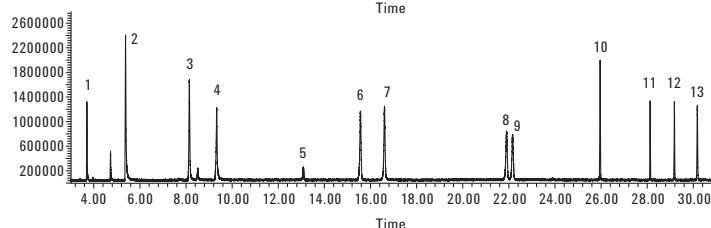
Postrun Backflush: 5 min at 280 °C, PCM 1 pressure 70 psi during
backflush, 2 psi inlet pressure during backflush

Detector: 310 °C transfer line, 310 °C source, 150 °C quad

1. Oxydemeton-methyl
2. Methamidophos
3. Mevinphos
4. Acephate
5. Naled
6. Diazinon
7. Dimethoate
8. Chlorpyrifos
9. Malathion
10. Methidathion
11. TPP (surrogate std)
12. Phosmet



MSD (SIM): 600 ng/mL



FPD (P): 200 ng/mL

GC/MS-SIM and FPD chromatograms of a matrix matched organophosphorus pesticides standard analyzed on an Agilent J&W DB-35ms UI column. The effluent split ratio is MSD:FPD = 3:1.

Environmental Applications, Semivolatiles

Agilent's Ultra Inert Test Probe Mixture

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

Carrier: Hydrogen, constant pressure, 38 cm/s

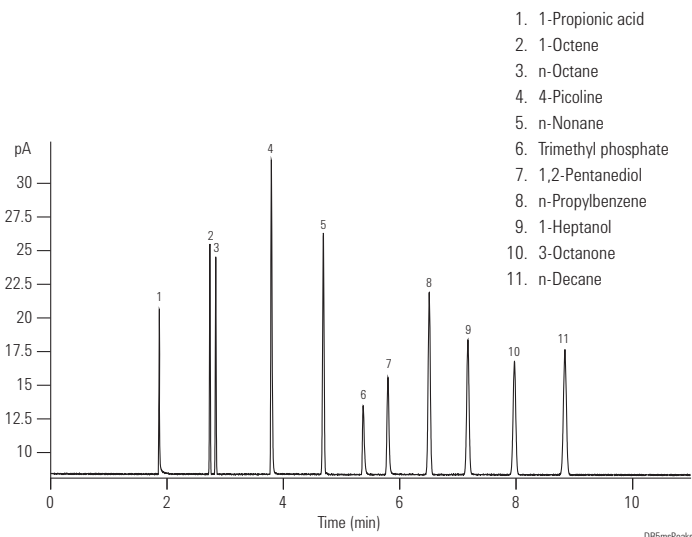
Oven: 65 °C isothermal

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

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

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

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



Trace Level Polycyclic Aromatic Hydrocarbon (PAH) Analyses

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

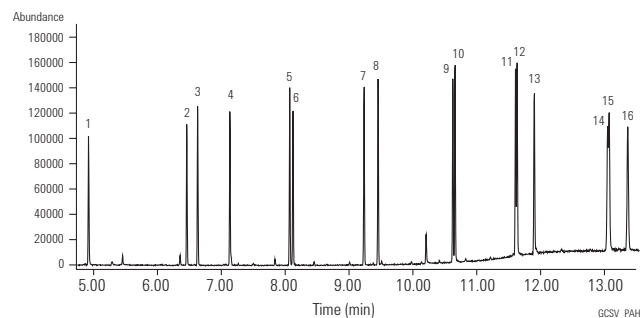
Carrier: Helium constant flow 30 cm/s

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

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

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

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



Tetrachlorodibenzo-p-furans

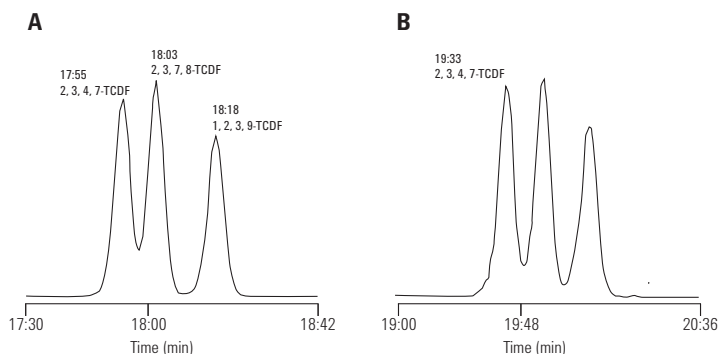
Column A: DB-225
122-2232
30 m x 0.25 mm, 0.25 µm

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

Carrier: Helium at 12 mL/min

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

Injection: Splitless, 240 °C



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 Agilent J&W 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/s, 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

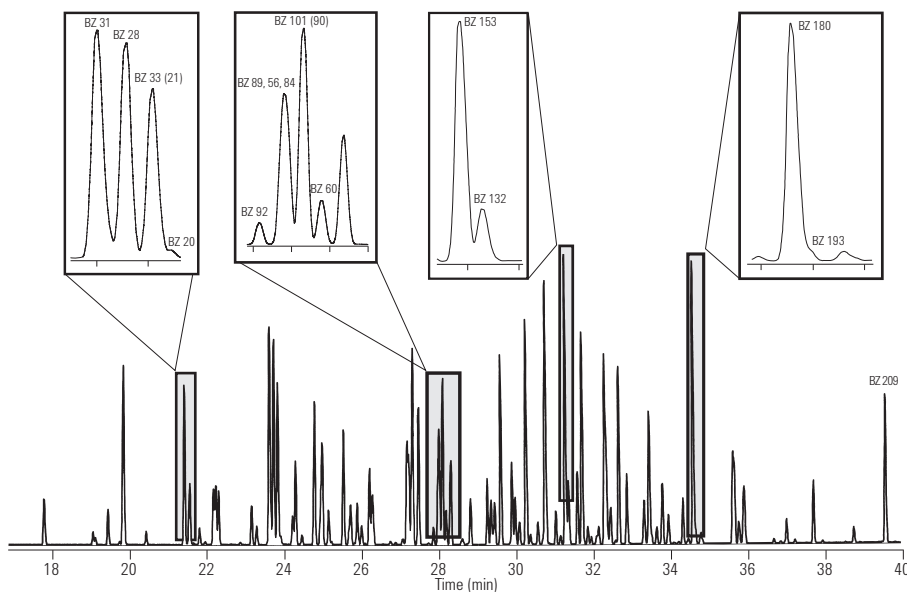
Sample: 2 µL dilute Aroclor mixture

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

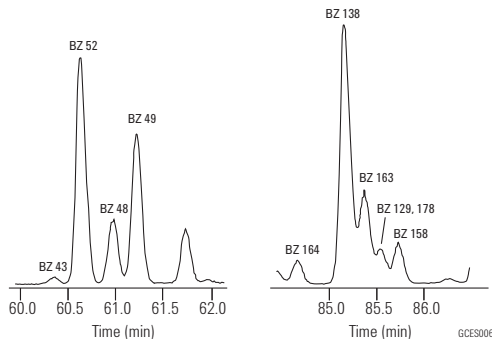
Carrier: Helium at 34.2 cm/s, measured at 150 °C

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

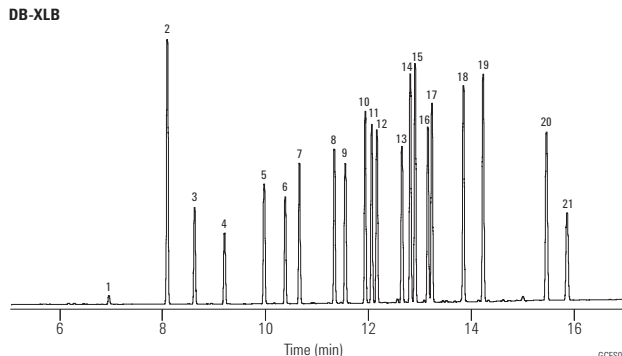
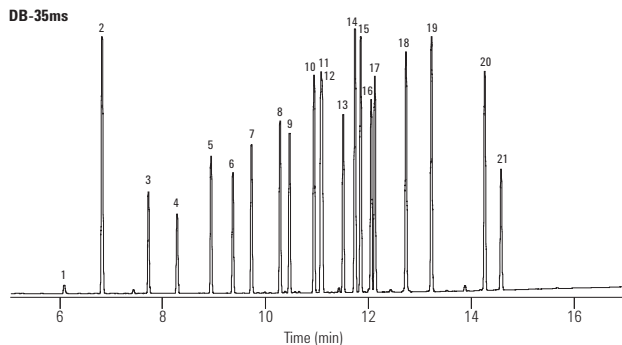
Carrier: Helium at 45 cm/s
(EPC in constant flow mode)

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

Injection: Splitless, 250 °C
30 s 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

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

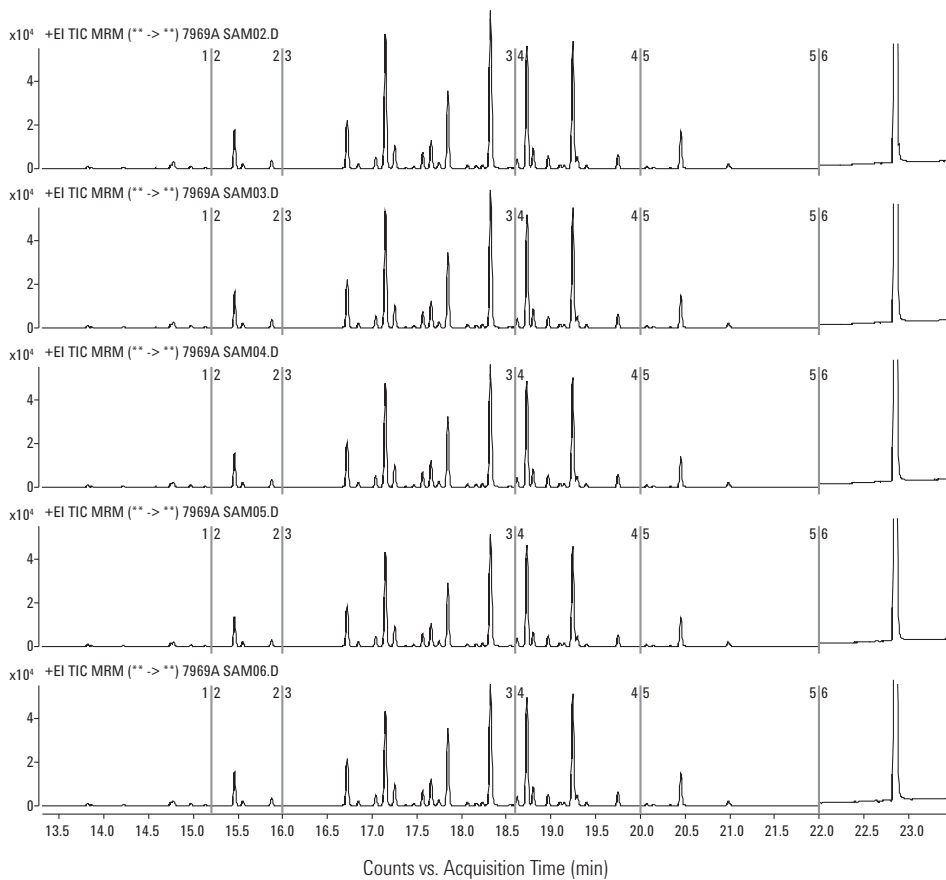
**Automated Cleanup of PCB extracts from Waste Oil
Using 7696A Sample Prep Workbench**

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

Instrument: Agilent 7000 Triple Quadrupole GC/MS system
Carrier: Helium, 1 mL/min constant flow
During backflush: 2 mL/min
Oven: 80 °C (1 min), 10 °C/min to 305 °C, 7.5 min hold
Injection: 1 µL, pulsed splitless
QuickSwap: 28 kPa constant pressure
Backflush: Start at 23.5 min

Detector: MRM mode
CE 25 V, dwell time 100 ms per transition
Trichloro-biphenyls: 256.0 > 186.0; 258.0 > 186.0
Tetrachloro-biphenyls: 293.8 > 222.0; 291.8 > 222.0
Pentachloro-biphenyls: 325.8 > 256.0; 327.8 > 256.0
Hexachloro-biphenyls: 359.9 > 289.9; 361.9 > 289.9
Heptachloro-biphenyls: 393.8 > 323.8; 395.8 > 323.8
Octachloronaphthalene (IS): 404.0 > 404.0 (CE OV)

Sample: Reference sample BCR-449, five aliquots



Pyrethrins

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

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

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

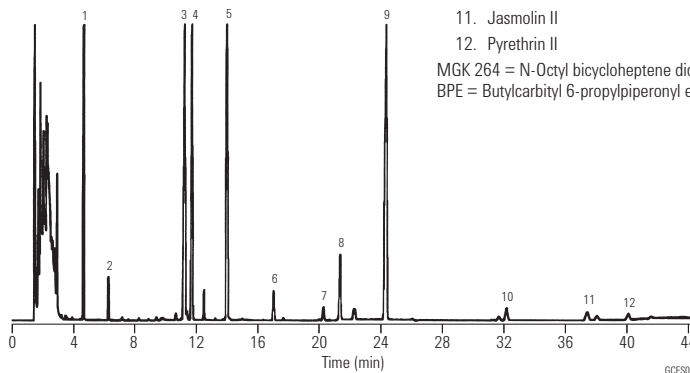
Injection: Split, 250 °C
Split ratio 1:20

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

Sample: 1 µL

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

MGK 264 = N-Octyl bicycloheptene dicarboximide
BPE = Butylcarbityl 6-propylpiperonyl ether

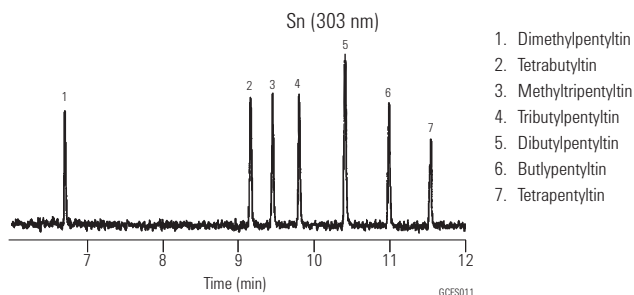


Chromatogram courtesy of Khan Nguyen and Richard Moorman of Sandoz Agro Inc.

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

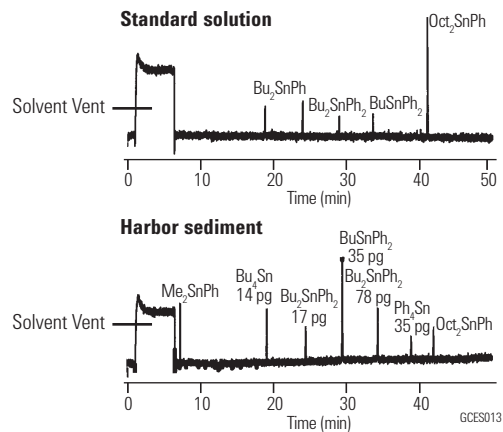
**Suggested Supplies**

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

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 nm
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

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/s

Sample: 1 µL of 50 ng standard

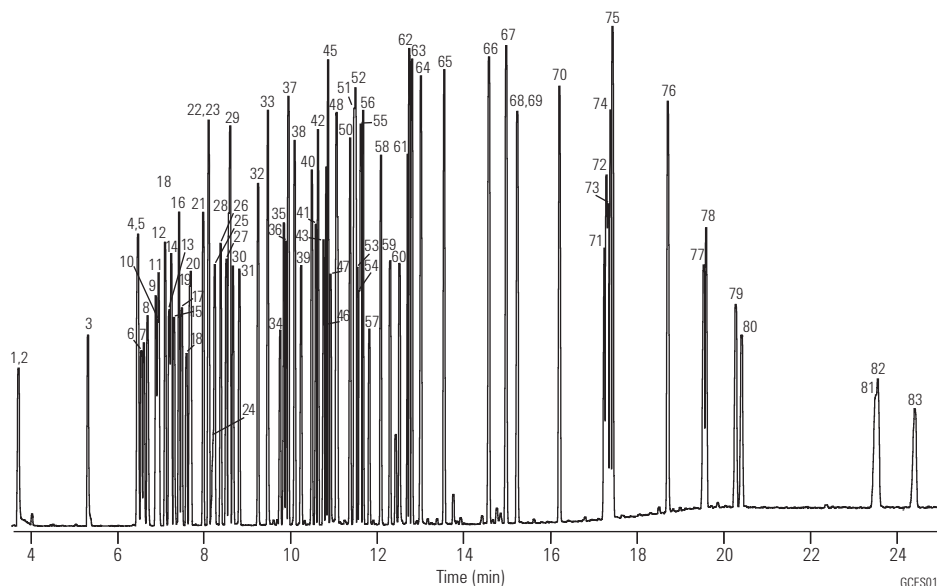
Suggested Supplies

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 | 36. 2,4,5-Trichlorophenol | 52. Fluorene | 68. Terphenyl-d14 |
| 2. Pyridine | 37. 2-Fluorobiphenyl | 53. 4-Nitroaniline | 69. Benzidine |
| 3. 2-Fluorophenol | 38. 2-Chloronaphthalene | 54. 4,6-Dinitro-2-methylphenol | 70. Butylbenzylphthalate |
| 4. Phenol-d5 | 39. 2-Nitroaniline | 55. n-Nitrosodiphenylamine | 71. 3,3'-Dichlorobenzidine |
| 5. Phenol | 40. Dimethyl phthalate | 56. Azobenzene | 72. Benzo[a]anthracene |
| 6. Aniline | 41. 2,6-Dinitrotoluene | 57. 2,4,6-Tribromophenol | 73. Chrysene-d12 |
| 7. Bis(2-chloroethyl) ether | 42. Acenaphthylene | 58. 4-Bromophenyl-phenylether | 74. Chrysene |
| 8. 2-Chlorophenol | 43. 3-Nitroaniline | 59. Hexachlorobenzene | 75. Bis(2-ethylhexyl) phthalate |
| 9. 1,3-Dichlorobenzene | 44. Acenaphthene-d10 | 60. Pentachlorophenol | 76. Di-n-octylphthalate |
| 10. 1,4-Dichlorobenzene-d4 | 45. Acenaphthene | 61. Phenanthrene-d10 | 77. Benzo[b]fluoranthene |
| 11. 1,4-Dichlorobenzene | 46. 2,4-Dinitrophenol | 62. Phenanthrene | 78. Benzo[k]fluoranthene |
| 12. Benzyl alcohol | 47. 4-Nitrophenol | 63. Anthracene | 79. Benzo[a]pyrene |
| 13. 1,2-Dichlorobenzene | 48. Dibenzofuran | 64. Carbazole | 80. Perylene-d12 |
| 14. 2-Methylphenol | 49. 2,4-Dinitrotoluene | 65. Di-n-butyl phthalate | 81. Indeno[1,2,3-cd]pyrene |
| 15. Bis(2-chloroisopropyl) ether | 50. Diethyl phthalate | 66. Fluoranthene | 82. Dibenz[a,h]anthracene |
| 16. 4-Methylphenol | 51. 4-Chlorophenyl-phenyl ether | 67. Pyrene | 83. Benzo[g,h,i]perylene |



A variety of 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.

US EPA Method 8061 (Phthalate Esters)

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

Carrier: Helium at 49 cm/s, 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 s purge activation time

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

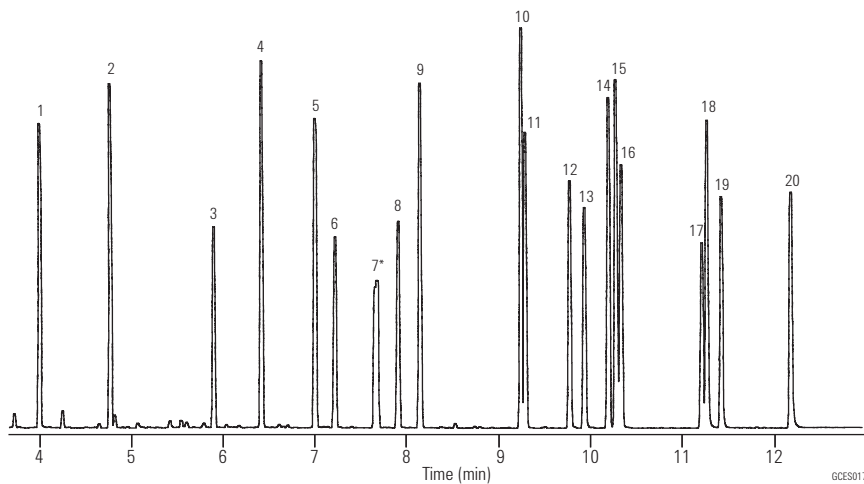
Sample: 1 µL of 20 ng/µL
Method 8061 mixture (AccuStandard) in hexane

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

PAHs

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

Carrier: Helium at: 34.1 cm/s, 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

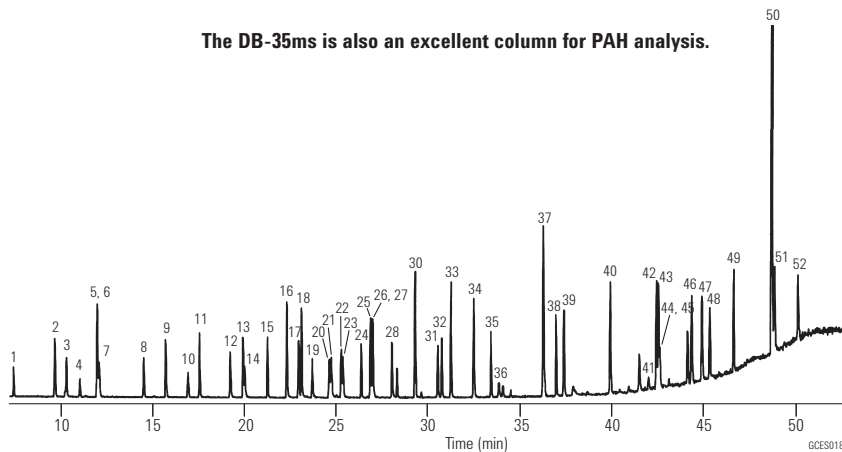
Septum: 11 mm Advanced Green septa, 5183-4759

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

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



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

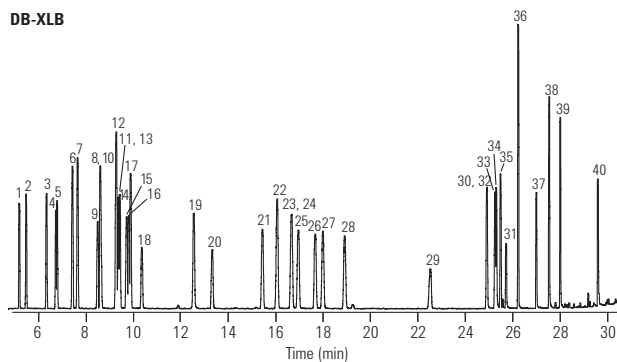
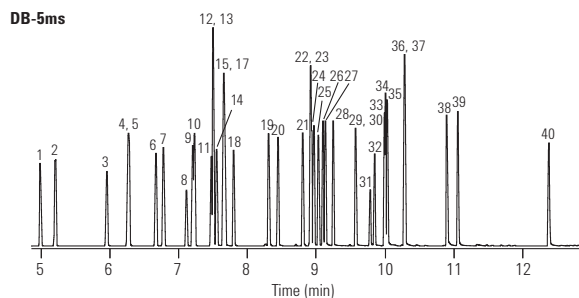
Oven: 40 °C for 2 min
40-100 °C at 40 °C/min
100 °C for 0.50 min
100-140 °C at 2 °C/min
140-340 °C at 30 °C/min

Injection: Pulsed splitless, 200 °C
Pulse pressure & time: 25 psi for 1 min
Purge flow & time: 50 mL/min for 0.25 min
Gas saver flow & time: 20 mL/min for 3 min

Detector: MSD, 320 °C transfer line
Quadrupole 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

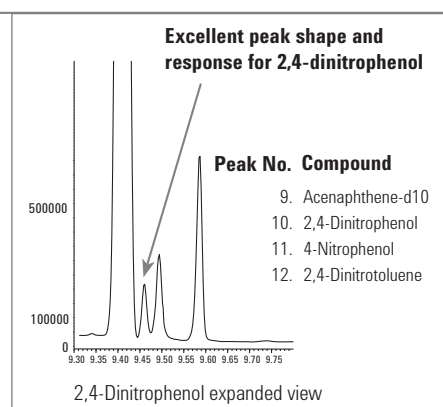
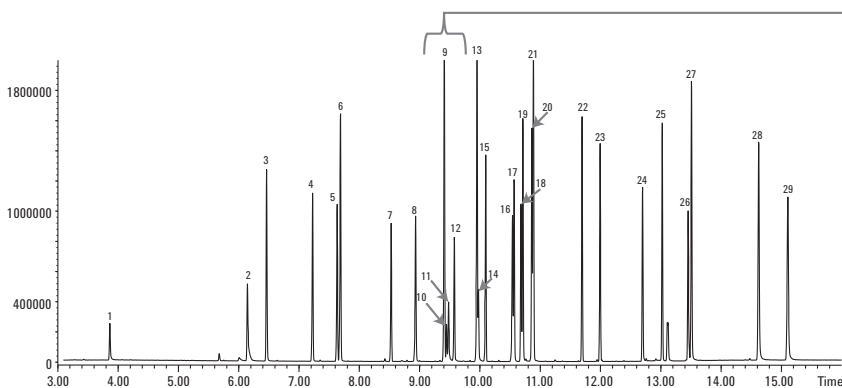
GCES019

10 ng/μL Semivolatile Checkout Standard on a 20 m x 0.18 mm, 0.36 μm Agilent J&W DB-UI 8270D Capillary GC Column using an Ultra Inert Liner with Wool

Column: DB-UI 8270D
121-9723
20 m x 0.18 mm, 0.36 μm

Inlet: S/SL 1 μL pulsed splitless, 300 °C 44 psi pulse to 1.4 min, purge flow 50 mL/min at 1.42 min, gas saver off
Inlet liner: Agilent Ultra Inert single taper with wool (p/n 5190-2293)
Oven: 40 °C (2.5 min), 25 °C/min to 320 °C (4.8 min)
Carrier: Helium, constant flow 1.58 mL/min set at 40 °C
MSD: 325 °C transfer line, 300 °C source, 150 °C quad, 30-550 amu range
GC/MSD: Agilent 7890 Series GC/5975C Series GC/MSD
Aux EPC: 2 psi with 5 mL/min bleed during run
Sampler: Agilent 7683B, 5.0 μL syringe (p/n G4513-80206)
Backflush: Post run 3.5 min at 75 psi Aux EPC, 2 psi inlet pressure

- | | |
|----------------------------------|----------------------------|
| 1. N-Nitrosodimethylamine | 16. Simazine |
| 2. Aniline | 17. Atrazine |
| 3. 1,4-Dichlorobenzene-d4 | 18. Pentachlorophenol |
| 4. Isophorone | 19. Terbufos |
| 5. 1,3-Dimethyl-2-nitrobenzene | 20. Chlorothalonil |
| 6. Naphthalene | 21. Phenanthrene-d10 |
| 7. Hexachlorocyclopentadiene | 22. Aldrin |
| 8. Mevinphos | 23. Heptachlor epoxide |
| 9. Acenaphthene-d10 | 24. Endrin |
| 10. 2,4-Dinitrophenol | 25. 4,4'-DDT |
| 11. 4-Nitrophenol | 26. 3,3'-Dichlorobenzidine |
| 12. 2,4-Dinitrotoluene | 27. Chrysene d-12 |
| 13. Fluorene | 28. Benzo[b]fluoranthene |
| 14. 4,6,-Dinitro-2-methyl phenol | 29. Perylene-d12 |
| 15. Trifluralin | |

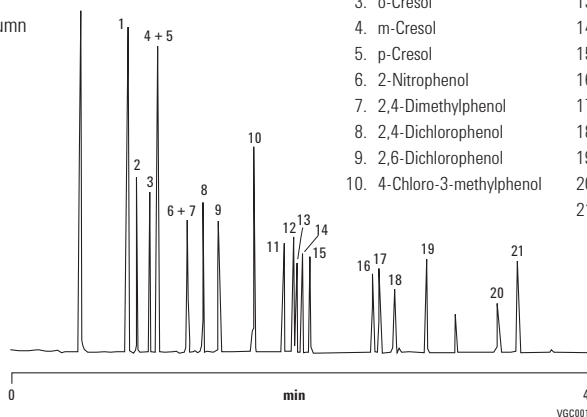


High Resolution Phenol Analysis by GC/MS

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: Agilent Ion Trap MS

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

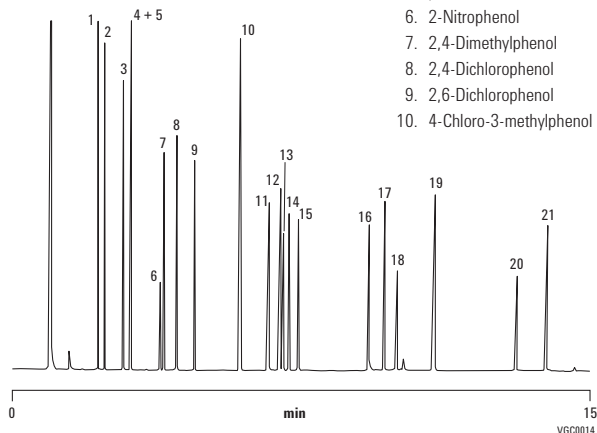


Phenols According to EPA Method 8040

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: H₂, 150 kPa (1.5 bar, 21 psi)
Injection: Split, 100 mL/min
Detector: FID

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

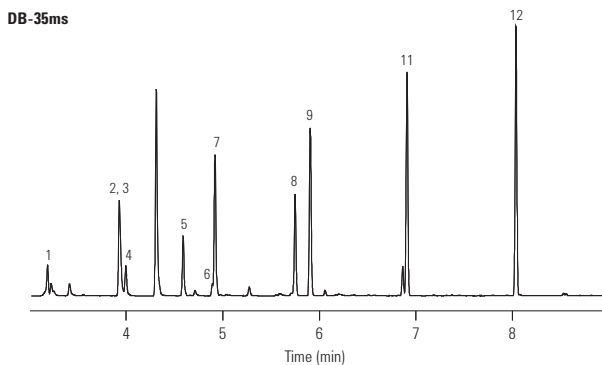


EPA Method 552.2

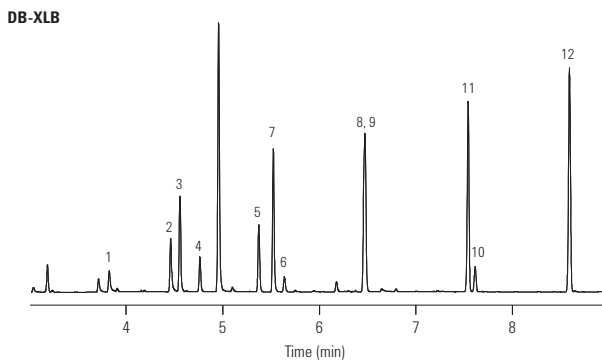
Column: DB-35ms
123-3832
30 m x 0.32 mm, 0.25 µm

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

Carrier: Helium at 45 cm/s
(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 s 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 (ELCD)

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

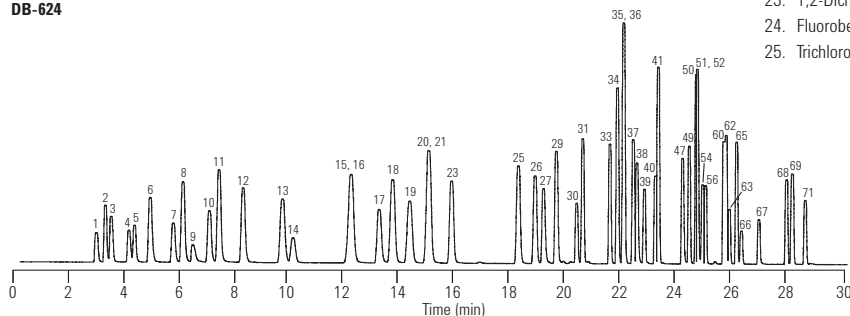
Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

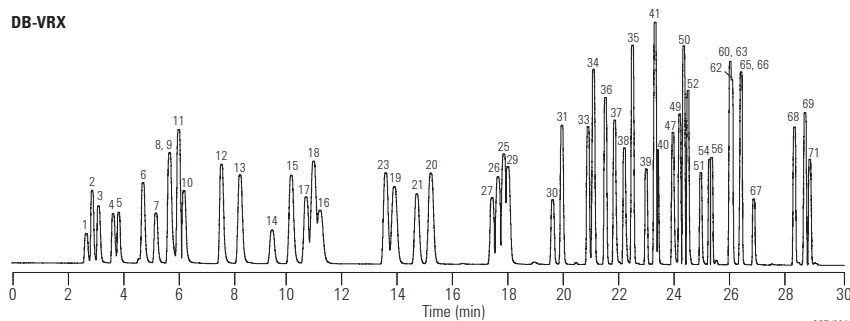
Septum: 11 mm Advanced Green septa, 5183-4759

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-Xylene
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/s, (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 s

Sample: 10 ppb per component in 25 mL water

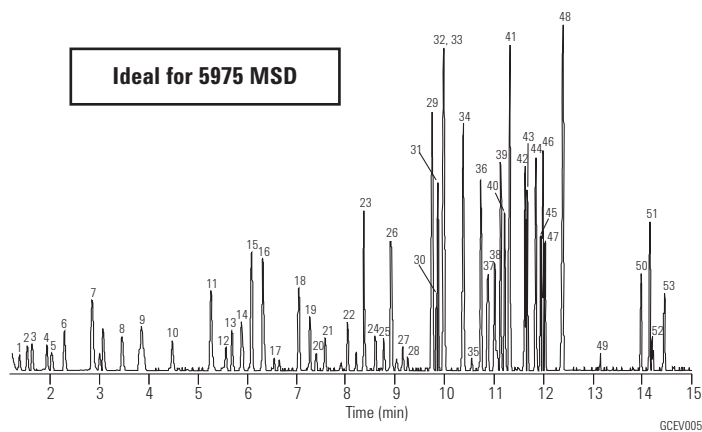
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

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



Analysis of Volatile Organic Compounds in Environmental Waters Using the Agilent 7697A Headspace and 7890B/5977A GC/MS

Column: VF-624ms
CP9103
60 m x 0.25 mm, 1.40 µm

Instrument: Agilent 7697A Headspace and 7890B/5977A GC/MS

Carrier: Helium, 11 mL/min, 160 °C

Oven: 32 °C for 2 min, then 10 °C/min to 220 °C for 5 min

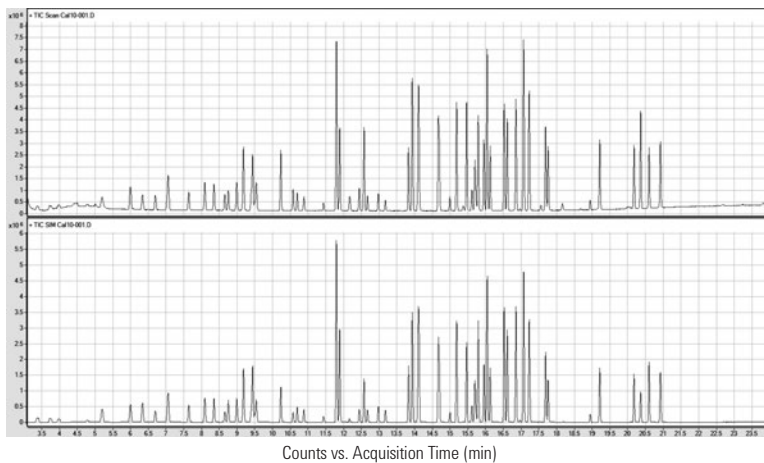
Injection: Split, 4:1, 160 °C for 5 min, purge 100 mL/min for 1 min

Detector: 5977A MSD, simultaneous Scan/SIM mode

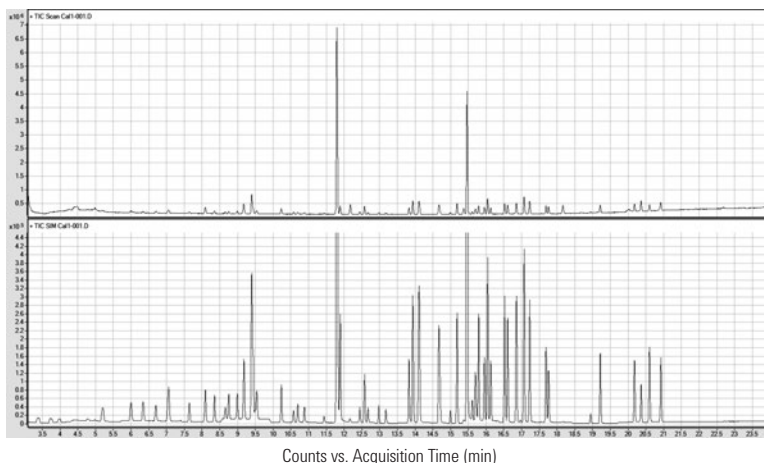
Sample: Standard VOC mix

Sample Conc: 10 µg/L

RT, min	CAS Number	RT, min	CAS Number	RT, min	CAS Number
1. Dichlorodifluoromethane	3.387 75-71-8	11. trans-1,2-Dichloroethene	7.069 156-60-5	21. Benzene	9.440 71-43-2
2. Chloromethane	3.734 74-87-3	12. 1,1-Dichloroethane	7.644 75-34-3	22. 1,2-Dichloroethane	9.497 107-06-2
3. Vinyl chloride	3.980 75-01-4	13. Ethyl tert-butyl ether	8.091 637-92-3	23. tert-Amyl methyl ether	9.540 994-05-8
4. Bromomethane	4.390 74-83-9	14. cis-1,2-Dichloroethene	8.353 156-59-2	24. Trichloroethene	10.232 79-01-6
5. Chloroethane	4.788 75-00-3	15. 2,2-Dichloropropane	8.370 594-20-7	25. 1,2-Dichloropropane	10.576 78-87-5
6. Trichlorofluoromethane	5.202 75-69-4	16. Bromochloromethane	8.656 74-97-5	26. Dibromomethane	10.699 74-95-3
7. 1,1-Dichloroethene	5.998 75-34-4	17. Chloroform	8.756 67-66-3	27. Bromodichloromethane	10.884 75-27-4
8. Carbon disulfide	6.338 75-15-0	18. 1,1,1-Trichloroethane	8.995 71-55-6	28. cis-1,3-Dichloropropene	11.437 10061-01-5
9. Dichloromethane	6.701 75-09-2	19. 1,1-Dichloro-1-propene	9.177 563-58-6	29. Toluene	11.890 108-88-3
10. Methyl tert-butyl ether	7.046 1634-04-4	20. Carbon tetrachloride	9.189 56-23-5	30. trans-1,3-Dichloropropene	12.165 10061-02-6
				31. 1,1,2-Trichloroethane	12.443 79-00-5
				32. Tetrachloroethene	12.580 127-18-4
				33. 1,3-Dichloropropane	12.673 142-28-9
				34. Dibromochloromethane	12.981 124-48-1
				35. 1,2-Dibromoethane	13.175 106-93-4
				36. Chlorobenzene	13.830 108-90-7
				37. 1,1,1,2-Tetrachloroethane	13.939 630-20-6
				38. Ethylbenzene	13.934 100-41-4
				39. m and p-Xylene	14.115 108-38-3 & 106-42-3
				40. o-Xylene	14.669 95-47-6
				41. Styrene	14.699 100-42-5
				42. Bromoform	14.994 75-25-2
				43. Isopropylbenzene	15.183 98-82-8
				44. 1,1,2,2-Tetrachloroethane	15.612 79-34-5
				45. Bromobenzene	15.697 108-86-1
				46. 1,2,3-Trichloropropane	15.731 96-18-4
				47. n-Propylbenzene	15.793 103-65-1
				48. 2-Chlorotoluene	15.952 95-49-8
				49. 3-Chlorotoluene	16.042 108-41-8
				50. 1,3,5-Trimethylbenzene	16.048 108-67-8
				51. 4-Chlorotoluene	16.133 106-43-4
				52. tert-Butylbenzene	16.526 98-06-6
				53. 1,2,4-Trimethylbenzene	16.608 95-63-6
				54. sec-Butylbenzene	16.856 135-98-8
				55. 1,3-Dichlorobenzene	17.071 541-73-1
				56. 4-Isopropyltoluene	17.077 99-87-6
				57. 1,4-Dichlorobenzene	17.220 106-46-7
				58. 1,2,3-Trimethylbenzene	17.231 526-73-8
				59. n-Butylbenzene	17.689 104-51-8
				60. 1,2-Dichlorobenzene	17.761 95-50-1
				61. 1,2-Dibromo-3-chloropropane	18.949 96-12-8
				62. 1,3,5-Trichlorobenzene	19.215 108-70-3
				63. 1,2,4-Trichlorobenzene	20.179 120-82-1
				64. Hexachlorobutadiene	20.370 87-68-3
				65. Naphthalene	20.604 91-20-3
				66. 1,2,3-Trichlorobenzene	20.922 87-61-6



10 µg/L VOC Standard Scan and SIM Traces



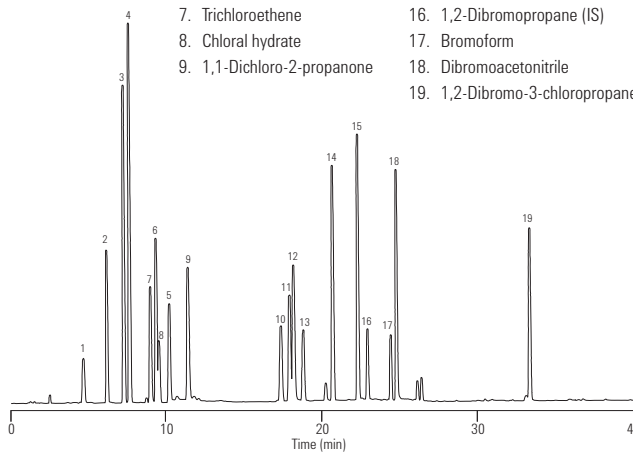
1 µg/L VOC Standard Scan and SIM Traces

EPA Method 551

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

Carrier: Helium at 24.8 cm/s, measured at 150 °C
Injection: Splitless, 200 °C
15 s purge activation time
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
Detector: ECD, 300 °C
Sample: 1 µL of 50 pg/µL, AccuStandard

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



Suggested Supplies

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

European Red List Volatiles

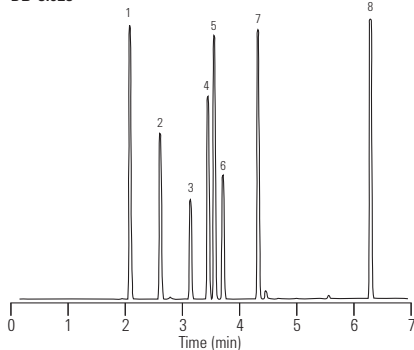
Column: DB-5.625
122-5632
30 m x 0.25 mm, 0.50 µm
Column: DB-624
122-1334
30 m x 0.25 mm, 1.40 µm

Carrier: Helium at 35 cm/s, measured at 40 °C
Injection: Split, 250 °C
Split ratio 1:50
Oven: 40 °C for 2 min
40-140 °C at 12 °C/min
Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min
Sample: 1 µL of headspace of neat mixture

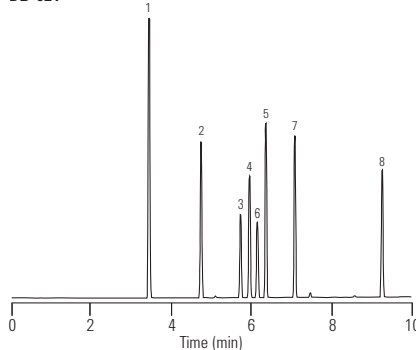
Suggested Supplies

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

DB-5.625



DB-624



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

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/s, 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

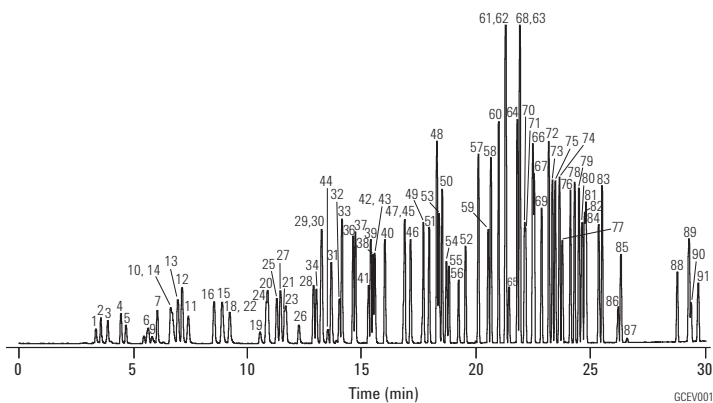
Detector: MSD, 235 °C transfer line
Full scan 35-260 amu (m/z 44 subtracted)

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/s, 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

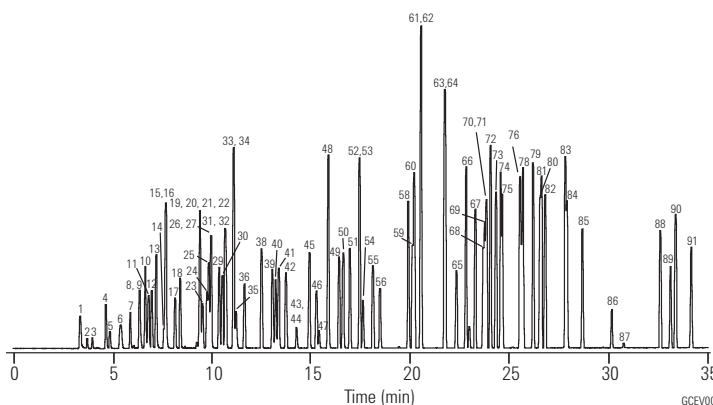
Detector: MSD, 235 °C transfer line
Full scan 35-260 amu (m/z 44 subtracted)

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

Note: Some compounds not present in both chromatograms

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 μ m

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

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

Injection: Entech 7100 cryogenic sample preconcentrator

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

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

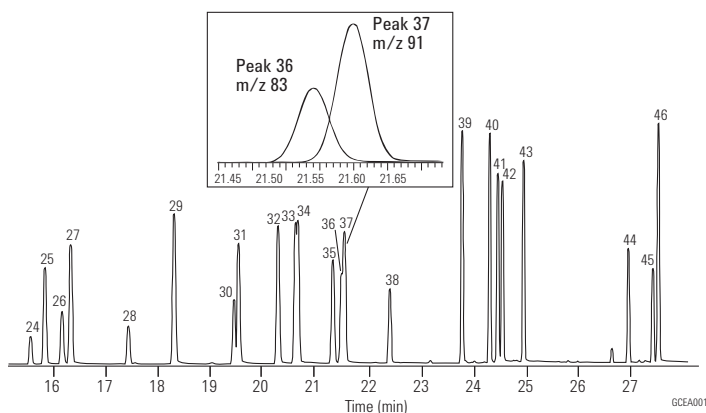
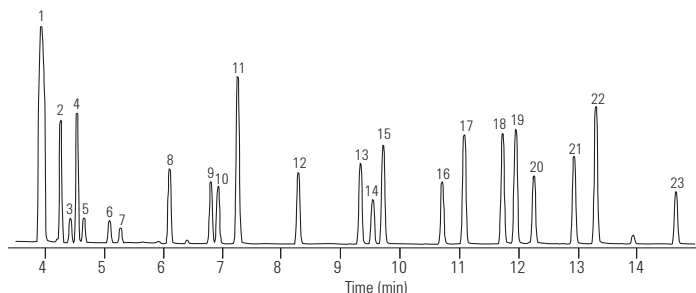
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

- | | |
|---|-------------------------------|
| 1. CO ₂ | 14. Bromochloromethane (IS) |
| 2. Freon 12 (dichlorodifluoromethane) | 15. Chloroform |
| 3. Chloromethane | 16. 1,2-Dichloroethane |
| 4. Freon 114 (1,2-dichloro-1,1,2,2-tetrafluoroethane) | 17. 1,1,1-Trichloroethane |
| 5. Vinyl chloride | 18. Benzene |
| 6. Bromomethane | 19. Carbon tetrachloride |
| 7. Chloroethane | 20. 1,4-Difluorobenzene (IS) |
| 8. Freon 11 (trichlorofluoromethane) | 21. 1,2-Dichloropropane |
| 9. 1,1-Dichloroethane | 22. Trichloroethene |
| 10. Methylene chloride | 23. cis-1,3-Dichloropropene |
| 11. Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane) | 24. trans-1,3-Dichloropropene |
| 12. 1,1-Dichloroethane | 25. 1,1,2-Trichloroethane |
| 13. cis-1,2-Dichloroethane | 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, 50 ppb

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

Carrier: Helium, 1.5 mL/min

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

Sampler: Entech 7100 cryogenic sample preconcentrator

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

Sample: 100 cc 50 ppb Formaldehyde/20 ppb others

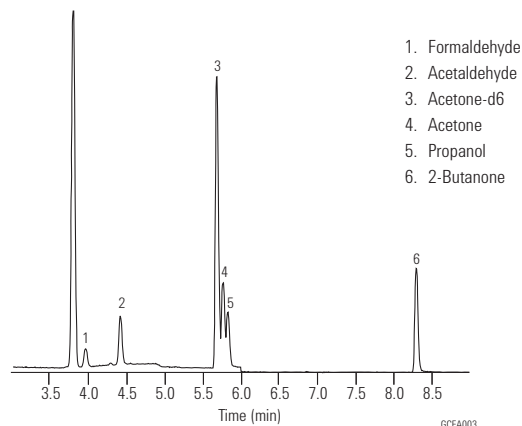
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

Agilent wishes to thank Entech Instruments for providing this chromatogram.



Sulfur in Air

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

Carrier: Helium, 1.5 mL/min

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

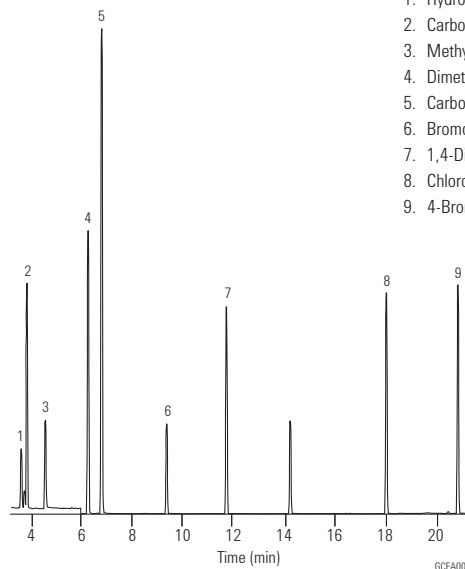
Sampler: Entech 7100 cryogenic sample preconcentrator

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

Sample: 400 cc 10 ppb sulfurs

1. Hydrogen sulfide
2. Carbonyl sulfide
3. Methyl mercaptan
4. Dimethyl sulfide
5. Carbon disulfide
6. Bromochloromethane
7. 1,4-Difluorobenzene
8. Chlorobenzene-d5
9. 4-Bromofluorobenzene

Agilent wishes to thank Entech Instruments for providing this chromatogram.



N₂O I

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

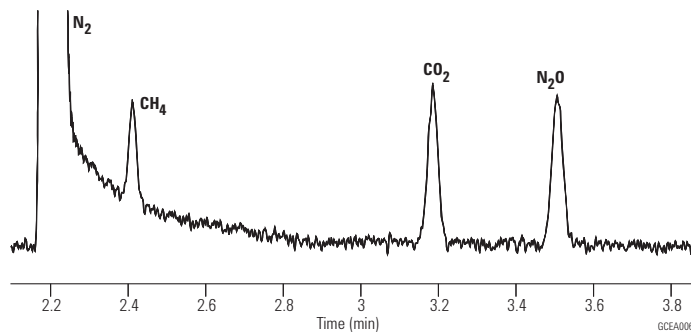
Carrier: Helium, 5 psi (approximately 8 mL/min)

Oven: 35 °C isothermal

Injection: 250 μL, injected
Split ratio 1:3

Detector: TCD, 200 °C

Sample: Approximately 200 ppmv methane
200 ppmv CO₂
250 ppmv N₂O (nitrogen balance gas)

**N₂O II**

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

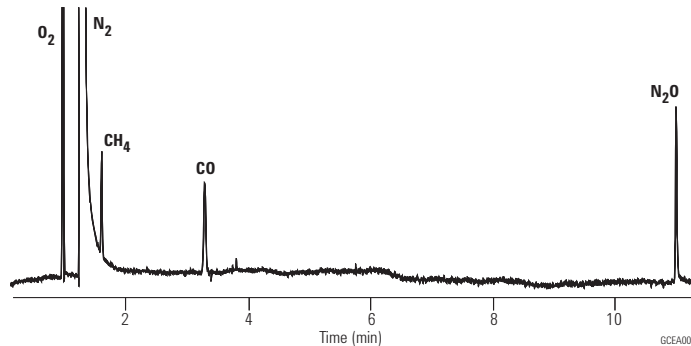
Carrier: Helium, 6 psi (approximately 10 mL/min)

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

Injection: 250 μL injected
Split ratio 1:4

Detector: TCD, 250 °C
Column compensation on

Sample: Approximately 200 ppmv methane
200 ppmv CO₂
250 ppmv N₂O (nitrogen balance gas)

**N₂O III**

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

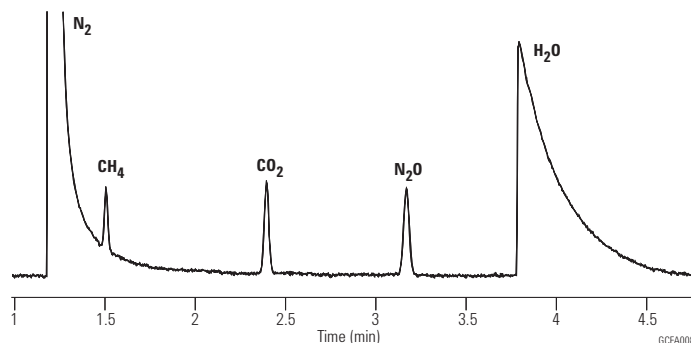
Carrier: Helium, 12 psi (approximately 3 mL/min)

Oven: 35 °C isothermal

Injection: 250 μL injected
Split ratio 1:4

Detector: TCD, 200 °C

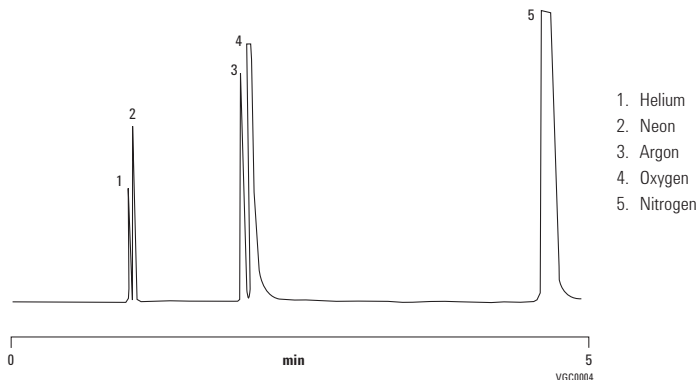
Sample: Approximately 200 ppmv methane
200 ppmv CO₂
250 ppmv N₂O (nitrogen balance gas)



Permanent Gases on a Thick Film Molsieve Column

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

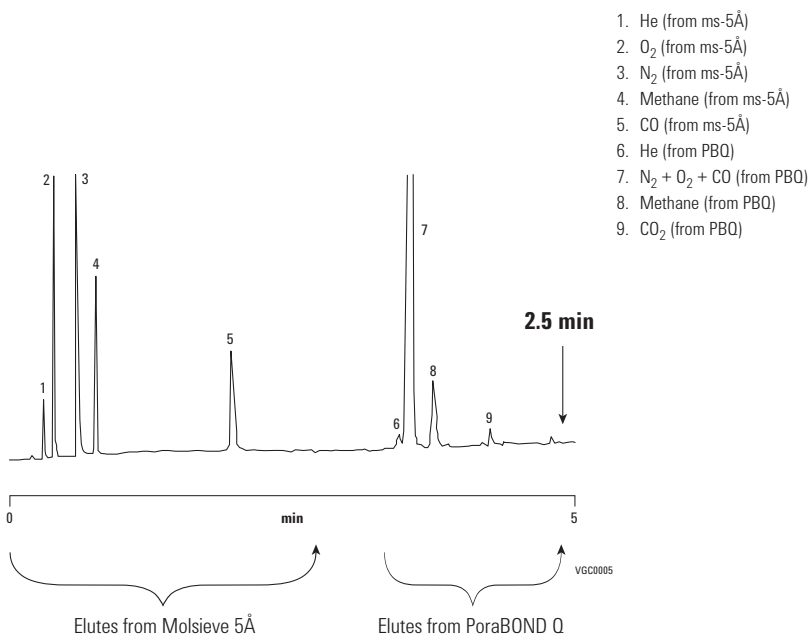
Sample: 10 µL
Sample Conc: % range
Carrier: H₂
Oven: 30 °C
Injection: Split, 100 mL/min
Detector: TCD



Fast Analysis of Permanent Gases and CO₂ using Tandem PLOT Columns

Column: Select for Permanent Gases/CO₂
CP7429

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



**EPA Air Analysis Method TO-15
(1 ppbv standard)**

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

Carrier: Helium, 1.5 mL/min

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

Sampler: Entech 7100 cryogenic sample preconcentrator

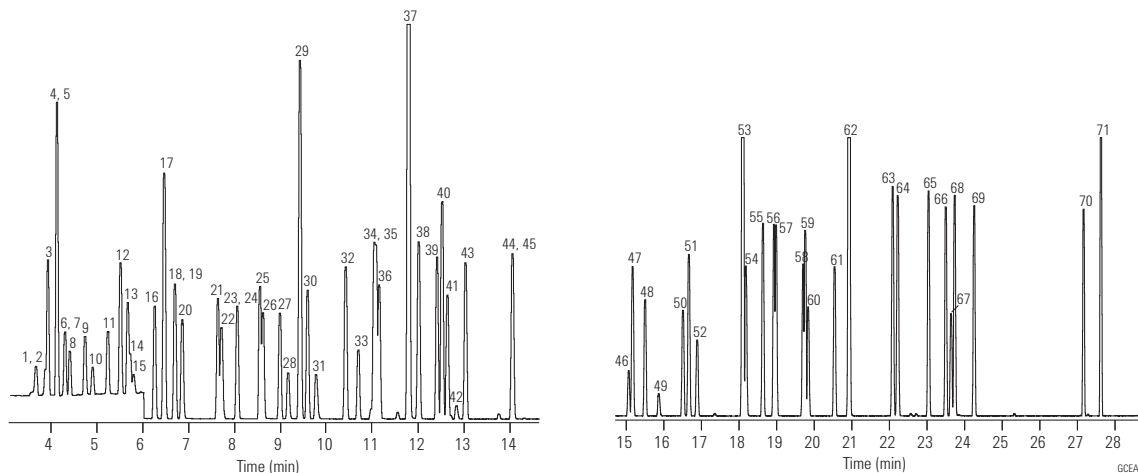
Suggested Supplies

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

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

Sample: 400 mL sample load
All compounds at 10 ppbv except formaldehyde (50 ppbv),
acetaldehyde (20 ppbv), propanol (20 ppbv), acetone (30 ppbv),
2-butanone (30 ppbv)

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



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-624 Ultra Inert

123-1334UI

30 m x 0.32 mm, 1.80 µm

Carrier: Helium, 2.3 mL/min, constant flow set at 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

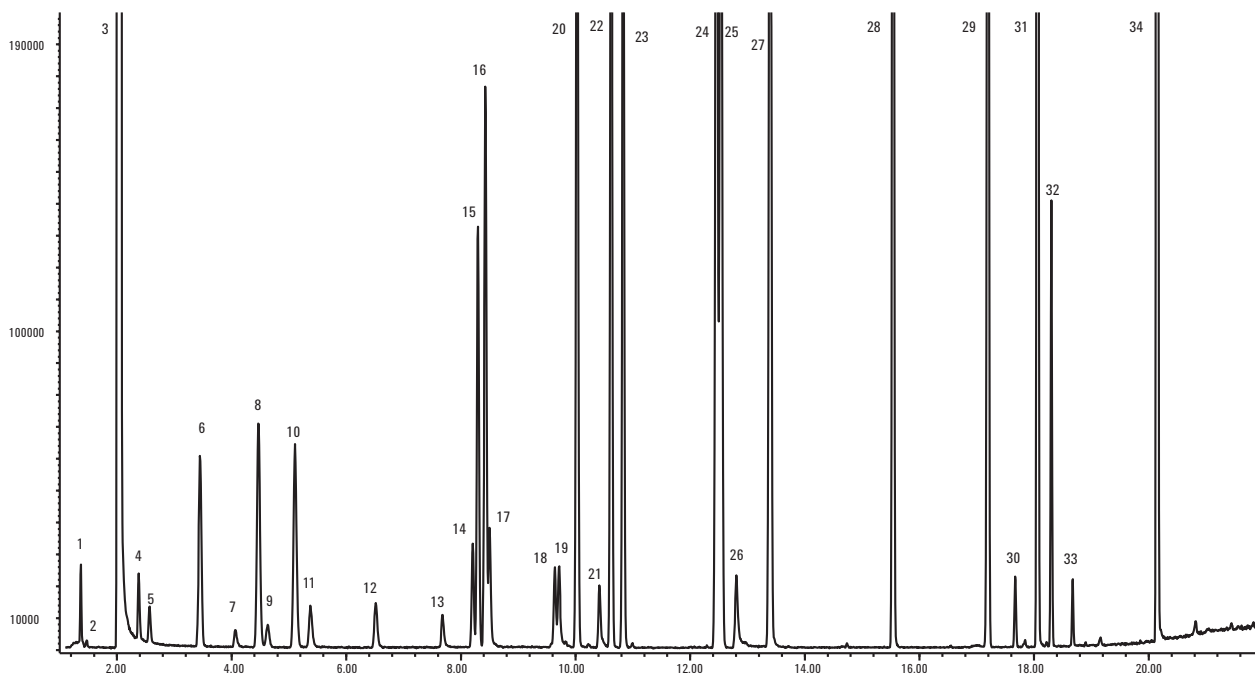
Inlet: Split/splitless, 220 °C, 1 µL, split 20:1

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 | 18. Isoamyl alcohol |
| 2. Methanol | 19. Active amyl alcohol |
| 3. Ethanol | 20. Isobutyl acetate |
| 4. Acetone | 21. 1-Pentanol |
| 5. Isopropanol | 22. Ethyl butanoate |
| 6. Isobutyl aldehyde | 23. Hexanal |
| 7. 1-Propanol | 24. Isoamyl acetate |
| 8. Butyl aldehyde | 25. Active amyl acetate |
| 9. 2,3 Butanedione (VDK) | 26. 1-Hexanol |
| 10. Ethyl acetate | 27. Heptanal |
| 11. 2-Butanol | 28. Octanal |
| 12. Isobutyl alcohol | 29. 1,3,5-Trioxane impurity |
| 13. 1-Butanol | 30. 1,3,5-Trioxane impurity |
| 14. 2,3 Pentanedione (VDK) | 31. Ethyl caprylate |
| 15. Ethyl propanoate | 32. 1-Phenyl ethyl acetate |
| 16. Propyl acetate | 33. Benzaldehyde, 3 methoxy |
| 17. 3-Pentanol | 34. Ethyl caprate |



Spearmint Oil

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

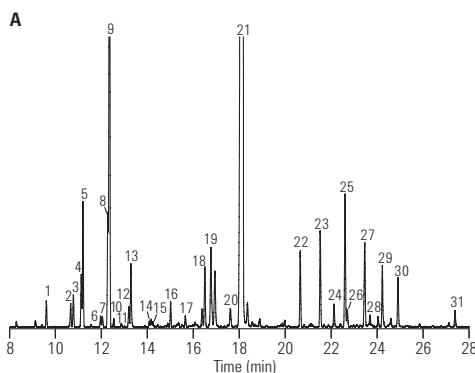
Column B: DB-1
121-1022
20 m x 0.18 mm, 0.18 µm

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

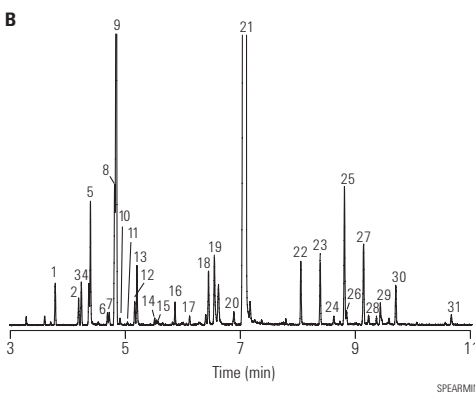
Injection: 250 °C, Split 40:1, 1 µL injection

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



1. α-Pinene
2. Sabinene
3. β-Pinene
4. 3-Octanol
5. Myrcene
6. α-Terpinene
7. p-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. Dihydro carvone
20. trans-Carveol
21. l-Carvone
22. trans-Dihydro carveol acetate
23. cis-Carvyl acetate
24. cis-Jasmone
25. β-Bourbonene
26. α-Bourbonene
27. β-Caryophyllene
28. α-Copaene
29. trans-β-Farnesene
30. Germacrene-d
31. Viridiflorol

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



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

Lavender Oil Characterization

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

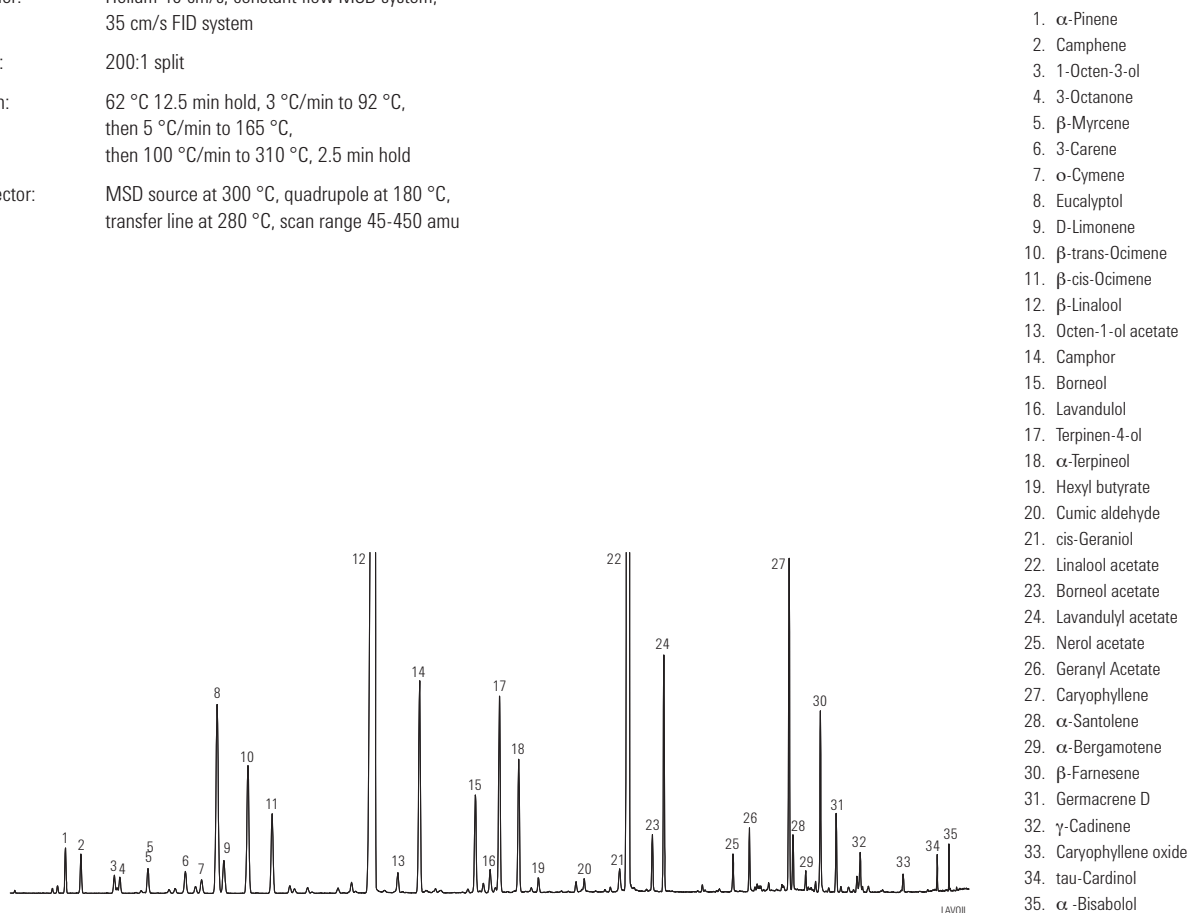
Detector: MSD source at 300 °C, quadrupole at 180 °C,
transfer line at 280 °C, scan range 45-450 amu

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

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

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



GC/MS total ion chromatogram of lavender oil sample on an Agilent J&W DB-1ms Ultra Inert 30 m x 0.25 mm, 0.25 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

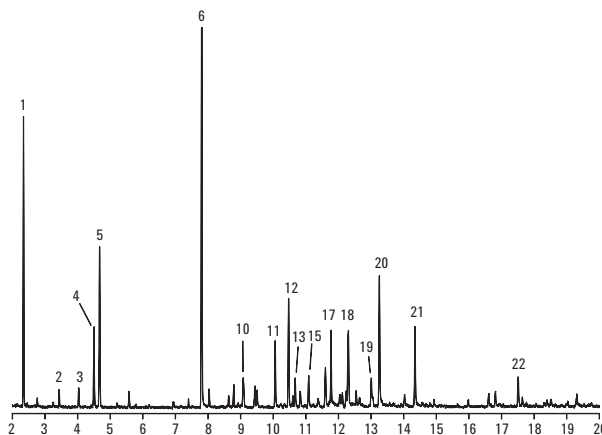
Carrier: Hydrogen at 44.3 cm/s
 Measured at 45 °C

Oven: 45 °C hold 0.77 min
 7.79 °C/min to 250 °C

Injection: Split 1:30, 250 °C
 1 μL of 1:35 oil in acetone

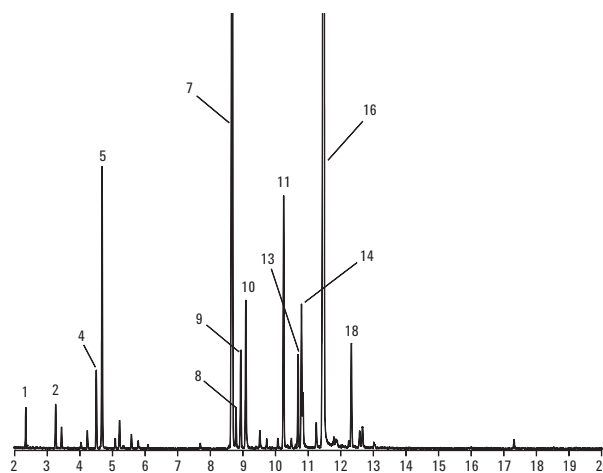
Detector: MSD full scan at m/z 40-500
 250 °C transfer line

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/s, 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

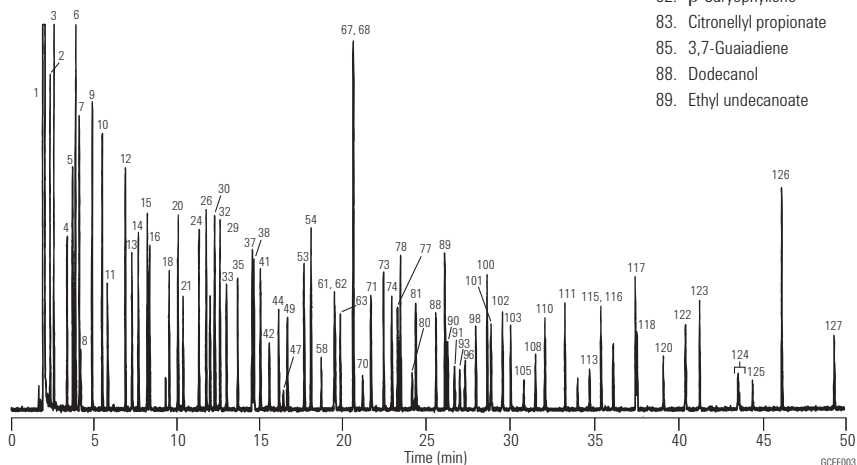
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

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

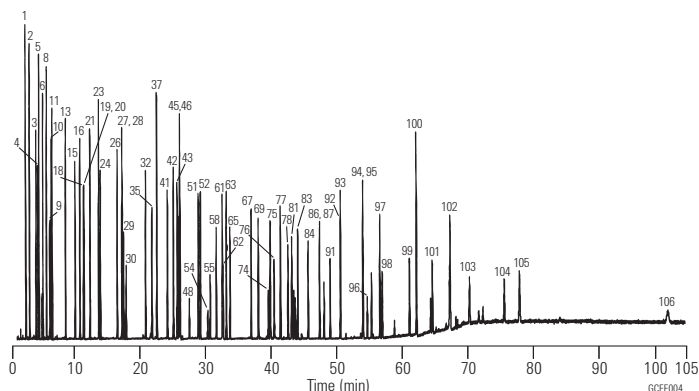
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

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



Perfume

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

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

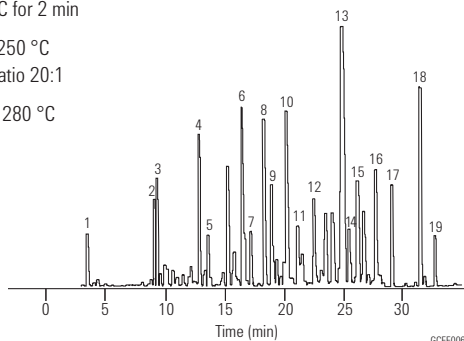
Oven: 80 °C for 1 min
80-250 °C at 5 °C/min
250 °C for 2 min

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

Detector: MSD, 280 °C

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 | 11. Commamyl acetate |
| 2. Linalool | 12. Acetyl cedrene |
| 3. Linalyl acetate | 13. Diethyl phthalate |
| 4. Benzyl acetate | 14. Tonalid |
| 5. Citronellol | 15. Coumarin |
| 6. Benzene ethanol | 16. Musk xylene |
| 7. α-Methyl ionone | 17. Benzyl benzoate |
| 8. Carvacrol and geraniol | 18. Benzyl salicylate |
| 9. Isoamyl salicylate | 19. Musk ketone |
| 10. n-Amyl salicylate | |

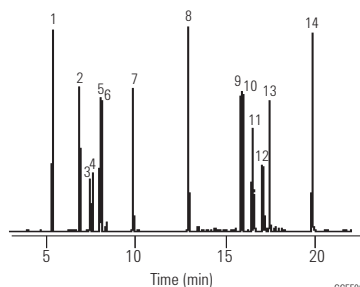
Chiral Compounds in Essential Oils and Fragrances

Column: HP-Chiral 20β
19091G-B233
30 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen, 39 cm/s, constant pressure
Injection: Split, 250 °C
Split ratio 30:1

Oven: 65 °C for 1 min
65-170 °C at 5 °C/min
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-B
112-2532
30 m x 0.25 mm, 0.25 µm

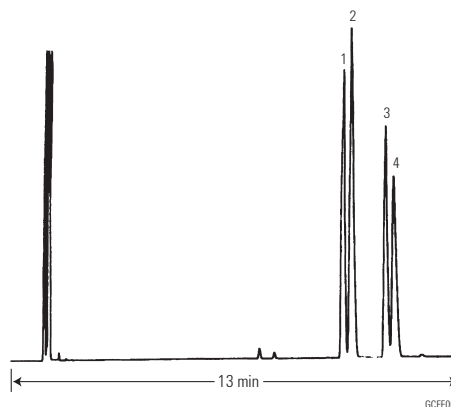
Carrier: Hydrogen, 55 cm/s

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/s,
constant pressure mode

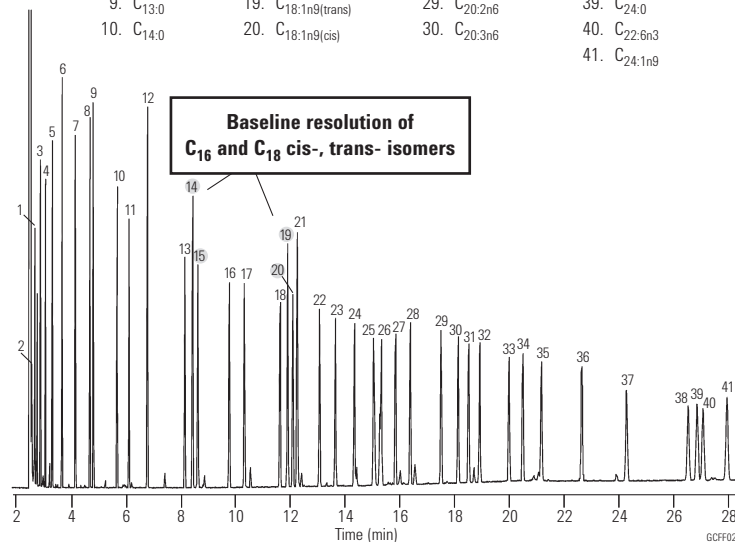
Oven: 130 °C for 1.0 min
130-170 °C at 6.5 °C/min
170-215 °C at 2.75 °C/min
215 °C for 12 min
215-230 °C at 40 °C/min
230 °C for 3 min

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

Detector: FID, 280 °C

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

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



Suggested Supplies

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

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

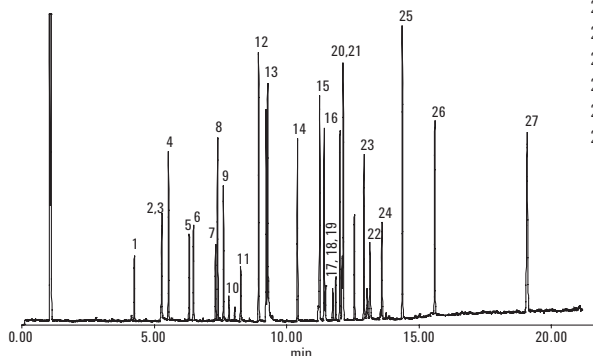
Carrier: Helium, 1.0 mL/min

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 | 11. Hydroxy citronellal |
| 2. Methyl heptine carbonate | 12. Methyl eugenol |
| 3. Phenyl acetaldehyde | 13. Lilial |
| 4. Methyl chavicol | 14. Eugenol |
| 5. Methyl octine carbonate | 15. Amyl cinnamyl aldehyde |
| 6. Citronellol | 16. Anisic alcohol |
| 7. Geraniol | 17. Cinnamyl alcohol |
| 8. Methyl gamma ionone | 18. Farnesol isomer I + II |
| 9. Benzyl alcohol | 19. Farnesol isomer III |
| 10. Cinnamaldehyde | 20. iso-Eugenol |
| | 21. Hexyl cinnamic aldehyde |
| | 22. Lyrall (4,4-isomer) |
| | 23. Coumarin |
| | 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

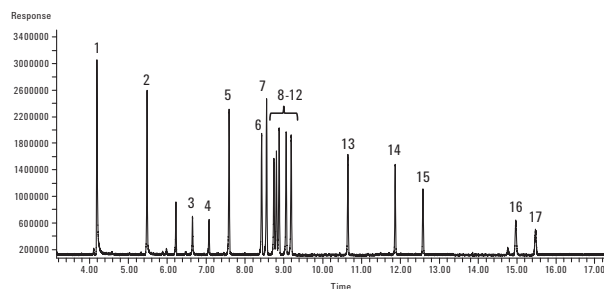
Oven: 95 °C (0.5 min), 25 °C/min to 210 °C, 10 °C/min to 250 °C (0.5 min),
20 °C to 290 °C (4.5 min)

Postrun: 7.5 min at 290 °C, Aux EPC pressure 54 psi during backflush,

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 (N₂) 60 mL/min

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



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



TIPS & TOOLS

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

Fragrance Allergens

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

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

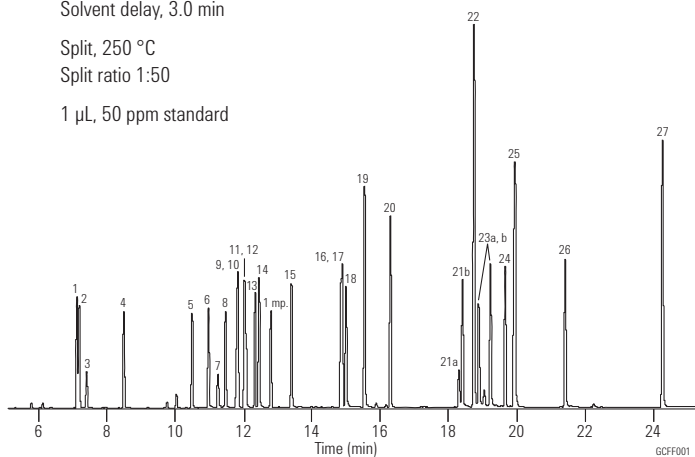
Oven: 50 °C in 1 min, 8 °C/min to 250 °C,
250-300 °C at 35 °C/min
300 °C hold, 5 min
5973N MSD in scan (40-350 amu)
Solvent delay, 3.0 min

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

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

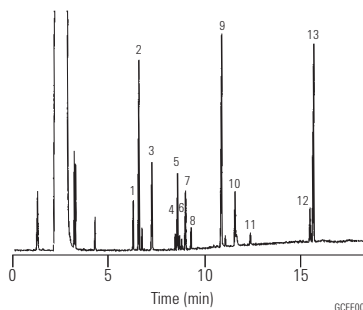
Oven: 80 °C for 1 min
80-210 °C at 8 °C/min
210 °C for 2 min

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/s, measured at 40 °C

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

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

Detector: Nitrogen makeup gas at 30 mL/min

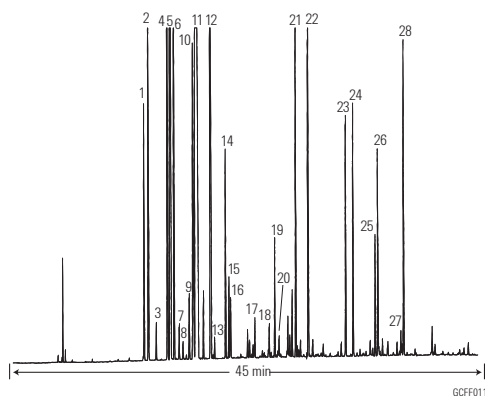
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

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

Seal: Gold plated seal, 18740-20885

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



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

Cold-pressed Orange Oil

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

Carrier: Hydrogen at 60 cm/s, 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

Suggested Supplies

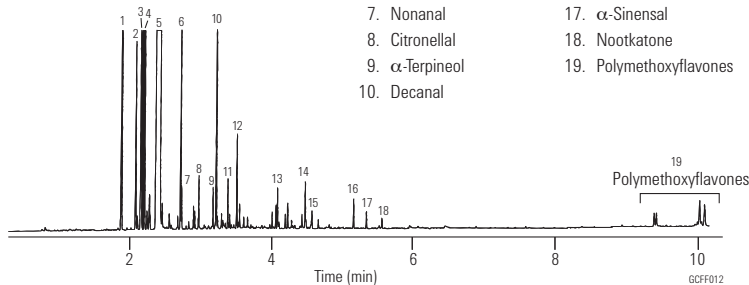
Septum: 11 mm Advanced Green septa, 5183-4759

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

Seal: Gold plated seal, 18740-20885

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

Chromatogram courtesy of Tastemaker



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

Peppermint Oil

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

Carrier: Helium at 25 cm/s (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

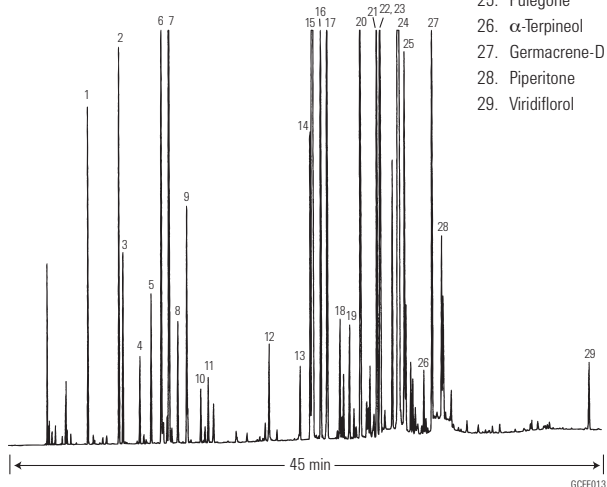
Sample: 1 µL neat

Thanks to 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

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



Spearmint Oil (Western)

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

Carrier: Helium at 25 cm/s (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

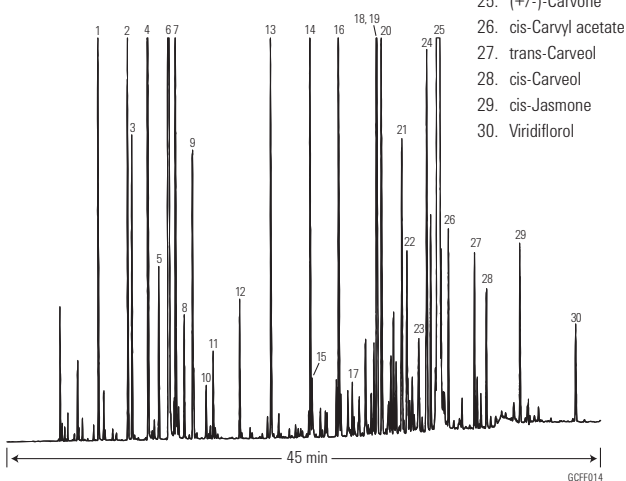
Sample: 1 µL neat

Thanks to 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

- | | | |
|-------------------|----------------------------|--------------------------|
| 1. α-Pinene | 9. γ-Terpinene | 17. Linalool |
| 2. β-Pinene | 10. r-Cymene | 18. Terpinen-4-ol |
| 3. Sabinene | 11. Terpinolene | 19. β-Caryophyllene |
| 4. Myrcene | 12. 3-Octylacetate | 20. Dihydro carvone |
| 5. α-Terpinene | 13. 3-Octanol | 21. trans-Dihydro carvyl |
| 6. (+/-)-Limonene | 14. trans-Sabinene hydrate | 22. trans-β-Farnesene |
| 7. 1,8-Cineol | 15. (+/-)-Methone | 23. α-Terpineol |
| 8. cis-Ocimene | 16. β-Bourbonene | 24. Germacrene-D |



Ylang Ylang Oil

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

Carrier: Helium at 34 cm/s, measured at 50 $^{\circ}$ C

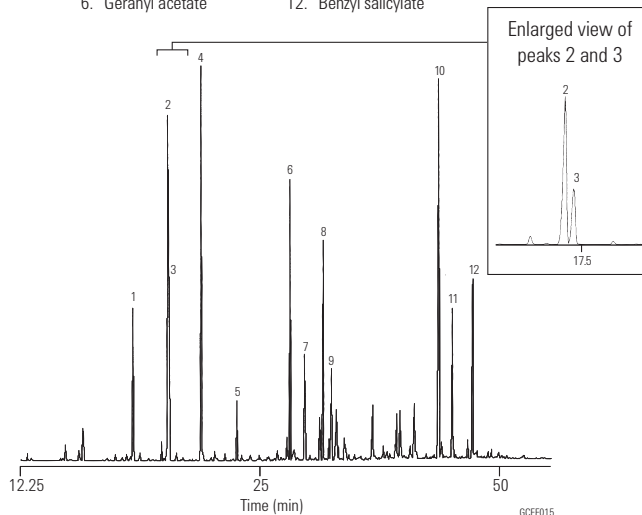
Oven: 50 $^{\circ}$ C for 1 min
50-250 $^{\circ}$ C at 3.5 $^{\circ}$ C/min

Injection: Split, 250 $^{\circ}$ C
Split ratio 1:125

Detector: MSD, 310 $^{\circ}$ C transfer line
full scan at m/z 35-550

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

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



Suggested Supplies

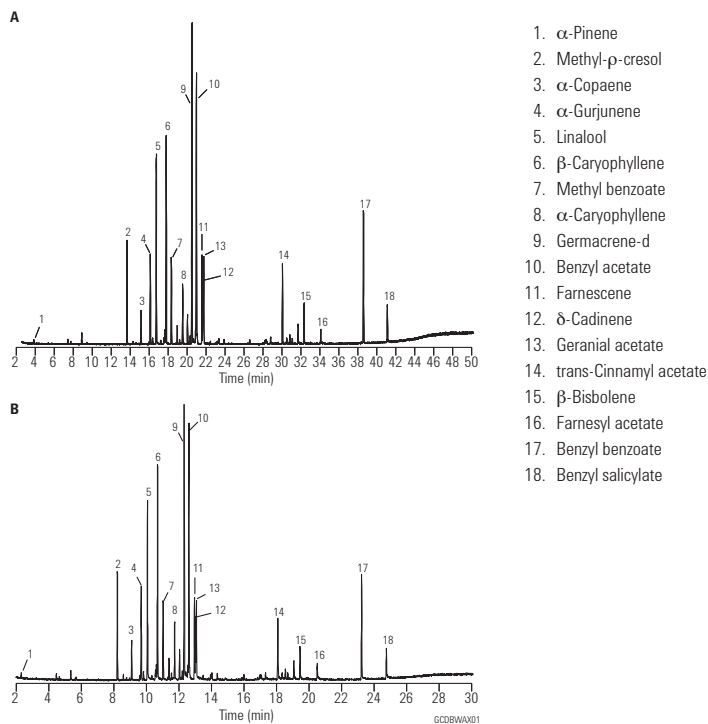
- Septum:** 11 mm Advanced Green septa, 5183-4759
- Liner:** Split, single taper, low pressure drop, glass wool, 5183-4647
- Seal:** Gold plated seal, 18740-20885
- Syringe:** 5 μ L tapered, FN 23-26s/42/HP, 5181-1273

Ylang Ylang Oil

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

Carrier: A: Helium 26.3 cm/s measured at 45 $^{\circ}$ C
B: Hydrogen 44.3 cm/s measured at 45 $^{\circ}$ C

Oven: A: 45 $^{\circ}$ C hold 1.28 min
4.68 $^{\circ}$ C/min to 250 $^{\circ}$ C hold 21.81 min
B: 45 $^{\circ}$ C hold 0.77 min
7.79 $^{\circ}$ C/min to 250 $^{\circ}$ C hold 13.09 min



Rosemary Oil

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

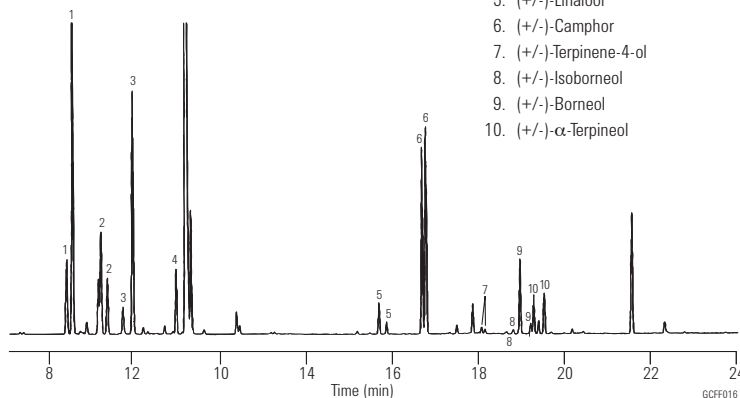
Carrier: Hydrogen at 40 cm/s, measured at 60 °C

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/s,
measured at 40 °C

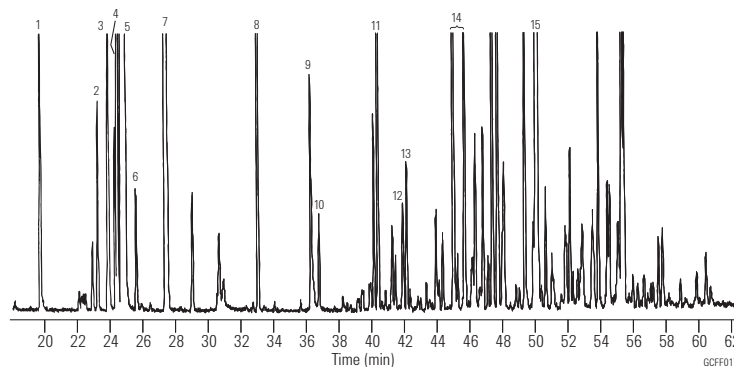
Oven: 40-190 °C at 2 °C/min

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

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

Detector: MSD, 280 °C transfer line

1. S-(-)-Limonene
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



Suggested Supplies

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

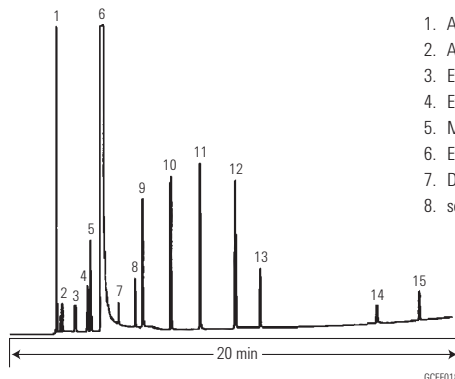
Alcohol Beverage Standard

Column: HP-FFAP
19091F-105
50 m x 0.20 mm, 0.33 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

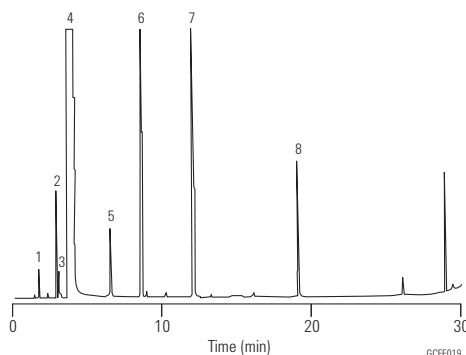
Carrier: Helium, 33 cm/s, 15.5 psi (35 °C)
1.5 mL/min constant flow

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

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

Detector: FID, 280 °C

Sample: 1 µL



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

Alditol Acetates

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

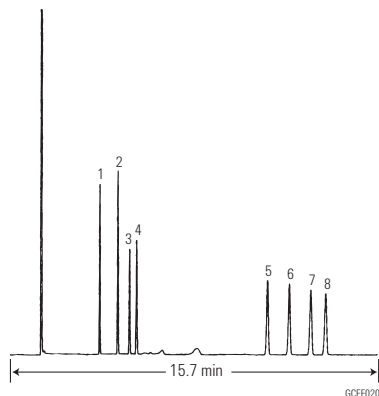
Carrier: Hydrogen at 36.5 cm/s

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

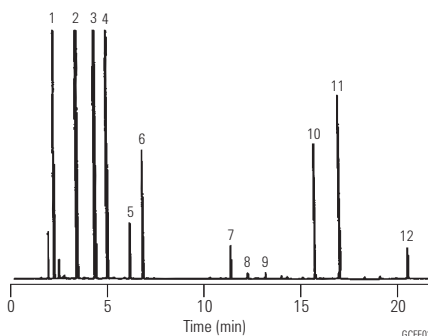
Column: HP-INNOWax
19091N-213
30 m x 0.32 mm, 0.50 µm

Carrier: Helium, 40 cm/s, 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

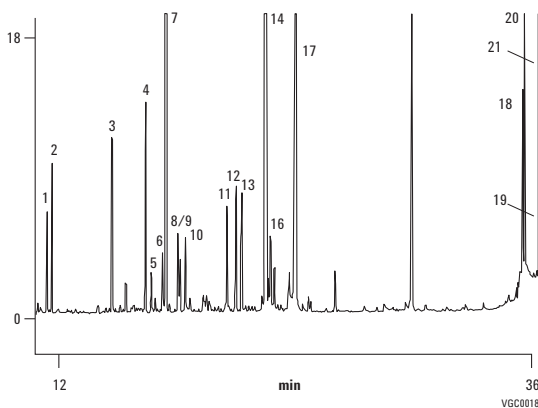
Sample Conc: 40 ppb

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-O-Methylglucose 1
9. Xylose 2
10. Rhamnitol
11. 3-O-Methylglucose 2
12. Glucuronic acid-1,5-lactone
13. Ribose 2
14. Mannitol
15. Sorbitol (not identified)
16. Galactitol
17. Glucuronic acid
18. Lactulose
19. Lactose
20. Sucrose
21. Trehalose

Organic Acids

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

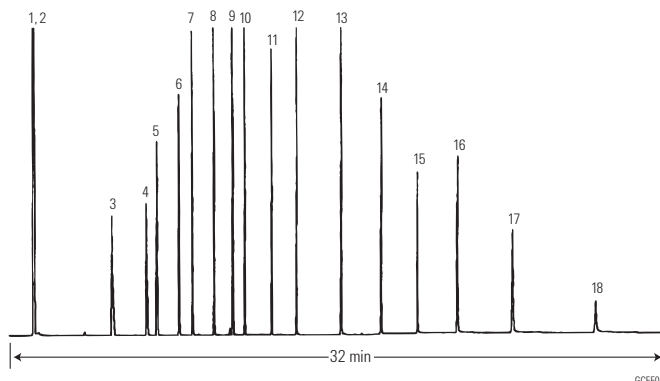
Carrier: Helium at 40 cm/s, measured at 100 °C

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

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



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

Acids

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

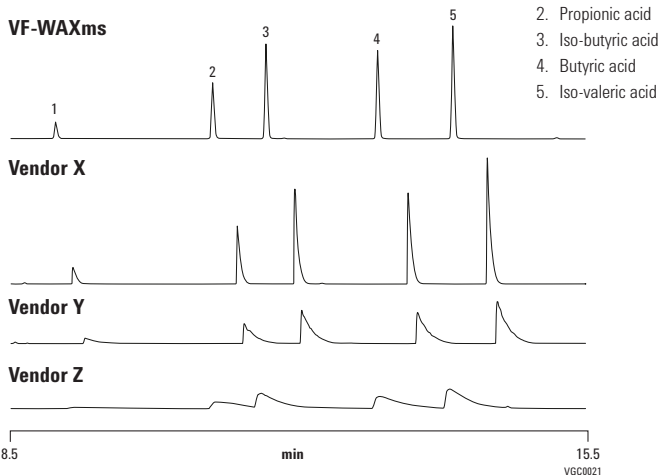
Sample: Acid sample, 0.1% (Cyclohexane), 1.0 µL

Carrier: Hydrogen, 75 kPa

Oven: 60 °C to 200 °C, 5 °C/min

Injection: 250 °C, split 100 mL/min

VF-WAXms



Bacterial Fatty Acid Methyl Esters

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

Carrier: Hydrogen at 42 cm/s

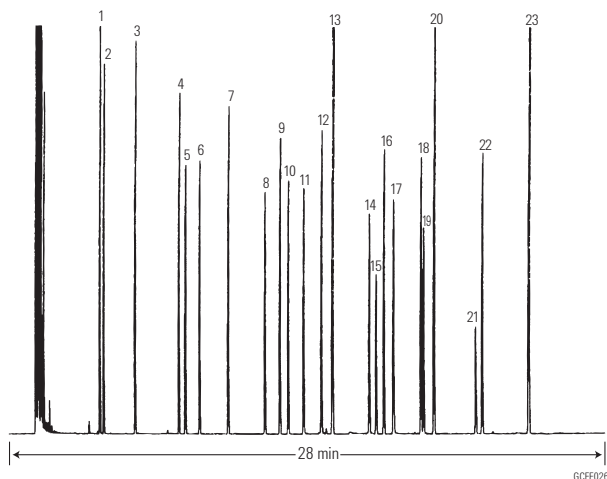
Oven: 150 °C for 4 min
150-250 °C at 4 °C/min

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} | Methyl undecanoate |
| 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

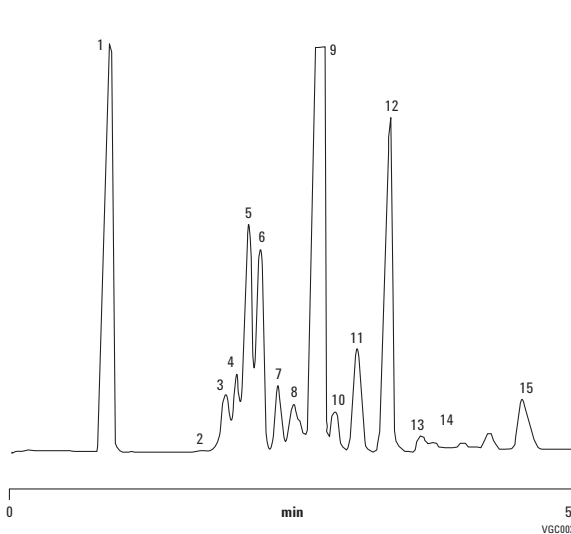
Sample Conc: 5 ng approx. per component on the column

Carrier: Helium, 520 kPa

Oven: 185 °C

Injection: Split, 1:20

Detector: FID



- | |
|-----------------------------------|
| 1. C _{18:0} |
| 2. C _{18:1} 7 trans |
| 3. C _{18:1} 8 trans |
| 4. C _{18:1} 9 trans |
| 5. C _{18:1} 10 trans |
| 6. C _{18:1} 11 trans |
| 7. C _{18:1} 12 trans |
| 8. C _{18:1} 13 trans + ? |
| 9. C _{18:1} 9 cis |
| 10. C _{18:1} 10 cis |
| 11. C _{18:1} 11 cis |
| 12. C _{18:1} 12 cis |
| 13. C _{18:1} 13 cis |
| 14. C _{18:1} 14 cis |
| 15. C _{18:1} 15 cis |

69 Component FAME Mix

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

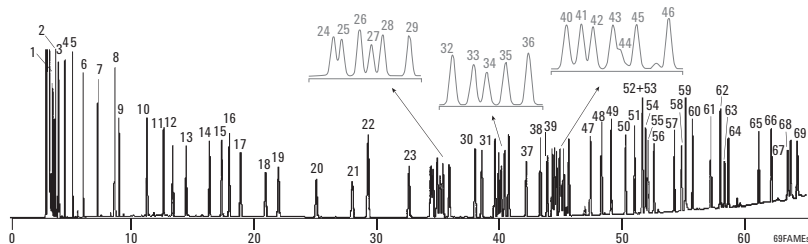
Carrier: He at 1.4 mL/min constant flow

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 CHCl₃

Detector: FID, 260 °C

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

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

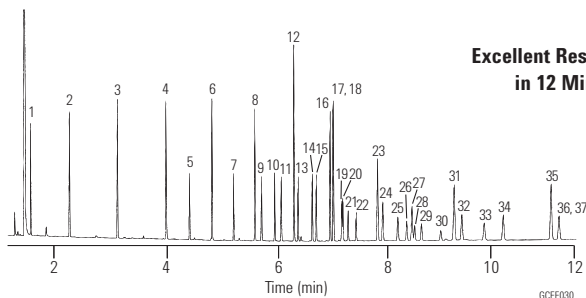
Suggested Supplies

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



FAME Standard

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

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

Oven: 35 °C 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

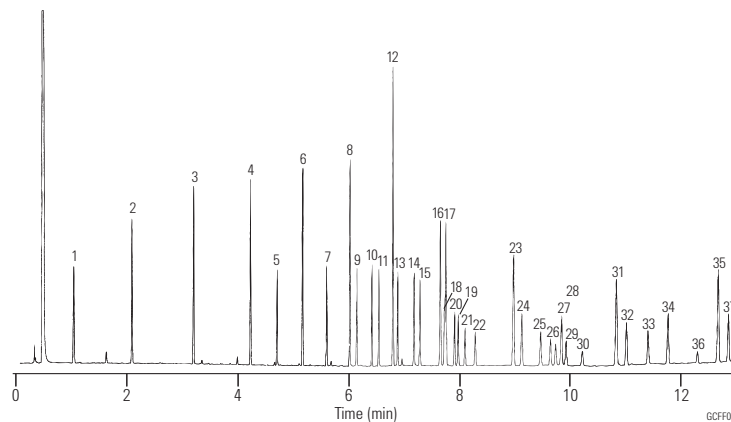
Injection: Split, 250 °C
Split ratio 1:30

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



**Canola Oil Margarine Partially Hydrogenated
FAMES AOCs Method 1c-89**

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

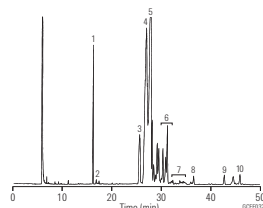
Carrier: Helium at 15 cm/s (0.44 mL/min),
measured at 150 °C

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

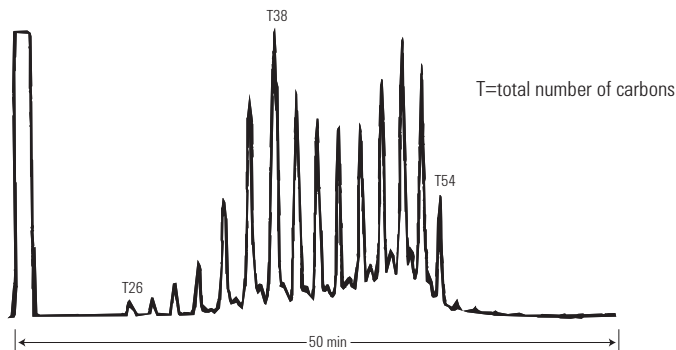
Carrier: Hydrogen at 55 cm/s, measured at 250 °C

Oven: 35-250 °C at 70 °C/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
(approximately 1% w/w solution)



Butter Triglycerides II

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

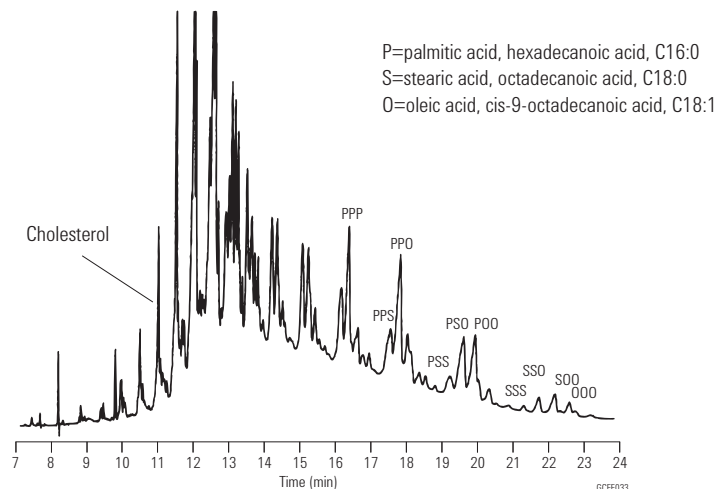
Carrier: Hydrogen at 40 cm/s

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
(approximately 1% w/w solution)



Fast Screening of FAME Isomers in Butter

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

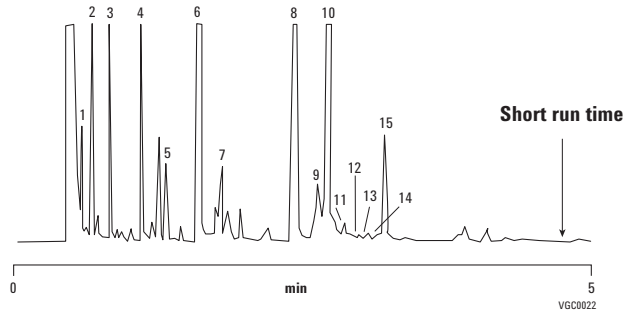
Sample: 0.5 µL ca. 5 ng per component on column

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

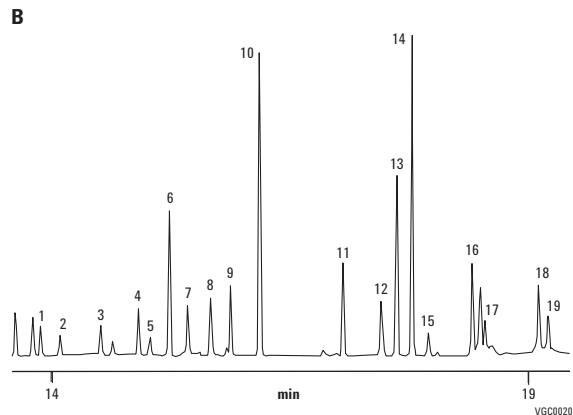
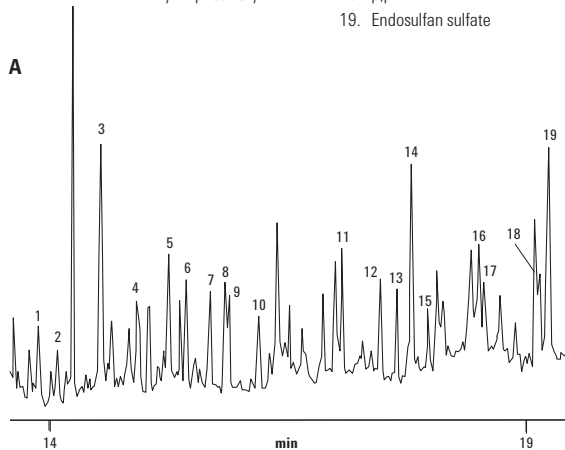
Carrier: He, 1.2 mL/min, constant flow

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: A: Ion Trap in MS/MS, full scan
B: MS/MS

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



Energy and Fuels Applications

Fast Analysis of Aromatic Solvent

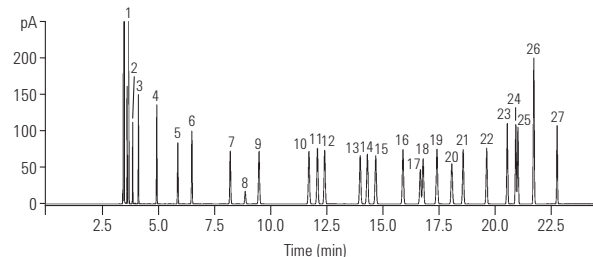
Column: HP-INNOWax
19091N-216
60 m x 0.32 mm, 0.50 μ m

Carrier: Helium at 20 psi constant pressure mode
Oven: 75 °C (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 μ L

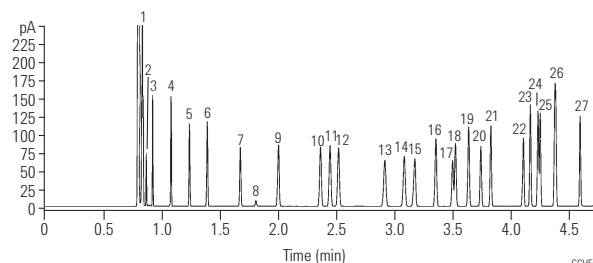
Column: HP-INNOWax
19091N-577
20 m x 0.18 mm, 0.18 μ m

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 μ L

Unified aromatic solvent method



Optimized unified aromatic solvent method



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. 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 four-fold reduction in run time (compared to a 0.32 mm id column) with no compromise in resolution.

Refinery Gas I

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

Carrier: Helium p=9.0 psi at 60 °C

Oven: 60 °C for 5 min
60-200 °C at 20 °C/min
200 °C for 1 min

Injection: Split, 250 °C
Split flow 100 mL/min
0.25 cc valve

Detector: TCD, 250 °C

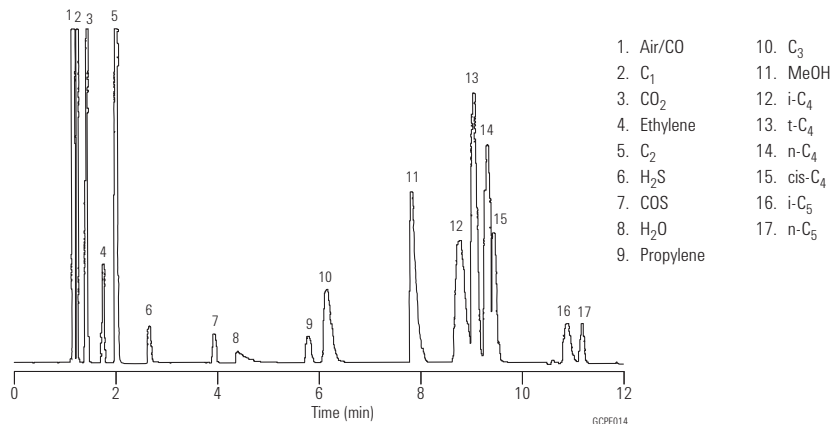
Sample: Refinery gas and others

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



Unleaded Gasoline

Column: DB-Petro
122-10A6
100 m x 0.25 mm, 0.50 µm

Carrier: Helium at 25.6 cm/s

Oven: 0 °C for 15 min
0-50 °C at 1 °C/min
50-130 °C at 2 °C/min
130-180 °C at 4 °C/min
180 °C for 20 min

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

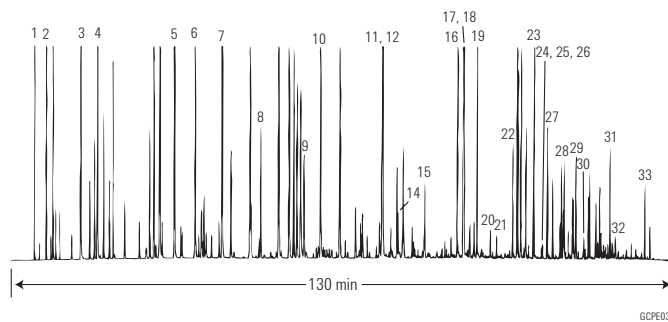
Detector: FID, 250 °C
Nitrogen makeup gas
at 30 mL/min

Sample: 1 µL of neat sample

- | | | |
|-----------------------|----------------------------|--------------------------------|
| 1. Methane | 12. 2,3,3-Trimethylpentane | 23. 1,2,4-Trimethylbenzene |
| 2. n-Butane | 13. 2-Methylheptane | 24. Isobutylbenzene |
| 3. Isopentane | 14. 4-Methylheptane | 25. sec-Butylbenzene |
| 4. n-Pentane | 15. n-Octane | 26. n-Decane |
| 5. n-Hexane | 16. Ethylbenzene | 27. 1,2,3-Trimethylbenzene |
| 6. Methylcyclopentane | 17. m-Xylene ** | 28. Butylbenzene |
| 7. Benzene | 18. p-Xylene | 29. n-Undecane |
| 8. Cyclohexane | 19. o-Xylene | 30. 1,2,4,5-Tetramethylbenzene |
| 9. Isooctane | 20. n-Nonane | 31. Naphthalene |
| 10. n-Heptane | 21. Isopropylbenzene | 32. Dodecane |
| 11. Toluene * | 22. Propylbenzene | 33. Tridecane |

*Valley point with 12 = 78%

**Valley point with 18 = 87%



n-Paraffin Standard

Column: DB-HT Sim Dis
145-1001
5 m x 0.53 mm, 0.15 µm

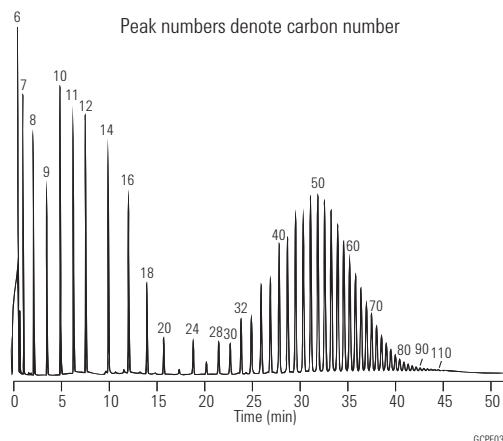
Carrier: Helium at 18 mL/min, measured at 35 °C

Oven: -30-430 °C at 10 °C/min

Injection: OPTIC PTV
55-450 °C at 2 °C/s

Detector: FID, 450 °C
Nitrogen makeup gas at 15 mL/min

Sample: 0.5 µL of about 2% n-paraffins in CS₂

**Sulfur Standards in Toluene**

Column: DB-Sulfur SCD
G3903-63001
60 m x 0.32 mm, 4.20 µm

Inlet: 275 °C, Split ratio 10:1
(Inert Flow Path split/splitless inlet)

Carrier: Helium, constant flow mode, 2.8 mL/min

Oven: 35 °C for 3 min,
35 °C to 250 °C at 10 °C/min,
250 °C for 10 min

Injection: 1 µL

Burner temperature: 800 °C

Vacuum of burner: 364 torr

Vacuum of reaction cell: 5 torr

Hydrogen: 40 mL/min

Air: 60 mL/min

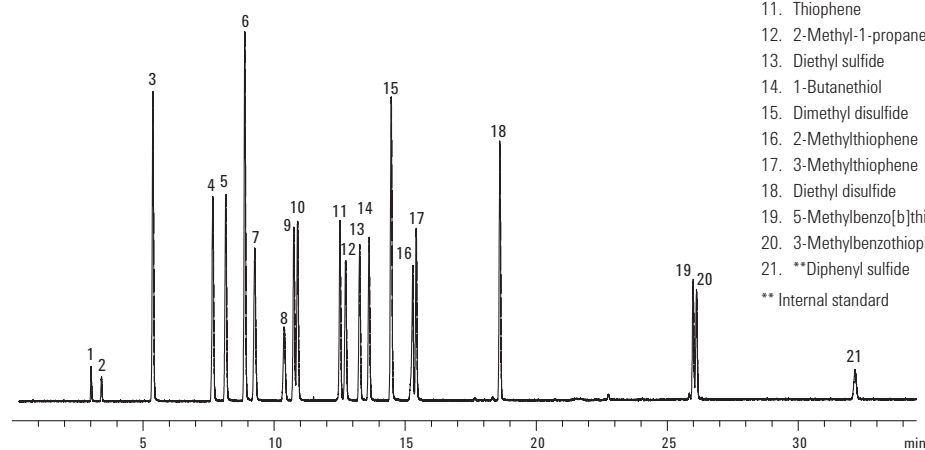
Suggested Supplies

Septum: Non-stick bleed and temperature optimized (BTO) septa, 11 mm, 50/pk, 5183-4757

Liner: Low pressure drop, Ultra Inert Liner with glass wool, 5190-2295

Seal: Ultra Inert gold plated seal and washer, 5190-6144

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



CAS No. **Formula** **Concentration (mg/kg)**

1.	Hydrogen sulfide	7783-06-4	H ₂ S	2000
2.	Carbonyl sulfide	463-58-1	COS	2000
3.	Methanethiol	74-93-1	CH ₃ SH	2000
4.	Ethanethiol	75-08-1	C ₂ H ₅ SH	2000
5.	Dimethyl sulfide	75-18-3	(CH ₃) ₂ S	2000
6.	Carbon disulfide	75-15-0	CS ₂	2000
7.	2-Propanethiol	75-33-2	C ₃ H ₇ S	2000
8.	2-Methyl-2-propanethiol	75-66-1	C ₄ H ₁₀ S	2000
9.	1-Propanethiol	107-03-9	C ₃ H ₇ S	2000
10.	Ethyl methyl sulfide	624-89-5	C ₂ H ₅ SCH ₃	2000
11.	Thiophene	110-02-1	C ₄ H ₄ S	2000
12.	2-Methyl-1-propanethiol	513-44-0	C ₄ H ₁₀ S	2000
13.	Diethyl sulfide	352-93-2	(C ₂ H ₅) ₂ S	2000
14.	1-Butanethiol	109-79-5	C ₄ H ₁₀ S	2000
15.	Dimethyl disulfide	624-92-0	(CH ₃) ₂ S ₂	2000
16.	2-Methylthiophene	554-14-3	C ₅ H ₆ S	2000
17.	3-Methylthiophene	616-44-4	C ₅ H ₆ S	2000
18.	Diethyl disulfide	110-81-6	(C ₂ H ₅ S) ₂	2000
19.	5-Methylbenzo[b]thiophene	14315-14-1	C ₉ H ₈ S	2000
20.	3-Methylbenzothiophene	1455-18-1	C ₉ H ₈ S	2000
21.	**Diphenyl sulfide	139-66-2	C ₁₂ H ₁₀ S	2000

** Internal standard

Sulfur Compounds in Propylene (1 ppm)

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

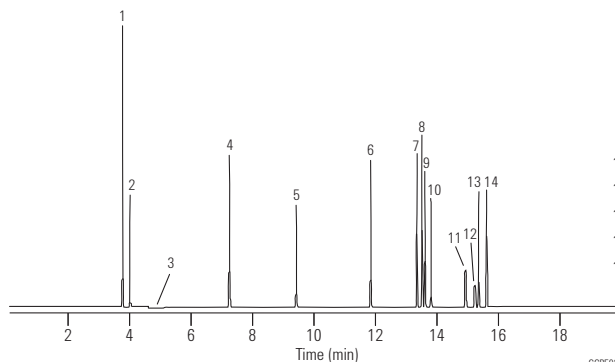
Oven: 60 °C for 2.5 min
60-250 °C at 10 °C/min

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

Chromatogram courtesy of OI Analytical



1. COS
2. H₂S
3. Propylene
4. CS₂
5. Methyl mercaptan
6. Ethyl mercaptan
7. Thiophene
8. Dimethyl sulfide
9. 2-Propanethiol
10. 1-Propanethiol
11. 2-Methyl-2-propanethiol
12. 2-Methyl-1-propanethiol
13. 1-Methyl-1-propanethiol
14. 1-Butanethiol

Sulfur Impurities in Propylene

Column: Select Low Sulfur
CP8575
60 m x 0.32 mm

Oven: 65 °C for 4 min, 30 °C/min to 120 °C for 5 min

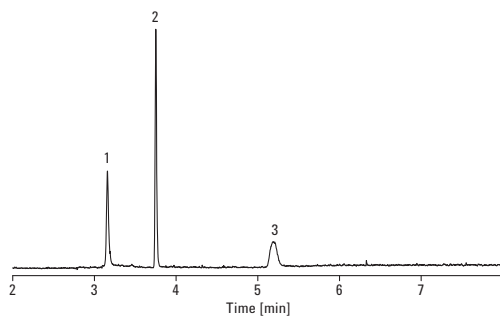
Carrier: Helium, constant flow, 2.0 mL/min

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

Detector: SCD, 200 °C

Sample: Polypropylene matrix containing
~300 ppb H₂S and CH₃SH, ~500 ppb COS

Injection Volume: 1 mL



1. H₂S
2. COS
3. CH₃SH

C₁ to C₄ Hydrocarbon Mix

Column: PoraPLOT Q PT
CP7550PT
10 m x 0.32 mm, 10.00 μ m

Carrier: Helium, 1 mL/min in constant flow mode

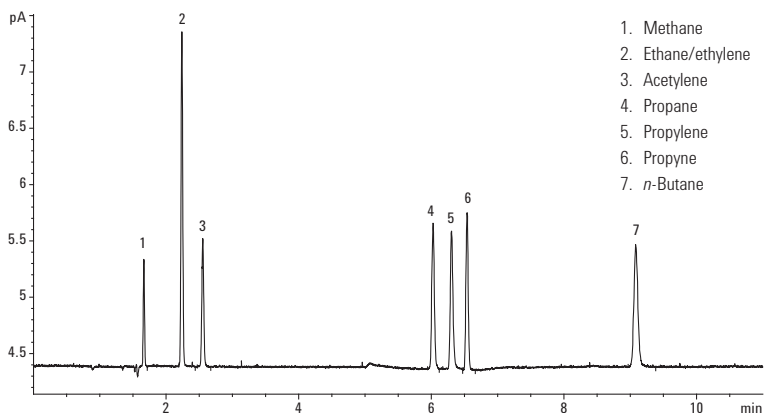
Oven: 50 °C (5 min) then to 120 °C at 50 °C/min,
hold 4.6 min

Sampler: Headspace unit
Oven 40 °C, valve 50 °C, transfer line 60 °C

Detector: FID or TCD at 250 °C

Injection Volume: 0.1 mL loop fitted to inlet valve of headspace unit

Inlet: Split mode at 5:1, typically at 70 °C or higher
depending on column oven initial conditions



PoraPLOT Q PT, 10 m x 0.32 mm, with attached manufacturer-prepared integrated dual-ended particle trap, showing the absence of particles or spikes on FID.

Column: PoraPLOT U PT
CP7584PT
25 m x 0.53 mm, 20.00 μ m

Carrier: Helium, 2 mL/min in constant flow mode

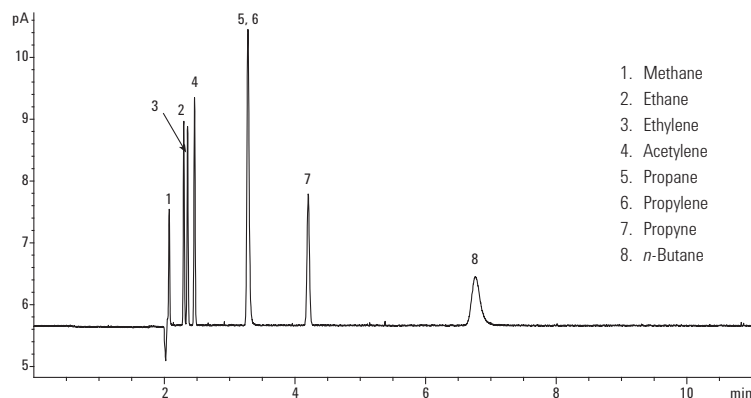
Oven: 85 °C isothermal

Sampler: Headspace unit
Oven 40 °C, valve 50 °C, transfer line 60 °C

Detector: FID or TCD at 250 °C

Injection Volume: 0.1 mL loop fitted to inlet valve of headspace unit

Inlet: Split mode at 5:1, typically at 70 °C or higher
depending on column oven initial conditions



PoraPLOT U PT, 25 m x 0.53 mm, 20 μ m film, with attached manufacturer-prepared integrated dual-ended particle trap, showing the lack of particles or spikes on FID.

Column: HP-PLOT Al₂O₃ KCl PT
19095P-K25PT
50 m x 0.53 mm, 15.00 μ m

Carrier: Helium, 3 mL/min in constant flow mode

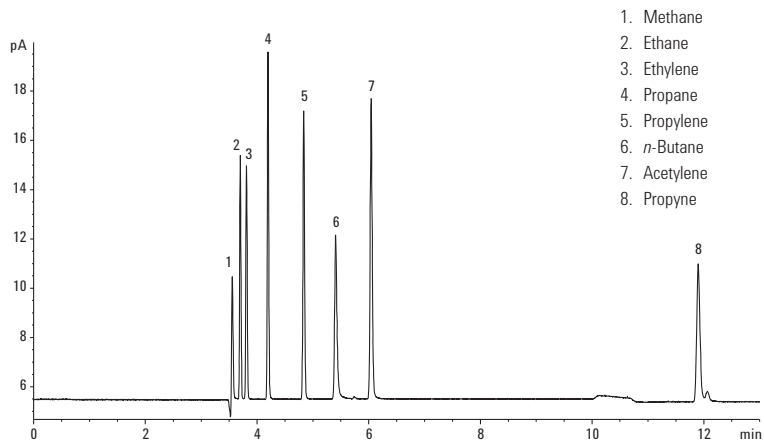
Oven: 100 °C (10 min) then to 120 °C at 30 °C/min,
hold 3 min

Sampler: Headspace unit
Oven 40 °C, valve 50 °C, transfer line 60 °C

Detector: FID or TCD at 250 °C

Injection Volume: 0.1 mL loop fitted to inlet valve of headspace unit

Inlet: Split mode at 5:1, typically at 70 °C or higher
depending on column oven initial conditions



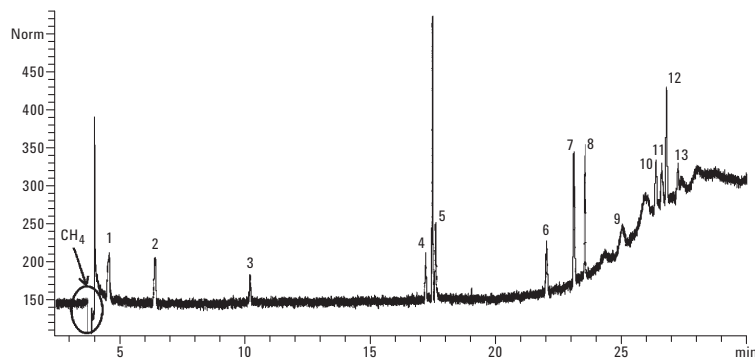
HP-PLOT Al₂O₃ KCl PT, 50 m x 0.53 mm, 15 μ m film, with integrated dual-ended particle trap, showing lack of particles or spikes on FID.

Trace Sulfur Compounds in Methane (50 ppbv)

Column: **Select Low Sulfur
CP8575
60 m x 0.32 mm**

Oven: 40 °C (6 min), to 120 °C at 6 °C/min,
to 180 °C (5 min) at 10 °C/min

Sample: 1 mL, split ratio: 3:1



Compound	Signal/noise
1. Hydrogen sulfide	3.8
2. Carbonyl sulfide	4.0
3. Methylmercaptan	2.2
4. Ethylmercaptan	3.8
5. Dimethyl sulfide	6.3
6. 2-Propanethiol	4.3
7. Methyl ethyl sulfide	11
8. Thiophene	11
9. tert-Butyl mercaptan	2.1
10. 2-Butanethiol	4.5
11. 2-Methyl-1 propanethiol	3.7
12. Diethyl sulfide	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**

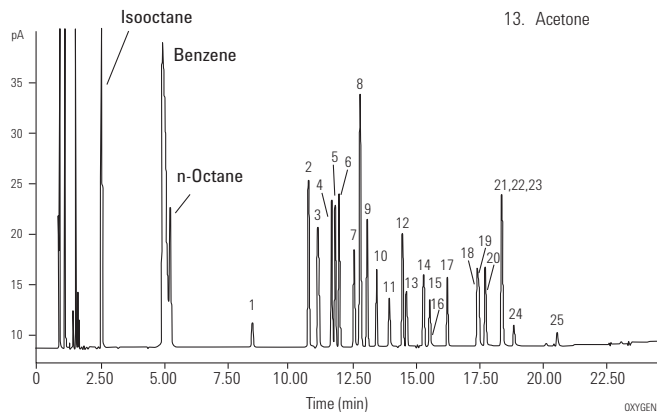
Column: **GS-OxyPLOT
115-4912
10 m x 0.53 mm**

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

Selected Oxygenates

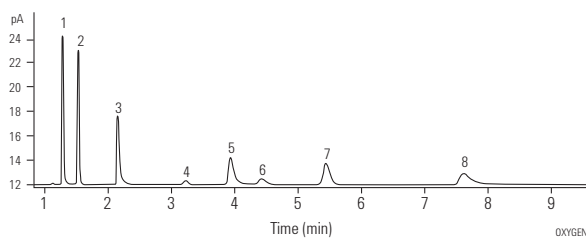
Column: GS-OxyPLOT
115-4912
10 m x 0.53 mm

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-Butyraldehyde
5. n-Tetradecane
6. Methanol
7. Acetone
8. n-Pentadecane

Noble Gases

Column: HP-PLOT Molesieve
19095P-MS0
30 m x 0.53 mm, 50.00 µm

Carrier: Helium, 4 mL/min

Oven: 35 °C for 3 min
35-120 °C at 25 °C/min
120 °C for 5 min

Injection: Split ratio 50:1

Detector: TCD

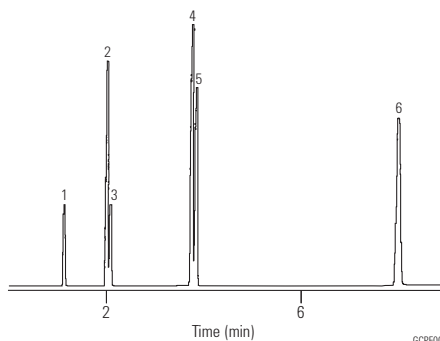
Sample: 250 µL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1. Neon
2. Argon
3. Oxygen
4. Nitrogen
5. Krypton
6. Xenon

Permanent Gases

Column: HP-PLOT Molesieve
19091P-MS4
30 m x 0.32 mm, 12.00 µm

Carrier: Helium, 2 mL/min

Oven: 40 °C isothermal

Injection: Split ratio 75:1

Detector: TCD

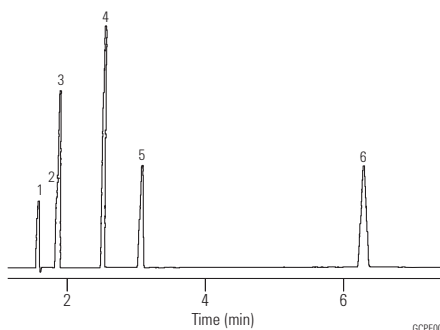
Sample: 250 µL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1. Neon
2. Argon
3. Oxygen
4. Nitrogen
5. Methane
6. Carbon monoxide

Baseline Resolution of Air/CO, CO₂, and Methane in a Natural Gas Sample

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

Carrier: Helium (8.6 mL/min at 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

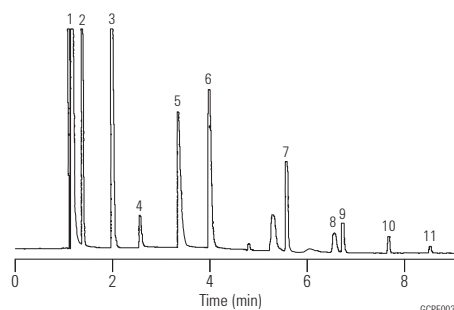
Sample: 0.25 cc natural gas sample, methane, 80%+

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. CO₂
3. Ethane
4. H₂S
5. Water
6. C₃
7. i-C₄/n-C₄
8. neo-C₅
9. i-C₅/n-C₅
10. C₆
11. C₇

Natural Gas

Column: HP-PLOT Al₂O₃ S
19095P-S21
15 m x 0.53 mm, 15.00 µm

Carrier: Helium, 50 cm/s (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

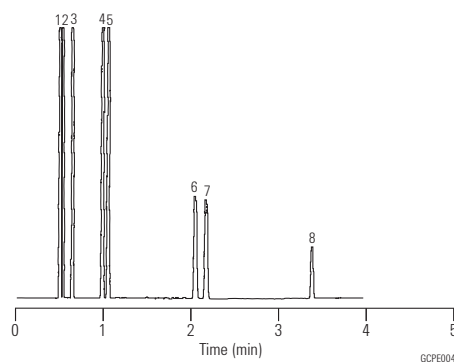
Sample: 5 µL natural gas, p/n 5080-8756

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 Al₂O₃ S
19095P-S25
50 m x 0.53 mm, 15.00 μm

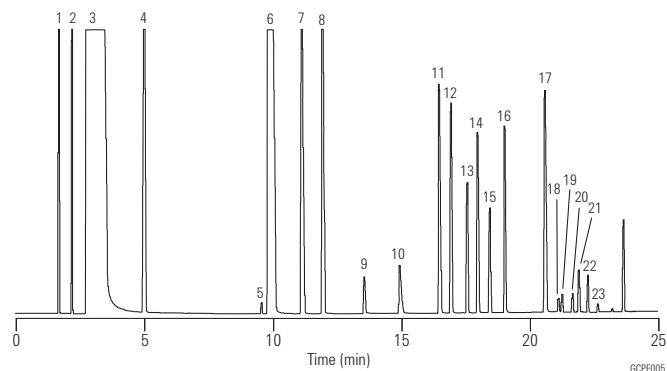
Carrier: Helium, 50 cm/s (35 °C),
7 mL/min constant flow

Oven: 35 °C for 2 min
35-100 °C at 5 °C/min

Injection: Split, 250 °C
Split ratio 65:1

Detector: FID, 250 °C

Sample: 5 μL
ethylene 98.4%



1. Methane
2. Ethane
3. Ethylene
4. Propane
5. Cyclopropane
6. Propylene
7. Isobutane
8. n-Butane
9. Propadiene
10. Acetylene
11. trans-2-Butene
12. Butene-1
13. Isobutylene
14. cis-2-Butene
15. Isopentane
16. n-Pentane
17. 1,3-Butadiene
18. Propyne
19. trans-2-Pentene
20. 2-Methyl-2-butene
21. Pentene-1
22. cis-2-Pentene
23. n-Hexane

Impurities in Ethylene

Column: GS-Alumina KCl
115-3352
50 m x 0.53 mm

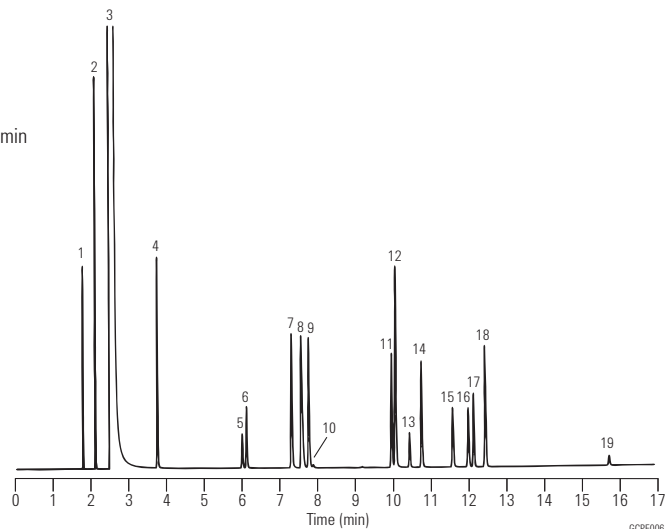
Carrier: Helium at 8 mL/min, measured at 35 °C

Oven: 35 °C for 2 min
35-190 °C at 10 °C/min
190 °C for 3 min

Injection: Split, 200 °C
Split ratio 1:40

Detector: FID, 200 °C
Nitrogen makeup gas at 20 mL/min

Sample: 0.2 mL of trace hydrocarbons
in ethylene



1. Methane
2. Ethane
3. Ethylene
4. Propane
5. Cyclopropane
6. Propylene
7. Isobutane
8. Acetylene
9. n-Butane
10. Propadiene
11. trans-2-Butene
12. 1-Butene
13. Isobutylene
14. cis-2-Butene
15. Isopentane
16. n-Pentane
17. Propyne
18. 1,3-Butadiene
19. 1-Pentene

Impurities in Propylene

Column: GS-Alumina KCl
115-3352
50 m x 0.53 mm

Carrier: Helium at 10 mL/min,
measured at 35 °C

Oven: 35 °C for 2 min
35-190 °C at 10 °C/min
190 °C for 3 min

Injection: Split, 200 °C
Split ratio 1:30

Detector: FID, 200 °C
Nitrogen makeup gas
at 20 mL/min

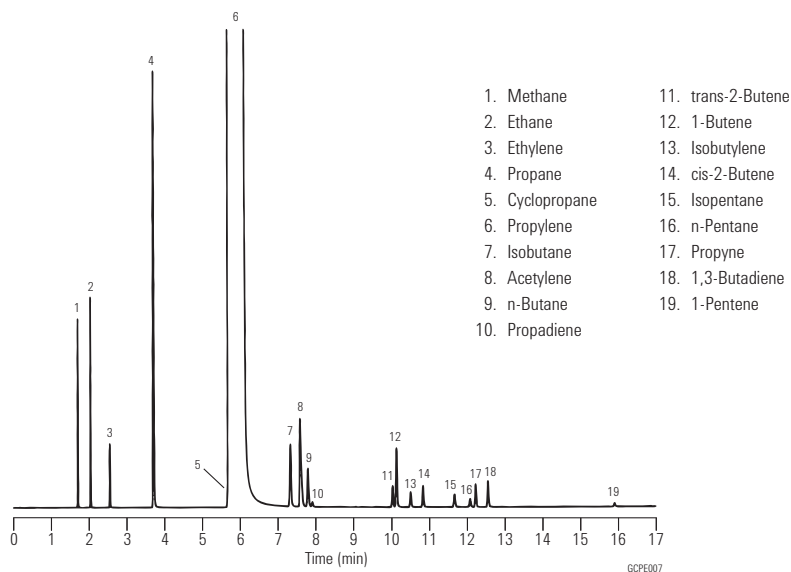
Sample: 0.2 mL of trace
hydrocarbons in propylene

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



Propylene

Column: GS-Alumina
115-3552
50 m x 0.53 mm

Carrier: Helium at 10 mL/min,
measured at 35 °C

Oven: 35 °C for 2 min
35-190 °C at 10 °C/min
190 °C for 3 min

Injection: Split, 200 °C
Split ratio 1:30

Detector: FID, 200 °C
Nitrogen makeup gas
at 20 mL/min

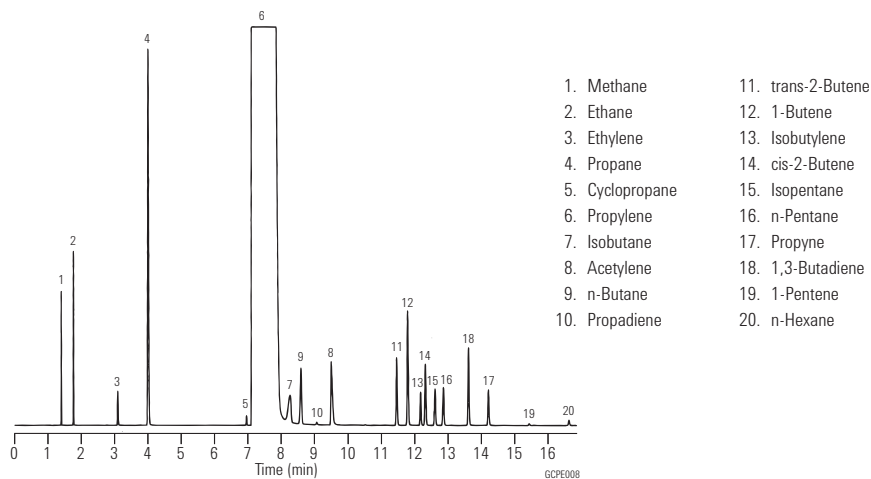
Sample: 0.2 mL of trace
hydrocarbons in propylene

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1,3-Butadiene

Column: DB-624
128-1324
25 m x 0.20 mm, 1.12 μ m

Carrier: Helium at 1.0 mL/min

Oven: -20 °C for 3 min
-20 °C to 20 °C at 4 °C/min
20 °C to 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 μ L

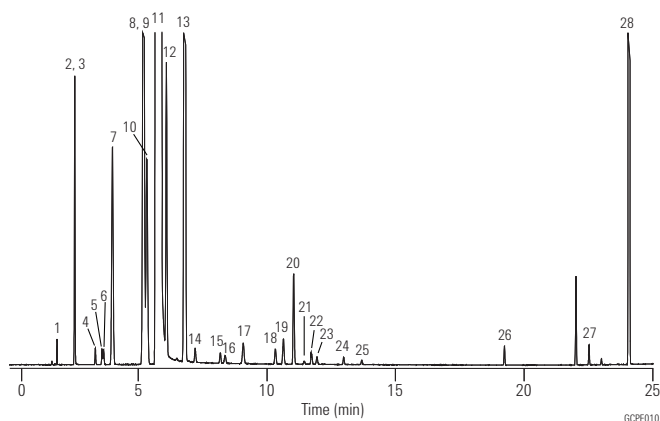
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

Agilent Technologies wishes to thank DCG Industries
(Pearland, TX) for providing this chromatogram.

**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)	

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

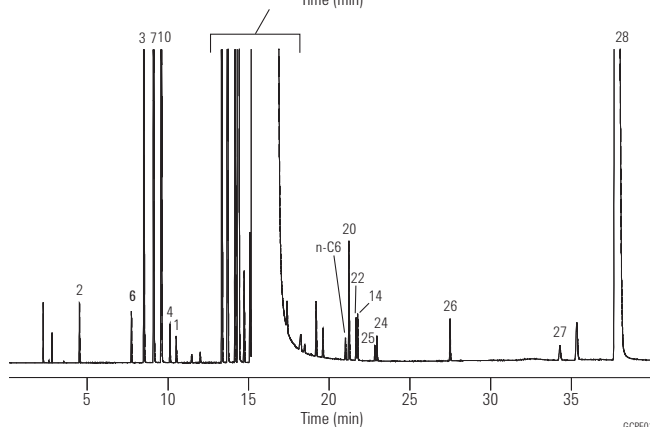
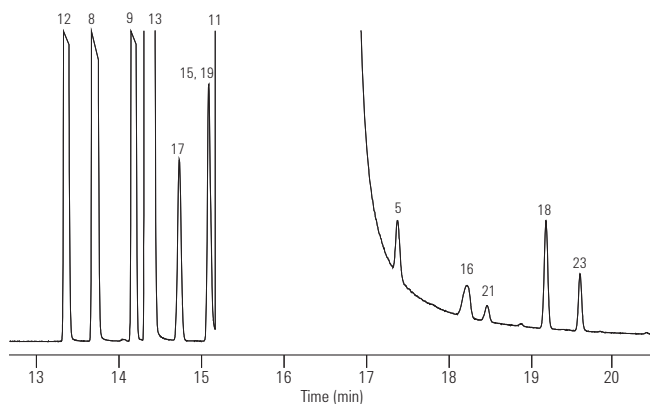
Septum: 11 mm Advanced Green septa, 5183-4759

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)	



GCPE011

Extended Hydrocarbon Analysis I

Column: GS-Alumina
115-3532
30 m x 0.53 mm

Carrier: Helium at 52 cm/s (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

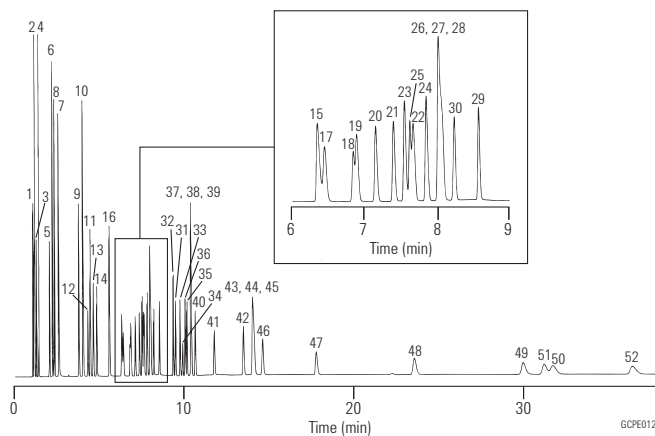
Sample: 300 µL injection of 100 ppmv
SUMMA canister mixture

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



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

Extended Hydrocarbon Analysis II

Column: GS-GasPro
113-4362
60 m x 0.32 mm

Carrier: Helium at 40 cm/s (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

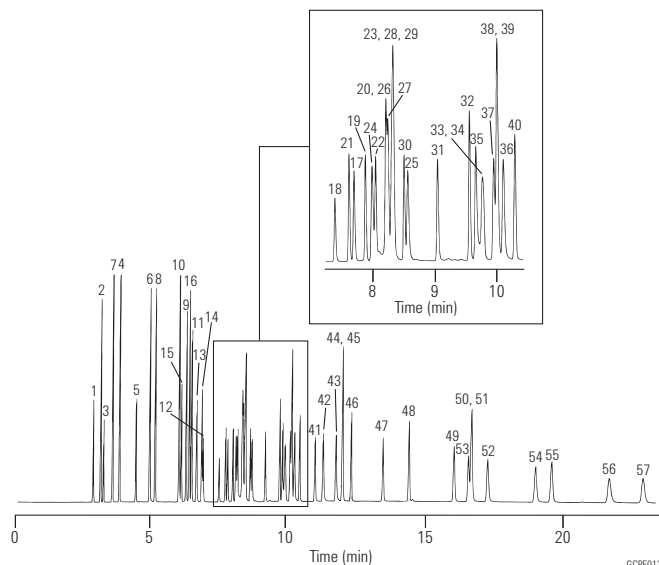
Sample: 500 µL injection of 100 ppmv
SUMMA canister mixture

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 | 30. n-Hexane |
| 2. Ethane | 31. 4-Methyl-1-pentene |
| 3. Ethylene | 32. trans-2-Hexene |
| 4. Propane | 33. 2-Methyl-1-pentene |
| 5. Propylene | 34. cis-2-Hexene |
| 6. Isobutane | 35. 2,4-Dimethylpentane |
| 7. Acetylene | 36. Methylcyclohexane |
| 8. n-Butane | 37. 2,3-Dimethylpentane |
| 9. trans-2-Butene | 38. 2-Methylhexane |
| 10. 1-Butene | 39. 3-Methylhexane |
| 11. cis-2-Butene | 40. n-Heptane |
| 12. Cyclopentane | 41. Benzene |
| 13. Isopentane | 42. Isooctane (2,2,4-trimethylpentane) |
| 14. n-Pentane | 43. 2,3,4-Trimethylpentane |
| 15. Propyne | 44. 3-Methylheptane |
| 16. 1,3-Butadiene | 45. 2-Methylheptane |
| 17. Cyclopentene | 46. n-Octane |
| 18. 3-Methyl-1-butene | 47. Toluene |
| 19. trans-2-Pentene | 48. n-Nonane |
| 20. 2-Methyl-2-butene | 49. Ethylbenzene |
| 21. 1-Pentene | 50. m-Xylene |
| 22. cis-2-Pentene | 51. p-Xylene |
| 23. Methylcyclopentane | 52. o-Xylene |
| 24. 2,2-Dimethylbutane | 53. Styrene |
| 25. Cyclohexane | 54. Isopropylbenzene (cumene) |
| 26. 2,3-Dimethylbutane | 55. n-Propylbenzene |
| 27. 2-Methylpentane | 56. 1,3,5-Trimethylbenzene |
| 28. 3-Methylpentane | 57. 1,2,4-Trimethylbenzene |
| 29. Isoprene | |

Refinery Gas

Column: HP-PLOT Al₂O₃ 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

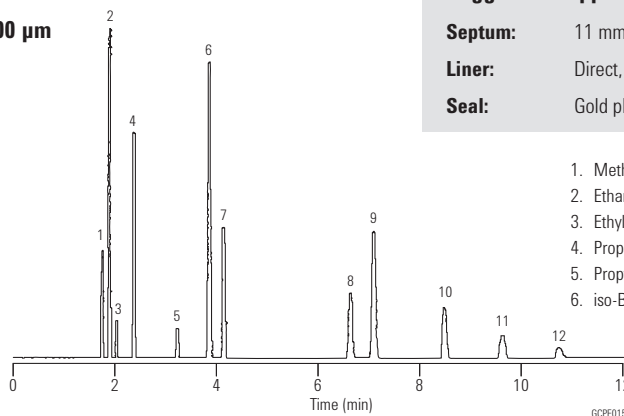
Sample: 5 µL

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 | 7. n-Butane |
| 2. Ethane | 8. trans-2-Butene |
| 3. Ethylene | 9. 1-Butene |
| 4. Propane | 10. cis-2-Butene |
| 5. Propylene | 11. iso-Pentane |
| 6. iso-Butane | 12. n-Pentane |

**Sulfur Gas Analysis
in Light Hydrocarbon Streams I**

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

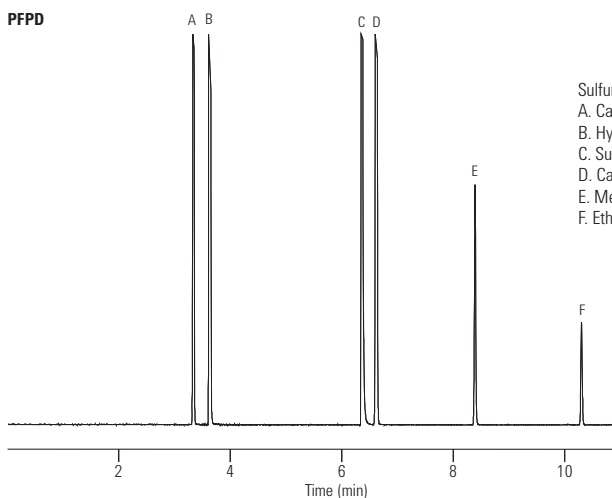
Carrier: Helium, 10 psig, 2.0 mL/min at 60 °C

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

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

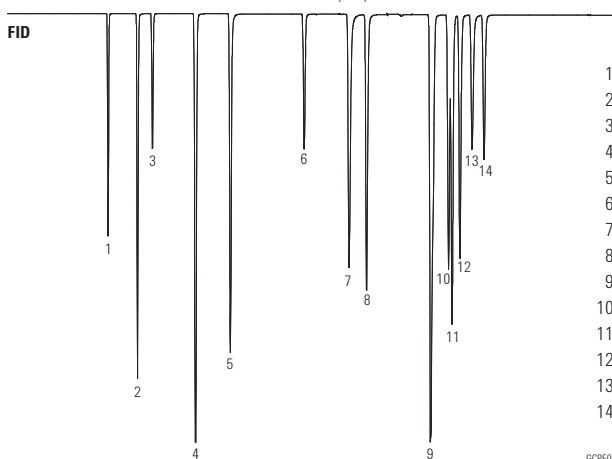
Detector: Two separate analyses under identical
conditions on FID and PFPD

PFPD



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

FID



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

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

Sulfur Gas Analysis in Light Hydrocarbon Streams II

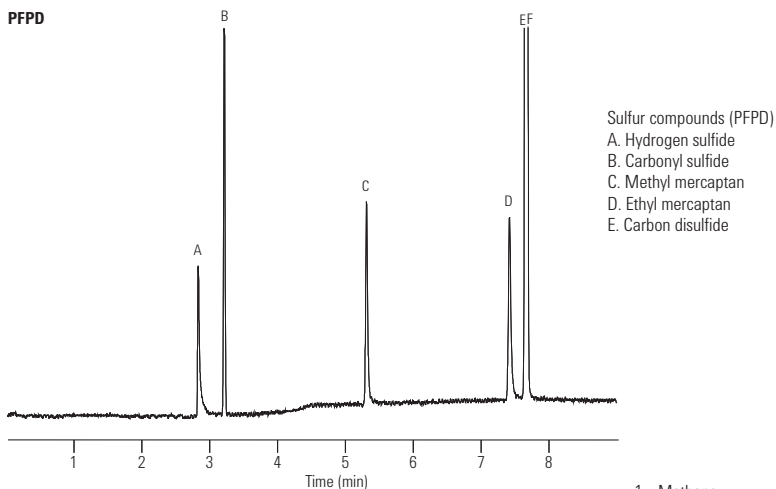
Column: GS-Q
113-3432
30 m x 0.32 mm, 0.20 µm

Carrier: Helium, 10 psig, 1.7 mL/min at 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

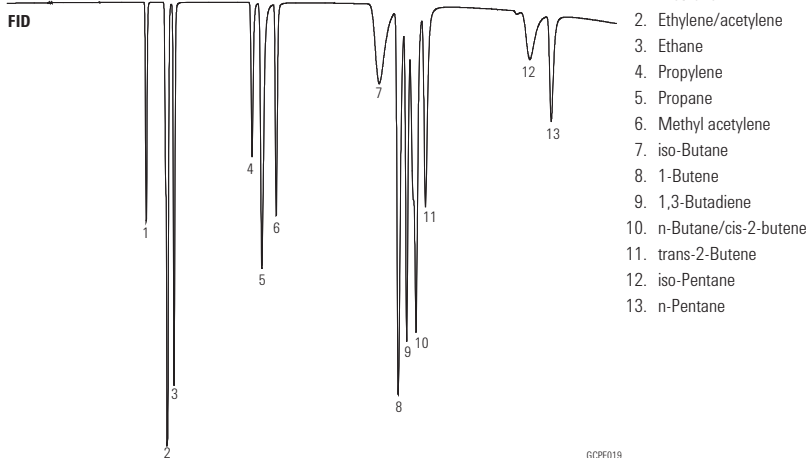


Suggested Supplies

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)

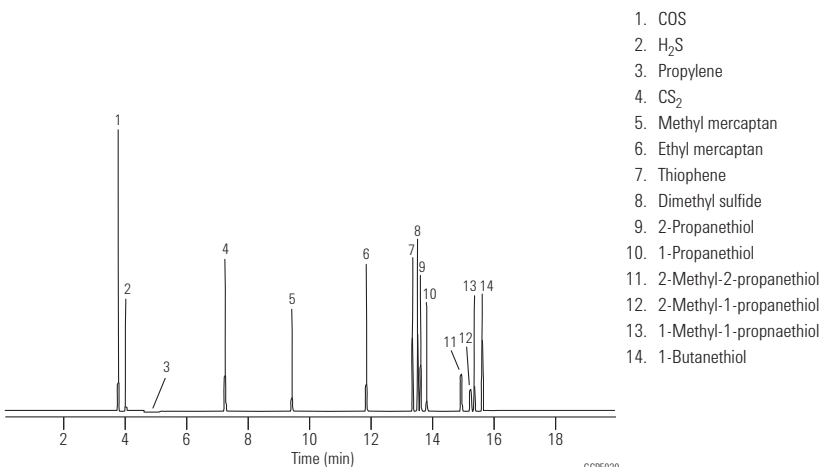
Column: GS-GasPro
113-4332
30 m x 0.32 mm

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



Chromatogram courtesy of OI Analytical

Mercaptans

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

Carrier: Helium at 25 cm/s

Oven: 175 °C for 2 min
175-260 °C at 10 °C/min

Injection: Split
Split flow 80 mL/min

Detector: FID

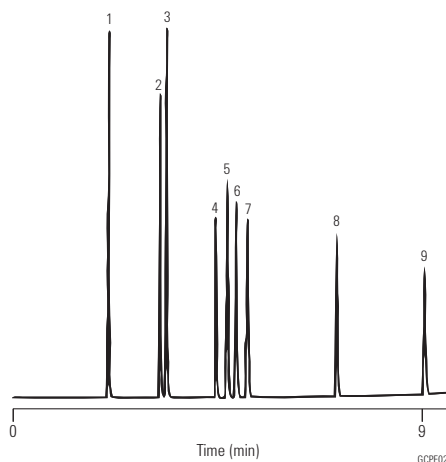
Sample: 0.2 mL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1. Ethyl mercaptan
2. 2-Propyl mercaptan
3. 1-Propyl mercaptan
4. 2-Methyl-2-propyl mercaptan
5. 2-Methyl-1-propyl mercaptan
6. 1-Methyl-1-propyl mercaptan
7. 1-Butyl mercaptan
8. 1-Pentyl mercaptan
9. 1-Hexyl mercaptan

Sulfur Compounds in Natural Gas – Synthetic Mixture

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

Carrier: Helium

Oven: 35 °C for 10 min
35-300 °C at 7 °C/min

Injection: Split 100:1

Detector: FPD

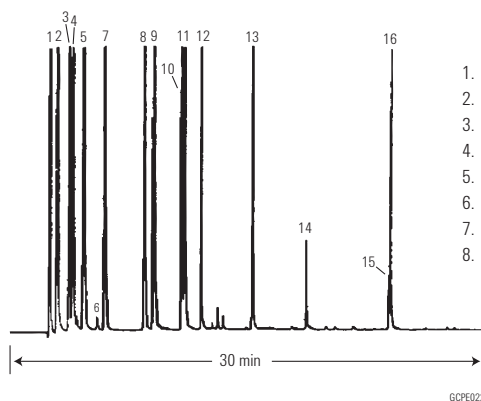
Sample: 0.5 mL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



- | | |
|--------------------------------------|----------------------------|
| 1. Hydrogen sulfide | 9. Isobutyl mercaptan |
| 2. Methyl mercaptan | 10. n-Butyl mercaptan |
| 3. Ethyl mercaptan | 11. tert-Amyl mercaptan |
| 4. Dimethyl sulfide | 12. Isoamyl mercaptan |
| 5. Isopropyl mercaptan | 13. n-Amyl mercaptan |
| 6. tert-Butyl mercaptan | 14. n-Hexyl mercaptan |
| 7. n-Propyl mercaptan | 15. tert-Dibutyl disulfide |
| 8. Thiophene and sec-butyl mercaptan | 16. n-Octyl mercaptan |

Sulfur Compounds in Naphtha

Column: HP-PONA
19091S-001
50 m x 0.20 mm, 0.50 µm

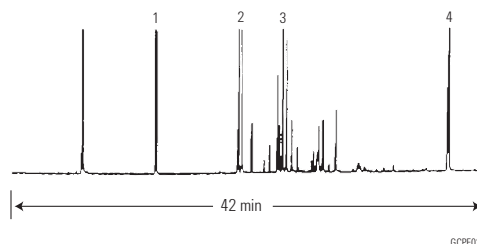
Carrier: Helium, 26 cm/s

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

GCPE023

Aromatics Analysis – ASTM D16 Analytes

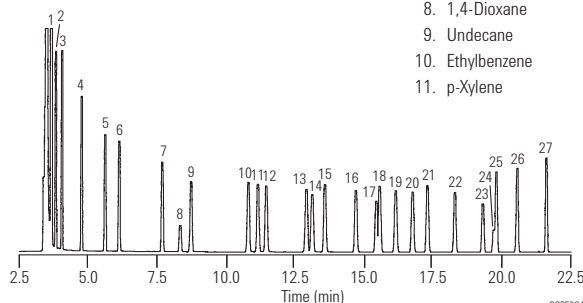
Column: HP-INNOWax
19091N-216
60 m x 0.32 mm, 0.50 µm

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 acquisition rate at 20 Hz



- | | |
|------------------|---------------------------|
| 1. Heptane | 12. m-Xylene |
| 2. Cyclohexane | 13. Cumene |
| 3. Octane | 14. Dodecane |
| 4. Nonane | 15. o-Xylene |
| 5. Benzene | 16. Propylbenzene |
| 6. Decane | 17. p-Ethyltoluene |
| 7. Toluene | 18. m-Ethyltoluene |
| 8. 1,4-Dioxane | 19. tert-Butylbenzene |
| 9. Undecane | 20. sec-Butylbenzene |
| 10. Ethylbenzene | 21. Styrene |
| 11. p-Xylene | 22. Tridecane |
| | 23. Diethylbenzene isomer |
| | 24. Diethylbenzene isomer |
| | 25. n-Butylbenzene |
| | 26. α-Methylstyrene |
| | 27. Phenylacetylene |

GCPE024

Aromatics Analysis – Ethylbenzene Impurities

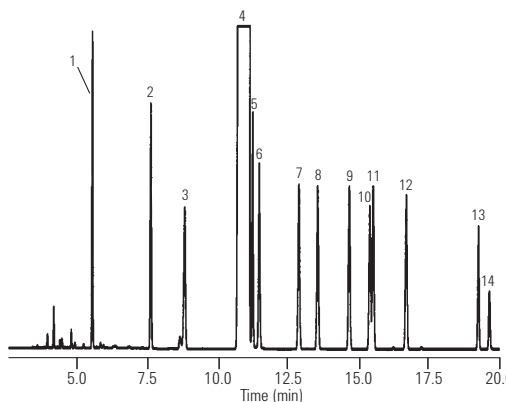
Column: HP-INNOWax
19091N-216
60 m x 0.32 mm, 0.50 µm

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 acquisition 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-Propylbenzene
10. p-Ethyltoluene
11. m-Ethyltoluene
12. s-Butylbenzene
13. Diethylbenzene
14. Diethylbenzene

GCPE025

Impurities in p-Xylene – ASTM D3798

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

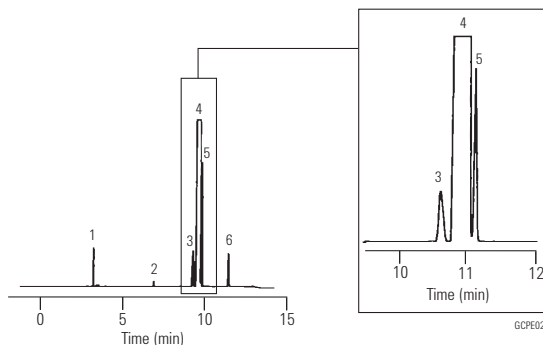
Carrier: Helium, 32 cm/s, 19.9 psi (60 °C),
2.5 mL/min constant flow

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

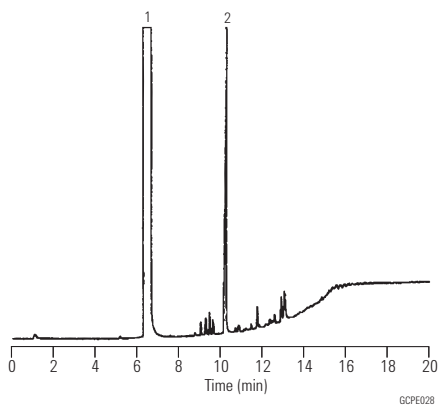
Suggested Supplies

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

Analysis of Oxygenates in Mixed C4 Streams

Column: PoraBOND Q PT
CP7351PT
25 m x 0.32 mm, 5.00 µm

Instrument: Agilent 7890A Series

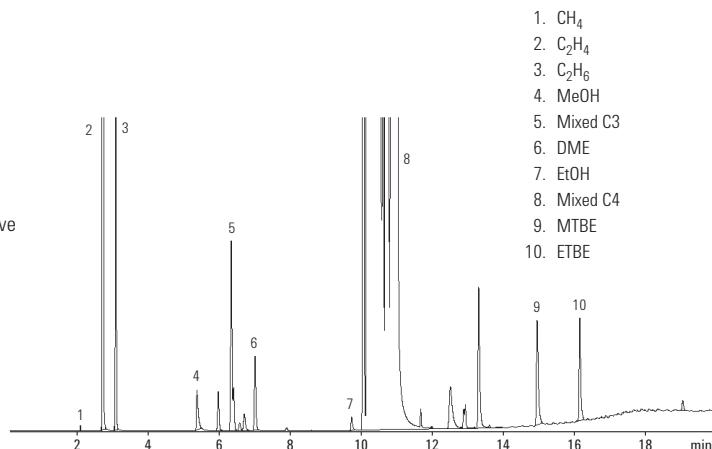
Carrier: Helium, constant flow mode, 35 cm/s, 45 °C

Oven: 45-90 °C at 6 °C/min, 90-240 °C at 15 °C/min,
240 °C for 10 min

Injection: 200 °C, split ratio 30:1, 200 µL gas sampling valve

Detector: FID at 250 °C

Sample: 50-100 mg/L oxygenates in mixed C4

**Oxygenates in Gasoline ASTM D5599 (GC-OFID)**

Column: HP-1
19091Z-236
60 m x 0.25 mm, 1.00 µm

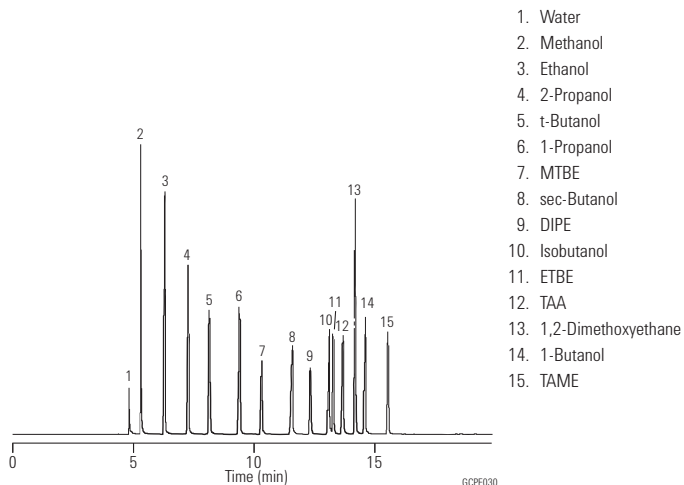
Carrier: Helium, 30 cm/s constant flow

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



Denatured Fuel Ethanol – ASTM D5501

Column: HP-1
19091Z-530
100 m x 0.25 mm, 0.50 µm

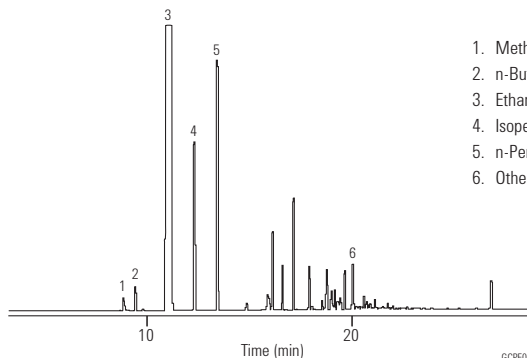
Carrier: Helium 24 cm/s

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

GCPE031

PONA Mix as Specified by AFNOR Method #2

Column: DB-Petro
128-1056
50 m x 0.20 mm, 0.50 µm

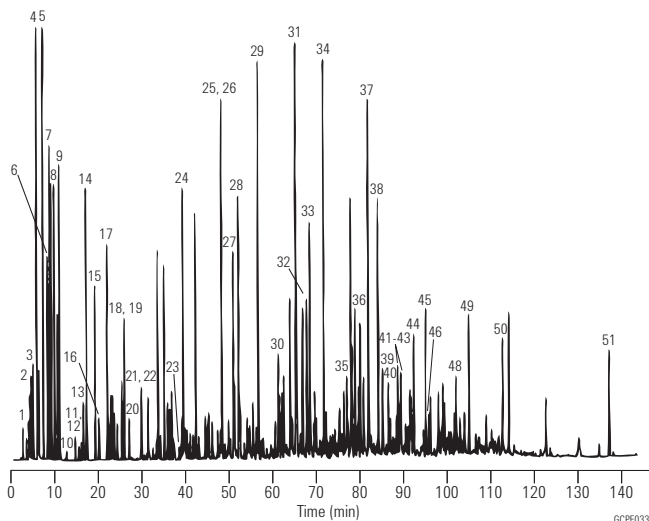
Carrier: Helium at 16.7 cm/s, measured at 35 °C

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 reformat



- 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

GCPE033

Aromatics in Finished Gasoline – ASTM Method D5769

Column: DB-1
122-1063
60 m x 0.25 mm, 1.00 µm

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

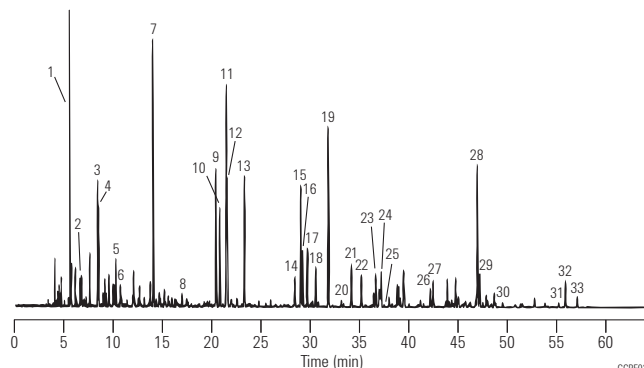
Oven: 50 °C for 1 min
50-190 °C at 2 °C/min
190 °C for 1 min

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

Detector: MSD

Sample: 0.3 µL unleaded gasoline
Calibration standard: ASTM/EPA gasoline
refinery aromatics
(AccuStandard M-GRA-CAL/IS-SET)

- | | | |
|-----------------------------------|-----------------------------|--------------------------------|
| 1. Methyl-tert-butyl-ether (MTBE) | 12. p-Xylene | 23. 1,4-Diethylbenzene |
| 2. n-Hexane | 13. o-Xylene | 24. n-Butylbenzene (valley) |
| 3. Benzene-d6 (IS) | 14. n-Propylbenzene | 25. 1,2-Diethylbenzene |
| 4. Benzene | 15. 1-Methyl-3-ethylbenzene | 26. 1,2,4,5-Tetramethylbenzene |
| 5. Isooctane | 16. 1-Methyl-4-ethylbenzene | 27. 1,2,3,5-Tetramethylbenzene |
| 6. n-Heptane | 17. 1,3,5-Trimethylbenzene | 28. Naphthalene-d8 (IS) |
| 7. Toluene | 18. 1-Methyl-2-ethylbenzene | 29. Naphthalene |
| 8. n-Octane | 19. 1,2,4-Trimethylbenzene | 30. n-Dodecane |
| 9. Ethylbenzene-d10 (IS) | 20. n-Decane | 31. Pentamethylbenzene |
| 10. Ethylbenzene | 21. 1,2,3-Trimethylbenzene | 32. 2-Methylnaphthalene |
| 11. m-Xylene | 22. Indan | 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

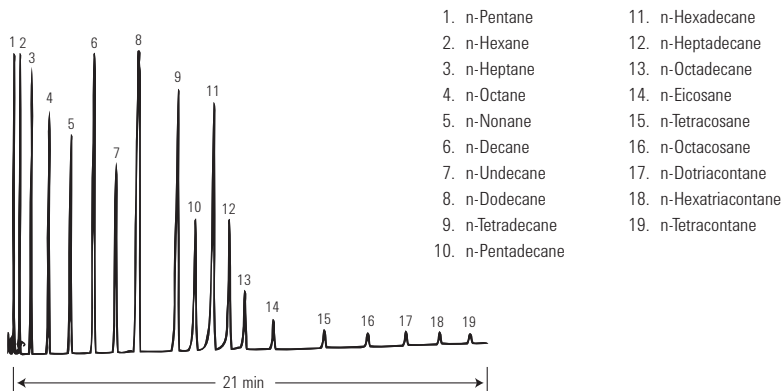
Suggested Supplies

Septum: Non-stick bleed and temperature optimized (BTO) septa, 11 mm, 50/pk, 5183-4757

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

Seal: Gold plated seal, 18740-20885

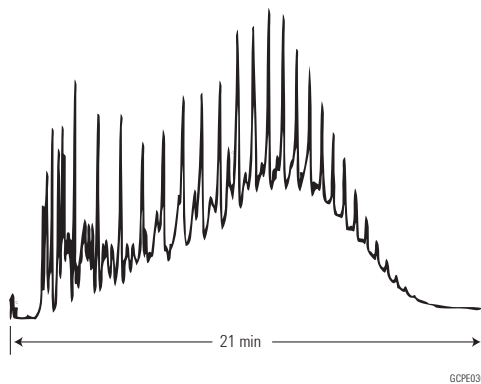
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



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



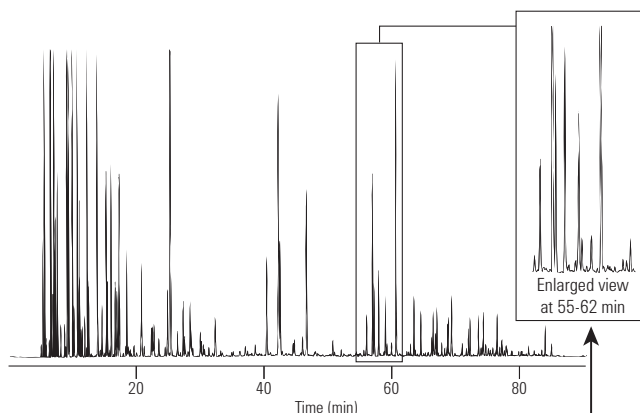
Suggested Supplies

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/s
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

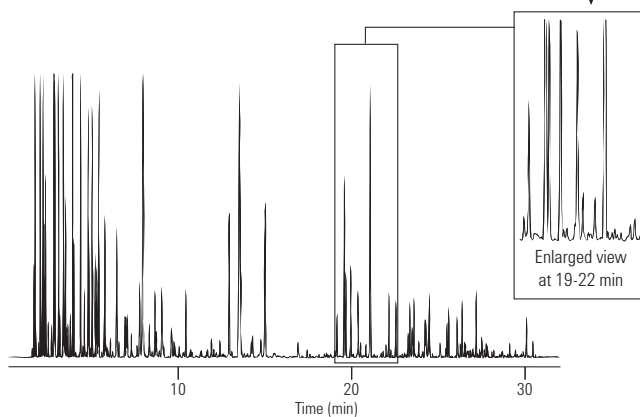


Compare Resolution

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/s
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 D5769

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

Sample: 0.1 μ L

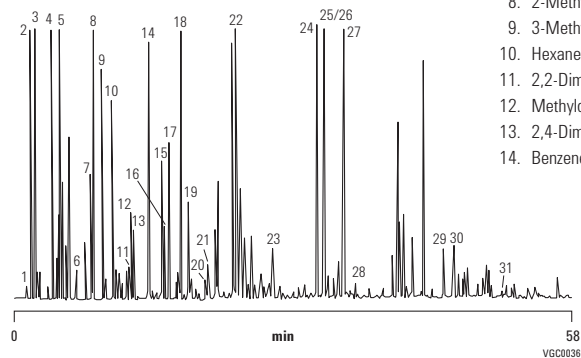
Carrier: Helium, 240 kPa (2.4 bar, 34 psi)

Oven: 35 $^{\circ}$ C (7 min) to 250 $^{\circ}$ C, 3 $^{\circ}$ C/min

Injection: Split, 80 mL/min

Detector: FID

- | | |
|-------------------------|------------------------------------|
| 1. Propane | 15. 2-Methylhexane |
| 2. Isobutane | 16. 2,3-Dimethylpentane |
| 3. Butane | 17. 3-Methylhexane |
| 4. 2-Methylbutane | 18. Tert. amyl methyl ether (TAME) |
| 5. Pentane | 19. Unknown |
| 6. 2,2-Dimethylbutane | 20. 2,2-Dimethylhexane |
| 7. 2,3-Dimethylbutane | 21. Methylcyclohexane |
| 8. 2-Methylpentane | 22. Toluene |
| 9. 3-Methylpentane | 23. Octane |
| 10. Hexane | 24. Ethylbenzene |
| 11. 2,2-Dimethylpentane | 25. p-Xylene |
| 12. Methylcyclopentane | 26. m-Xylene |
| 13. 2,4-Dimethylpentane | 27. o-Xylene |
| 14. Benzene | 28. Nonane |
| | 29. Decane |
| | 30. 1,2,3-Trimethylbenzene |
| | 31. Undecane |

**Polyethylene**

Column: DB-1
125-1011
15 m x 0.53 mm, 0.15 μ m

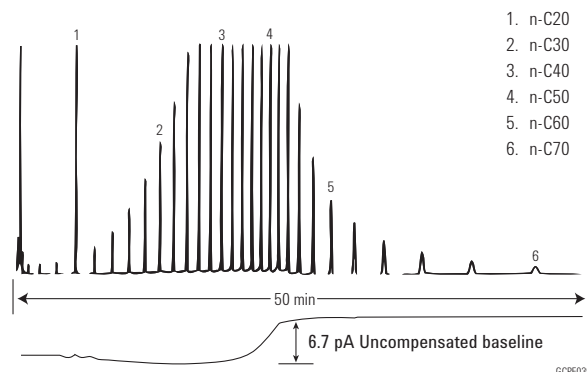
Carrier: Helium at 8 mL/min

Oven: 120-360 $^{\circ}$ C at 10 $^{\circ}$ C/min

Injection: Split ratio 1:500

Detector: FID, 300 $^{\circ}$ C
Nitrogen makeup gas at 30 mL/min

Sample: 0.5 μ L
3% solution in CS₂



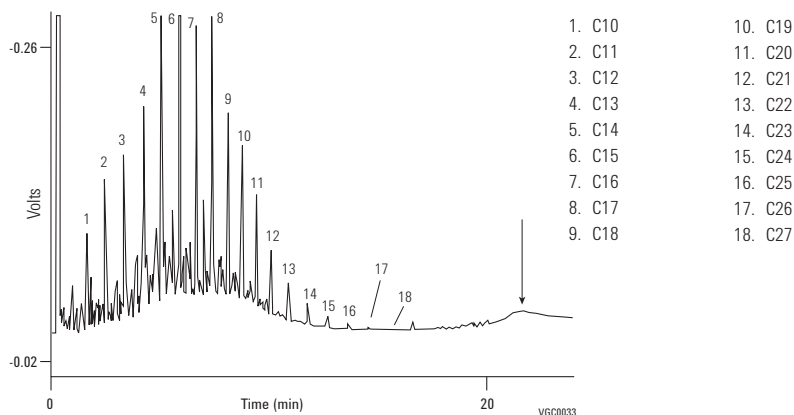
Diesel Analysis

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

Carrier: H₂, 60 kPa, 0.6 bar, 8.6 psi

Oven: 50 °C (1 min), 15 °C to 180 °C,
7 °C to 230 °C, 30 °C to 380 °C

Detector: FID

**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: Cyclohexane

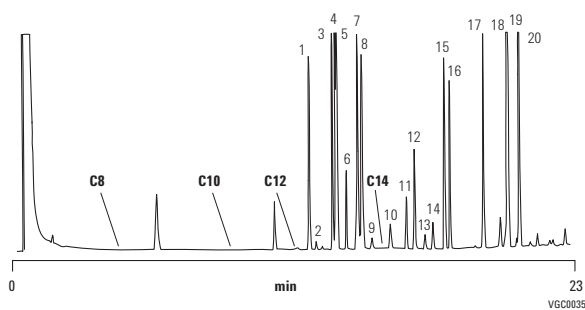
Carrier: He, 28.8 kPa (0.288 bar, 4.1 psi)

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

Injection: Split, T=250 °C

Detector: FID, T=250 °C

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



Analysis of Process Gas

Column: HP-PLOT Q PT
19095P-Q04PT
30 m x 0.53 mm, 40.00 µm

Instrument: Agilent 7890A

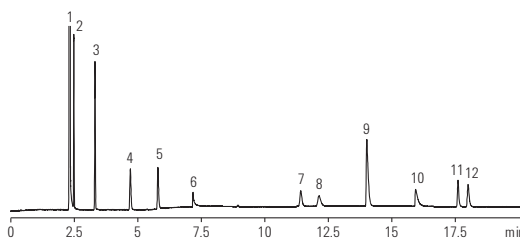
Carrier: Hydrogen, constant flow mode, 40 cm/s, 32 °C

Oven: 32 °C for 5 min, 32 °C to 70 °C at 30 °C/min,
70 °C for 5 min, 70 to 160 °C at 10 °C/min

Injection: 170 °C, split ratio 5:1, 250 µL gas sampling loop

Detector: TCD at 250 °C

1. CO/air
2. Methane
3. Carbon dioxide
4. Ethylene
5. Ethane
6. Hydrogen sulfide
7. Propylene
8. Propane
9. Dimethyl ether
10. Methanol
11. Butylene
12. Butane

**Detailed Hydrocarbon Analysis of Petroleum Naphthas Through N-nonane Using ASTM D5134**

Column: CP-Sil PONA for ASTM D5134
CP7531
50 m x 0.21 mm, 0.50 µm

Sample: 0.2 µL

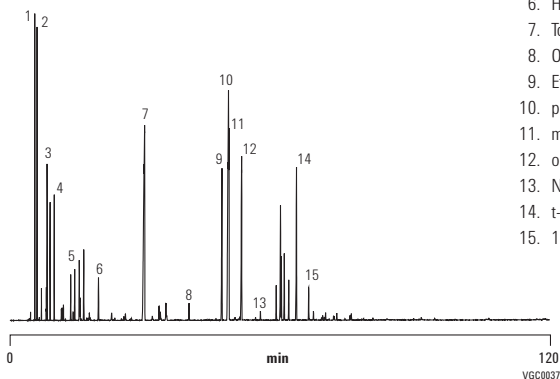
Carrier: Helium

Oven: 35 °C (30 min) at 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. iso-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



Industrial Chemical Applications

Alcohols I

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

Carrier: Helium at 30 cm/s,
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 μ L of 0.01-0.05% each solvent in CS₂

Suggested Supplies

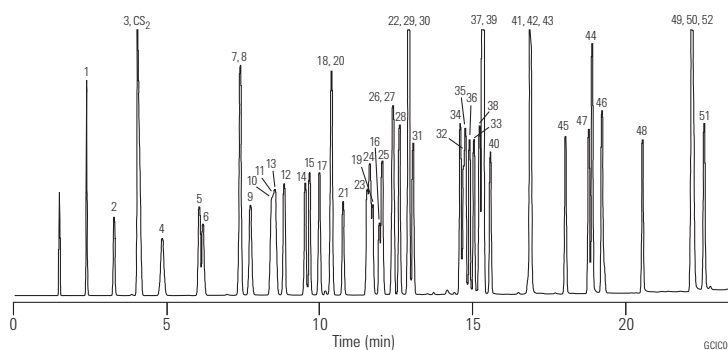
Septum: 11 mm Advanced Green septa, 5183-4759

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

Seal: Gold plated seal kit, 5188-5367

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

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



Halogenated Hydrocarbons I

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

Carrier: Helium at 35 cm/s

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

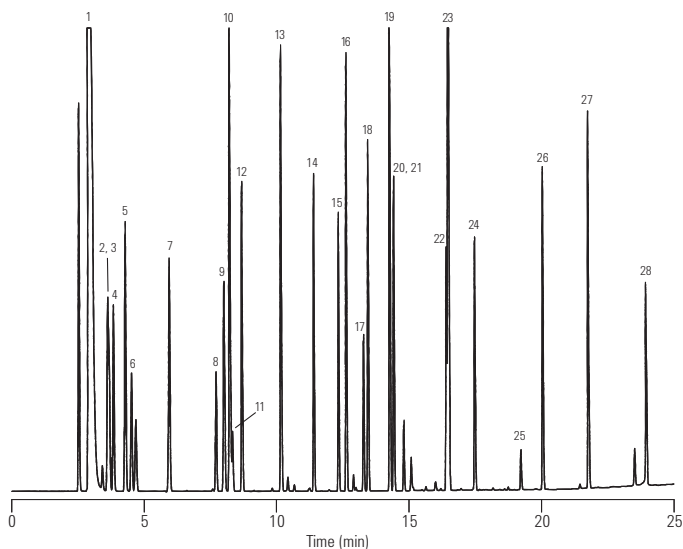
Suggested Supplies

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

G010034

Aromatic Solvents

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

Carrier: Helium at 31 cm/s

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

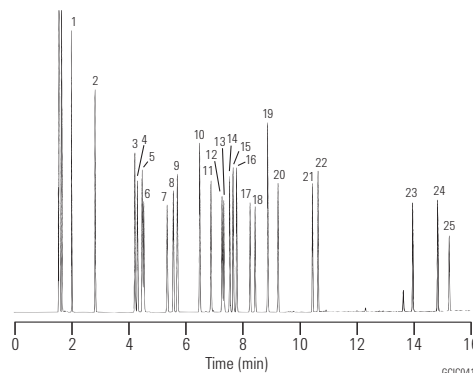
Suggested Supplies

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

Phenols I

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

Carrier: Helium, 33 cm/s, 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

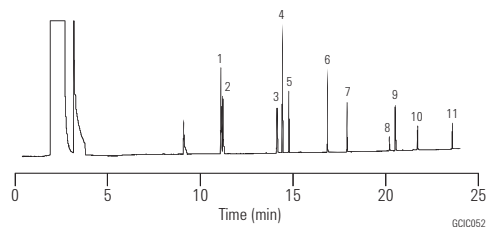
Suggested Supplies

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

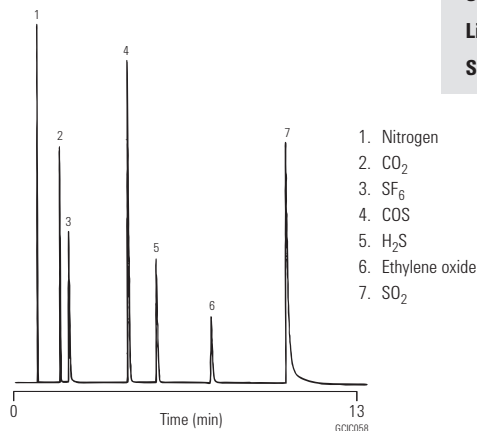
Carrier: Helium at 53 cm/s

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

Alcohols II

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

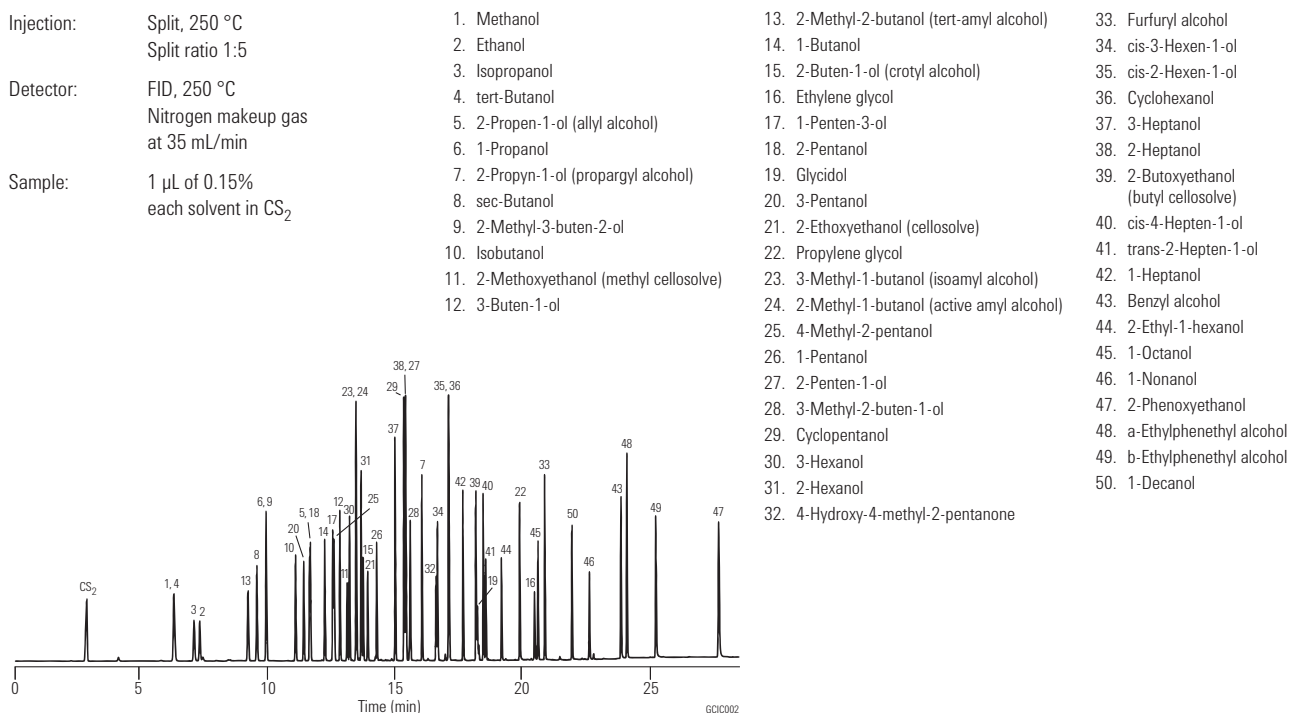
Carrier: Helium at 50 cm/s,
measured at 40 °C

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

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

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

Sample: 1 µL of 0.15%
each solvent in CS₂



Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

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

Seal: Gold plated seal kit, 5188-5367

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

Alcohols III

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

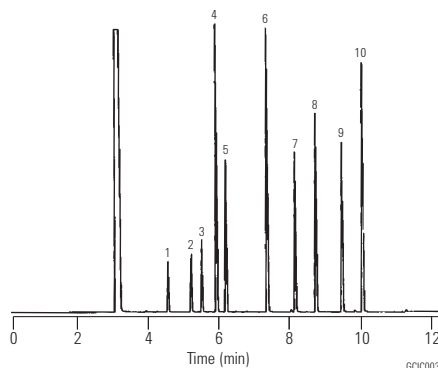
Carrier: Helium, 29 cm/s, 3.0 psi (45 °C)

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

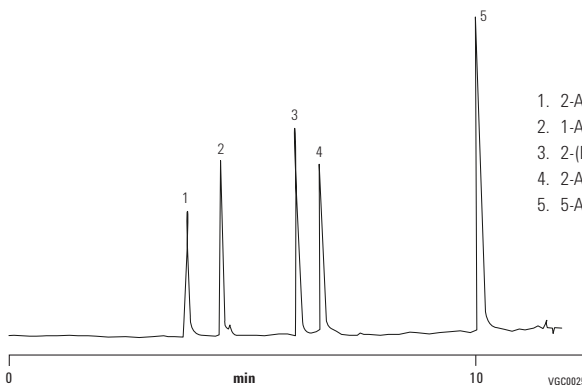
Solvent: Water

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-propanol
3. 2-(Ethylamino)-ethanol
4. 2-Amino-1-butanol
5. 5-Amino-1-pentanol

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

Amines and Alcohols

Column: CP-Volamine
CP7446
15 m x 0.32 mm

Sample: 0.5 µL

Sample Conc: 1000 ppm, approx. 5 ng per component on the column

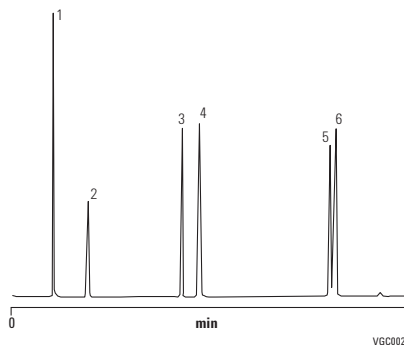
Solvent: Methanol

Carrier: Helium, 50 kPa, 55 cm/s

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

Injection: Split

Detector: MS



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

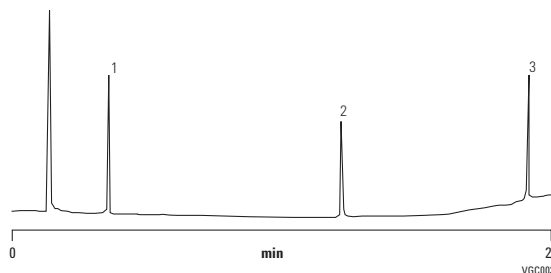
Solvent: Methanol

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

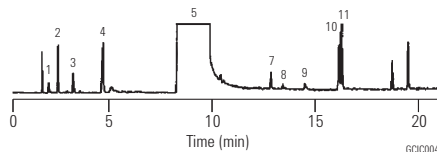
Suggested Supplies

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

Organic Acids

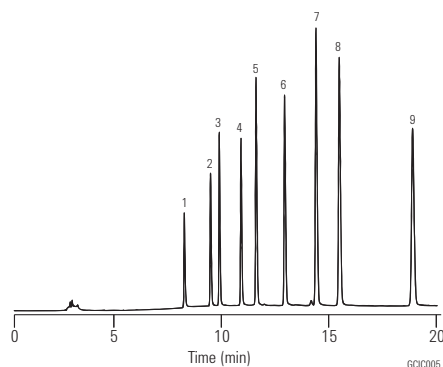
Column: DB-WAXetr
125-7332
30 m x 0.53 mm, 1.00 µm

Carrier: Helium at 37 cm/s,
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 | 6. Valeric acid (pentanoic acid) |
| 2. Propionic acid | 7. Isocaproic acid |
| 3. Isobutyric acid | 8. Caproic acid (hexanoic acid) |
| 4. Butyric acid | 9. Heptanoic acid |
| 5. Isovaleric acid | |

Free Organic Acids/C₄-C₅ Isomers

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

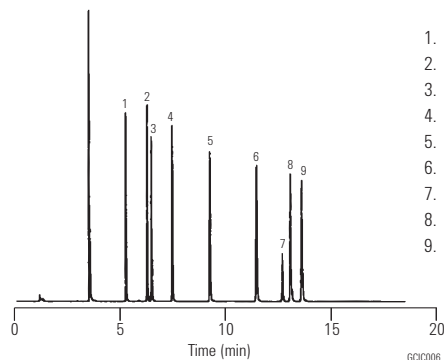
Carrier: Helium 42 cm/s, 24 psi (120 °C)
1.8 mL/min constant flow

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

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

Detector: FID, 300 °C

Sample: 1 µL



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

Volatile Amines

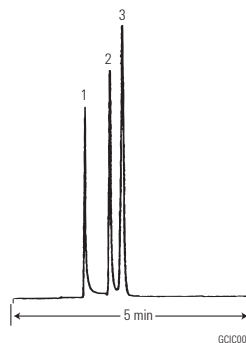
Column: DB-1
125-1035
30 m x 0.53 mm, 5.00 µm

Oven: 30 °C isothermal

Sampler: Headspace

Injection: Split ratio 1:10

Detector: FID
Nitrogen makeup gas at 30 mL/min



1. Methylamine
2. Dimethylamine
3. Trimethylamine

Trace Active Amines, 10 ng on-column

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

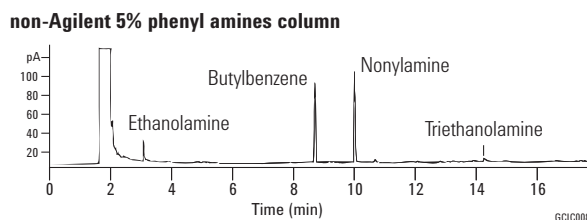
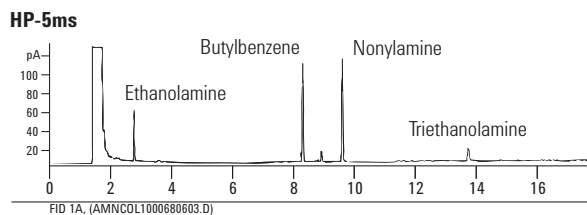
Carrier: Helium, constant pressure 9.79 psi

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

Injection: On-column
Oven tracking mode

Detector: FID, 300 °C

Sample: 0.5 µL of each standard in methanol



Primary Amines

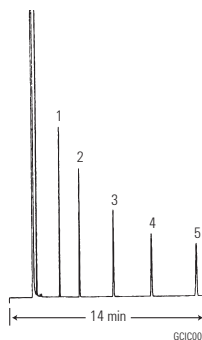
Column: CAM
112-2132
30 m x 0.25 mm, 0.25 μ m

Carrier: Hydrogen at 40 cm/s

Oven: 110 °C isothermal

Injection: Split

Detector: FID
Nitrogen makeup gas at 30 mL/min



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

Polyethyleneamines

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

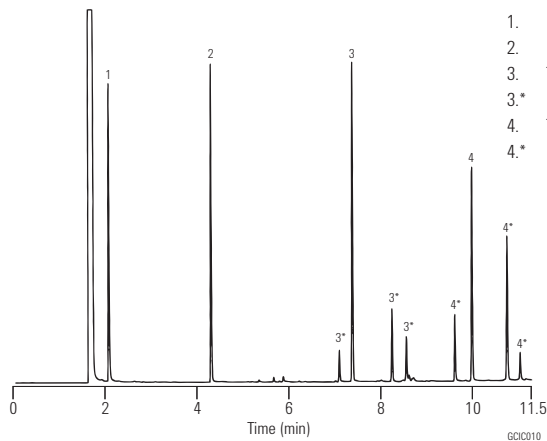
Carrier: Helium at 30 cm/s, measured at 100 °C

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 μ L of 100 ng/ μ L 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/s, 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

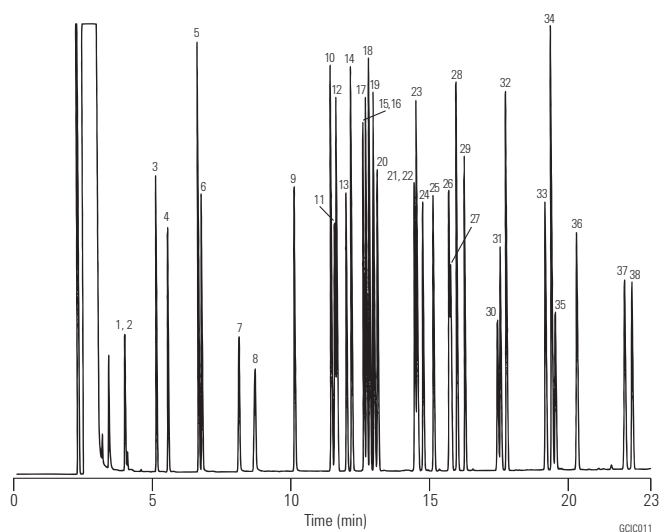
Suggested Supplies

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

Amines in Water

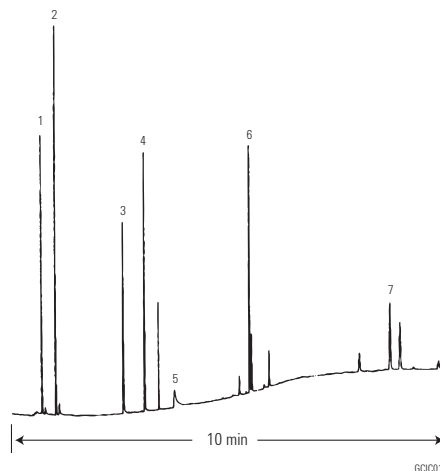
Column: CAM
112-2132
30 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen at 38 cm/s

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/s, 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

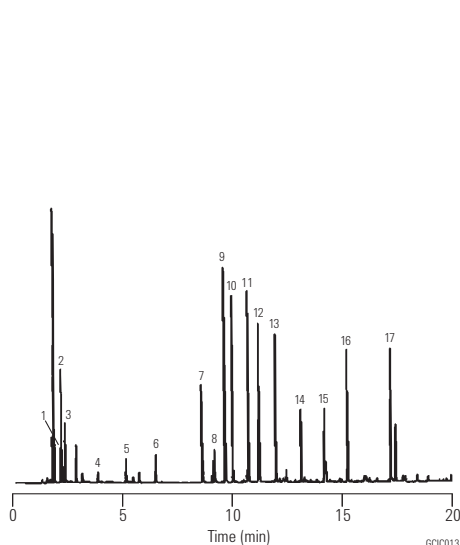
Suggested Supplies

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/s,
measured at 40 °C

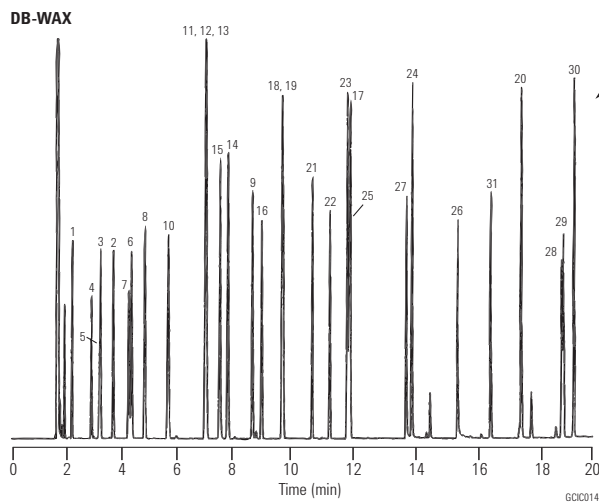
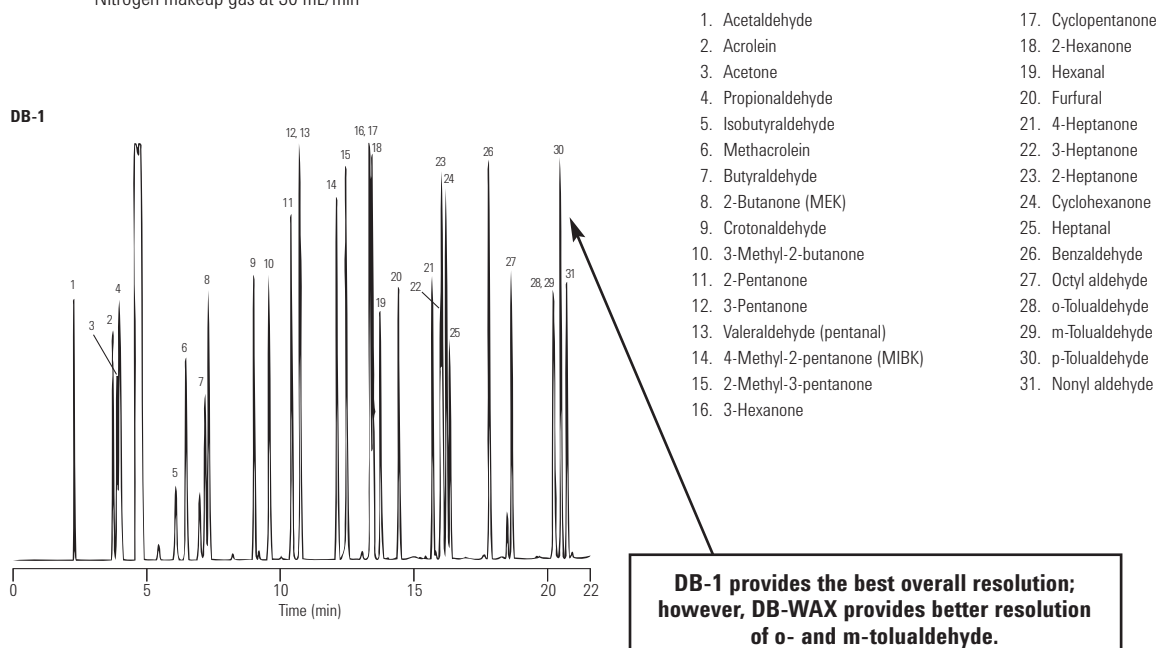
Oven: 40 °C for 5 min
40-210 °C at 10 °C/min

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 provides the best overall resolution; however, DB-WAX provides better resolution of o- and m-tolualdehyde.

Formaldehyde Underivatized

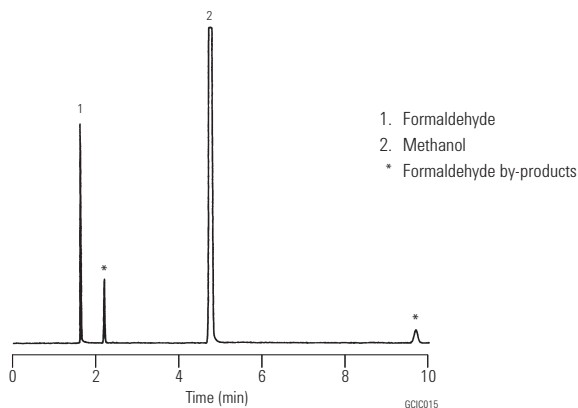
Column: DB-WAX
123-7033
30 m x 0.32 mm, 0.50 µm

Carrier: Helium at 36 cm/s,
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

**Formaldehyde-DNPH Derivative**

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

Carrier: Helium at 35 cm/s,
measured at 150 °C

Oven: 150-250 °C at 20 °C/min

Injection: Split, 300 °C
Split ratio 1:100

Detector: ECD, 375 °C
Nitrogen makeup gas at 35 mL/min

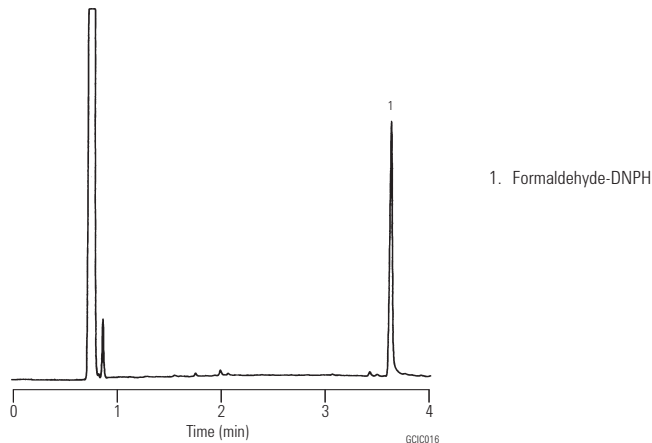
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

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

Seal: Gold plated seal, 18740-20885

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



PFBHA Derivative

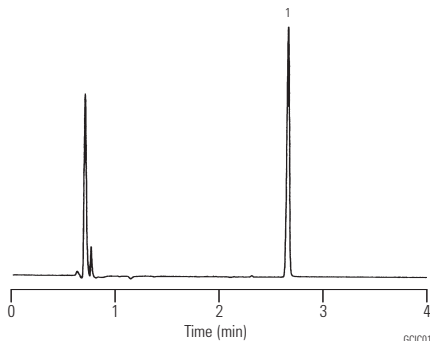
Column: DB-1
123-1012
15 m x 0.32 mm, 0.25 µm

Carrier: Helium at 40 cm/s,
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/s,
measured at 40 °C

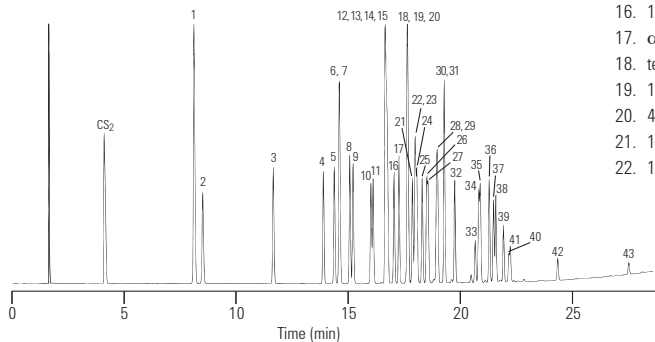
Oven: 40 °C for 5 min
40-260 °C at 10 °C/min

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 | 23. Isobutylbenzene |
| 2. Fluorobenzene | 24. sec-Butylbenzene |
| 3. Toluene | 25. 1,2,3-Trimethylbenzene (hemimellitene) |
| 4. Chlorobenzene | 26. 1,2-Dichlorobenzene |
| 5. Ethylbenzene | 27. Iodobenzene |
| 6. m-Xylene | 28. Styrene oxide |
| 7. p-Xylene | 29. Butylbenzene |
| 8. Styrene | 30. 4-Chlorostyrene |
| 9. o-Xylene | 31. Nitrobenzene |
| 10. Isopropylbenzene (cumene) | 32. 4-tert-Butyltoluene |
| 11. Bromobenzene | 33. 1,3,5-Trichlorobenzene |
| 12. Propylbenzene | 34. 2-Nitrotoluene |
| 13. 2-Chlorotoluene | 35. 1,3-Diisopropylbenzene |
| 14. 3-Chlorotoluene | 36. 1,4-Diisopropylbenzene |
| 15. 4-Chlorotoluene | 37. 1,2,4-Trichlorobenzene |
| 16. 1,3,5-Trimethylbenzene (mesitylene) | 38. 3-Nitrotoluene |
| 17. α-Methylstyrene | 39. 4-Nitrotoluene |
| 18. tert-Butylbenzene | 40. 1,2,3-Trichlorobenzene |
| 19. 1,2,4-Trimethylbenzene (pseudocumene) | 41. 1-Chloro-4-nitrobenzene |
| 20. 4-Methylstyrene | 42. 1,2,4,5-Tetrachlorobenzene |
| 21. 1,3-Dichlorobenzene | 43. Pentachlorobenzene |
| 22. 1,4-Dichlorobenzene | |

Aromatics II

Column: DB-WAX
125-7032
30 m x 0.53 mm, 1.00 µm

Carrier: Helium at 30 cm/s, 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

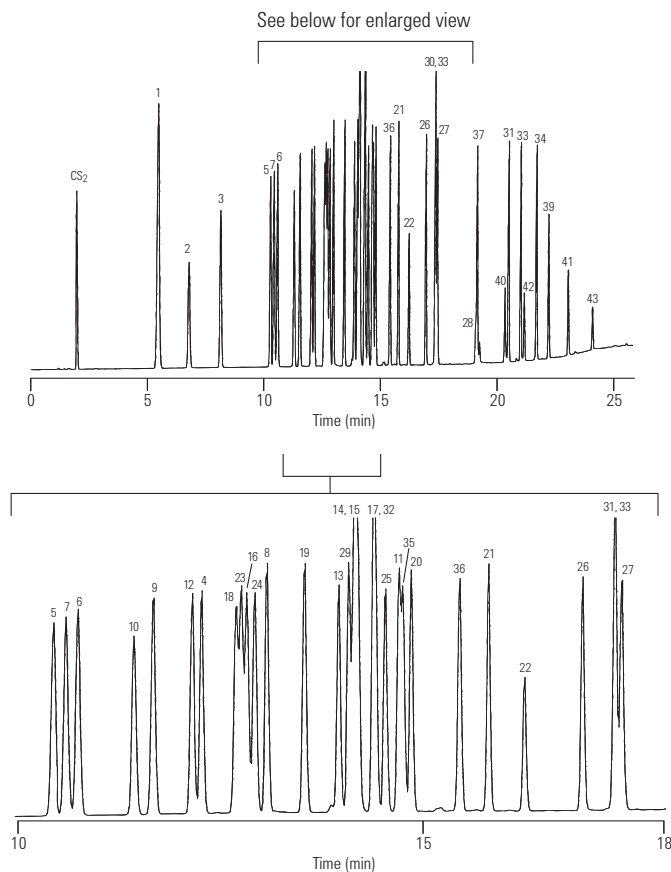
Septum: 11 mm Advanced Green septa, 5183-4759

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/s, measured at 70 °C

Oven: 80 °C isothermal

Injection: Split, 230 °C
Split ratio 1:150

Detector: FID, 240 °C

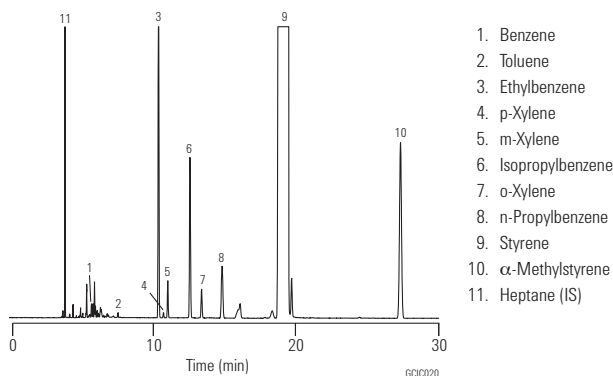
Suggested Supplies

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



Impurities in Ethylbenzene

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

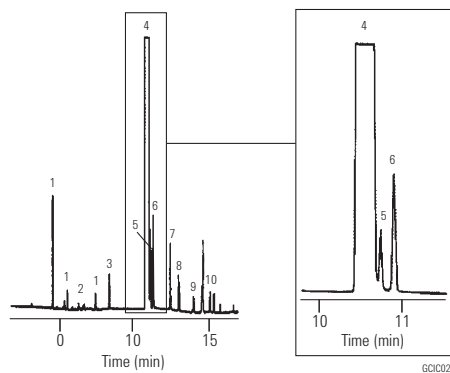
Carrier: Helium, 32 cm/s, 19.9 psi (60 °C)
2.5 mL/min constant flow

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%+



Pyrolysates of Polystyrene

Column: Ultra 1
19091A-105
50 m x 0.20 mm, 0.33 µm

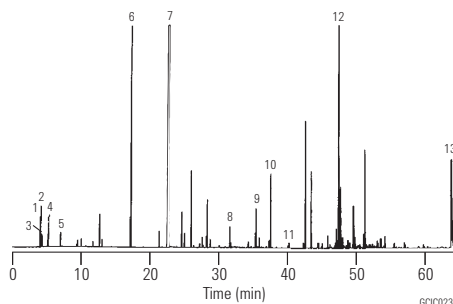
Carrier: Helium, 30 psi, 12 mL/min

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. $C_4H_9-CH_2-CH_2-Ph$
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

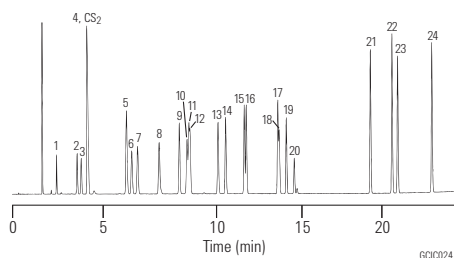
Column: DB-1
125-1034
30 m x 0.53 mm, 3.00 µm

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

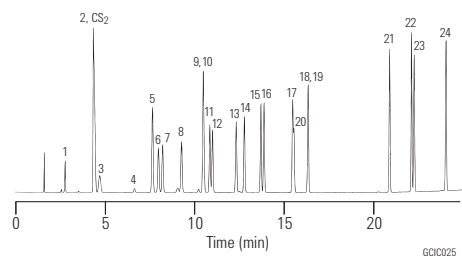
Oven: 40 °C for 5 min
40-260 °C at 10 °C/min
260 °C for 3 min

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

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

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



- | | |
|------------------------|---------------------------|
| 1. Methyl formate | 13. sec-Butyl acetate |
| 2. Ethyl formate | 14. Isobutyl acetate |
| 3. Methyl acetate | 15. Propyl propionate |
| 4. Vinyl acetate | 16. Butyl acetate |
| 5. Ethyl acetate | 17. Isoamyl acetate |
| 6. Propyl formate | 18. Amyl acetate |
| 7. Methyl propionate | 19. 2-Ethoxyethyl acetate |
| 8. Isopropyl acetate | 20. 2-Methylbutyl acetate |
| 9. Ethyl acrylate | 21. Methyl benzoate |
| 10. tert-Butyl acetate | 22. Benzyl acetate |
| 11. Ethyl propionate | 23. Ethyl benzoate |
| 12. Propyl acetate | 24. Propyl benzoate |

Esters III

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

Carrier: Helium 29 cm/s, 3.0 psi (45 °C)
4 mL/min constant flow

Oven: 45 °C for 1 min
45-200 °C at 5 °C/min

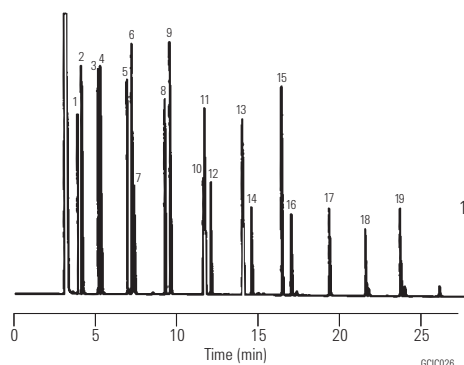
Injection: Split, 250 °C
Split ratio 25:1

Detector: FID, 250 °C

Sample: 1 µL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



- | | |
|----------------------|---------------------------|
| 1. Ethyl propionate | 11. Propyl caproate |
| 2. Propyl acetate | 12. Methyl decanoate |
| 3. Ethyl butyrate | 13. Butyl caproate |
| 4. Propyl propionate | 14. Methyl dodecanoate |
| 5. Propyl butyrate | 15. Butyl heptanoate |
| 6. Ethyl valerate | 16. Methyl tetradecanoate |
| 7. Butyl propionate | 17. Methyl hexadecanoate |
| 8. Propyl valerate | 18. Methyl octadecanoate |
| 9. Ethyl caproate | 19. Methyl eicosenoate |
| 10. Butyl valerate | |

Ethers

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

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

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

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

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

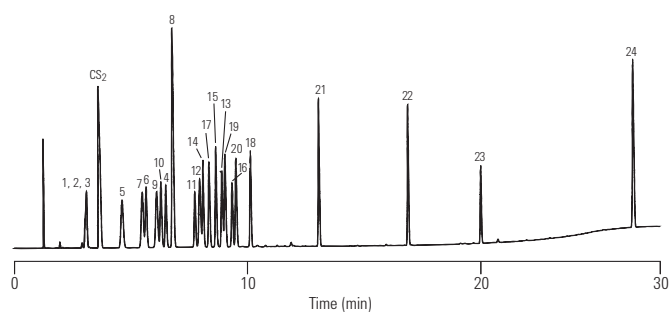
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

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

Seal: Gold plated seal, 18740-20885

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



GCIC027

- | | |
|---|--|
| 1. Furan | 13. Diglyme (diethylene glycol dimethyl ether) |
| 2. Ethyl vinyl ether | 14. Propyl ether |
| 3. Ethyl ether | 15. Allyl ether |
| 4. 1,3-Dioxalane | 16. 1,4-Dioxane |
| 5. Methyl-tert-butyl ether (MTBE) | 17. Butyl ethyl ether |
| 6. Allyl ethyl ether | 18. Epichlorohydrin |
| 7. Isopropyl ether | 19. Tetrahydropyran |
| 8. Tetrahydrofuran (THF) | 20. Acetal (acetaldehyde diethyl acetal) |
| 9. tert-Amyl methyl ether | 21. Butyl ether |
| 10. Butyl methyl ether | 22. Pentyl ether |
| 11. Glyme (propylene glycol dimethyl ether) | 23. Triglyme (triethylene glycol dimethyl ether) |
| 12. tert-Amyl methyl ether | 24. Benzyl ether |

Glycols I

Column: DB-WAX
124-7032
30 m x 0.45 mm, 0.85 µm

Carrier: Helium at 35 cm/s,
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

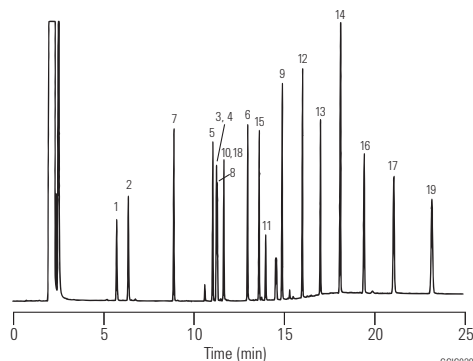
Suggested Supplies

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 | 11. Dipropylene glycol |
| 2. Ethylene glycol monoethyl ether | 12. 1,5-Pentandiol |
| 3. 1,3-Propanediol | 13. 1,6-Hexandiol |
| 4. 1,2-Propanediol (propylene glycol) | 14. 1,7-Heptandiol |
| 5. 2,3-Butandiol | 15. Diethylene glycol monobutyl ether |
| 6. 1,3-Butandiol | 16. 1,8-Octandiol |
| 7. Ethylene glycol monobutyl ether | 17. 1,9-Nonandiol |
| 8. Diethylene glycol monomethyl ether | 18. Ethylene glycol |
| 9. 1,4-Butandiol | 19. 1,10-Decandiol |
| 10. Diethylene glycol monoethyl ether | |

Glycols II

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

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

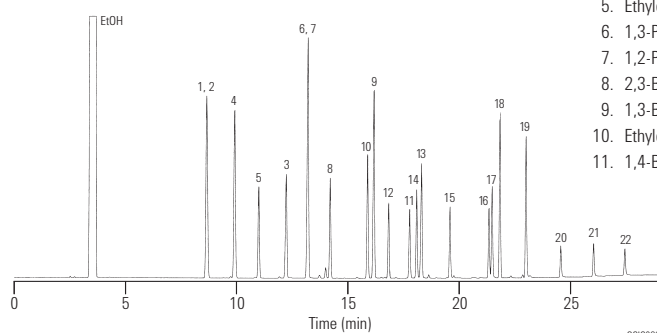
Oven: 40 °C for 5 min
40-260 °C at 10 °C/min
260 °C for 3 min

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

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

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct connect, dual taper, deactivated, 4 mm id, G1544-80700
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



- | | |
|---------------------------------------|--|
| 1. Ethylene glycol monomethyl ether | 12. Diethylene glycol monomethyl ether |
| 2. Glyme | 13. Diethylene glycol |
| 3. Ethylene glycol | 14. Diethylene glycol monoethyl ether |
| 4. Diglyme | 15. 1,5-Pentanediol |
| 5. Ethylene glycol monoethyl ether | 16. 1,6-Hexanediol |
| 6. 1,3-Propanediol | 17. Diethylene glycol monobutyl ether |
| 7. 1,2-Propanediol (propylene glycol) | 18. Triglyme |
| 8. 2,3-Butanediol | 19. 1,7-Heptanediol |
| 9. 1,3-Butanediol | 20. 1,8-Octanediol |
| 10. Ethylene glycol monobutyl ether | 21. 1,9-Nonanediol |
| 11. 1,4-Butanediol | 22. 1,10-Decanediol |

Glycols III

Column: DB-1
124-1032
30 m x 0.45 mm, 1.27 µm

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

Oven: 50 °C for 2 min
50-260 °C at 10 °C/min

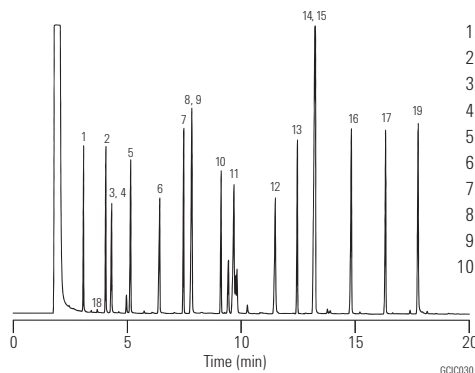
Injection: Split, 250 °C

Detector: FID, 280 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct connect, dual taper, deactivated, 4 mm id, G1544-80700
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



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

Triethylene Glycol and Impurities

Column: DB-1
124-1032
30 m x 0.45 mm, 1.27 μ m

Carrier: Helium at 35 cm/s,
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 μ L

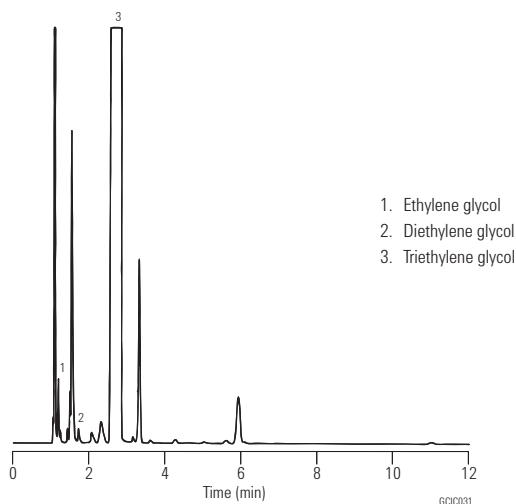
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

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

Seal: Gold plated seal, 18740-20885

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

**Ethylene Glycol Mixture**

Column: Ultra 1
19091A-101
12 m x 0.20 mm, 0.33 μ m

Carrier: Helium, 25 cm/s

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 μ L

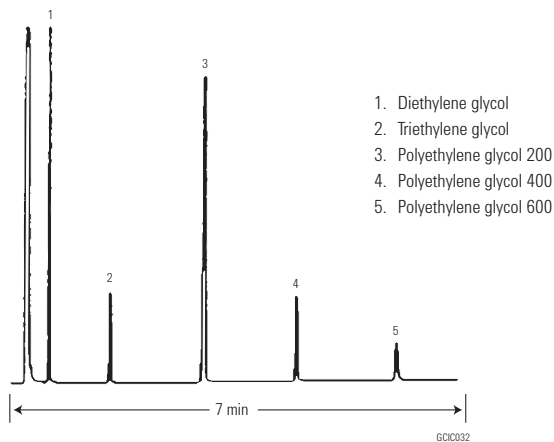
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Liner, splitless, single-taper, glass wool, deactivated, 5062-3587

Seal: Gold plated seal, 18740-20885

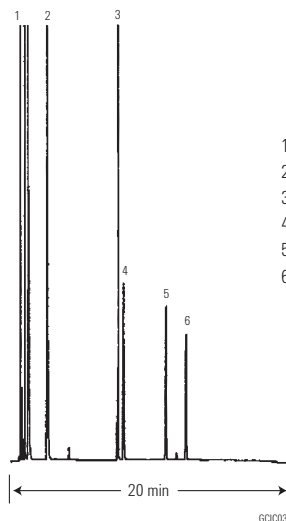
Syringe: 10 μ L tapered, FN 23-26s/42/HP, 5181-1267



Glycols/Diols

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

Carrier: Helium
Oven: 50 °C for 3 min
50-180 °C at 8 °C/min
Injection: On-column
Detector: FID, 250 °C
Sample: 1 µL



- 1. Ethylene glycol
- 2. 1,3-Butandiol
- 3. Ethylene glycol phenyl ether
- 4. 1,7-Hepatanediol
- 5. 1,9-Nonanediol
- 6. 1,10-Decanediol

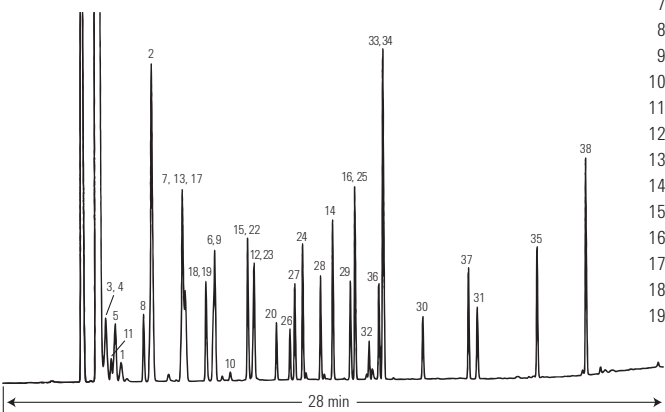
Halogenated Hydrocarbons II

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

Carrier: Helium at 35 cm/s, 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/s, 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

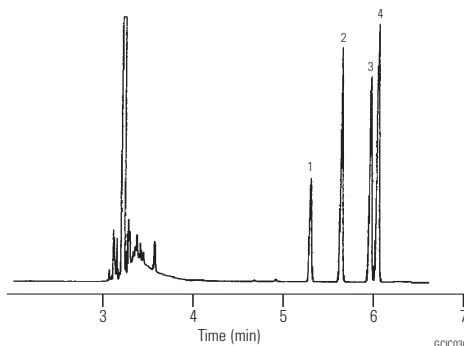
Suggested Supplies

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/s,
measured at 40 °C

Oven: 40 °C for 5 min
40-140 °C at 5 °C/min

Injection: Split, 250 °C

Detector: FID, 250 °C

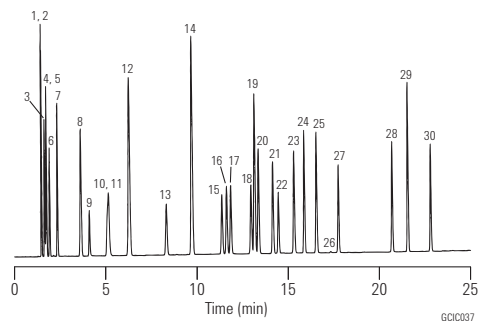
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

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

Seal: Gold plated seal, 18740-20885

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



- | | |
|-----------------------------------|----------------------------|
| 1. 3-Methylpentane | 16. p-Xylene |
| 2. Hexane | 17. m-Xylene |
| 3. Isooctane | 18. Cumene |
| 4. Methyl-tert-butyl ether (MTBE) | 19. Dodecane |
| 5. Heptane | 20. o-Xylene |
| 6. Cyclohexane | 21. Propylbenzene |
| 7. Octane | 22. Chlorobenzene |
| 8. Nonane | 23. Mesitylene |
| 9. Methanol | 24. Styrene |
| 10. Ethanol | 25. 1,2,4-Trimethylbenzene |
| 11. Benzene | 26. Naphthalene |
| 12. Decane | 27. 4-Chlorotoluene |
| 13. Toluene | 28. 1,3-Dichlorobenzene |
| 14. Undecane | 29. 1,4-Dichlorobenzene |
| 15. Ethylbenzene | 30. 1,2-Dichlorobenzene |

Solvents II

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

Carrier: Helium at 41 cm/s, measured at 50 °C

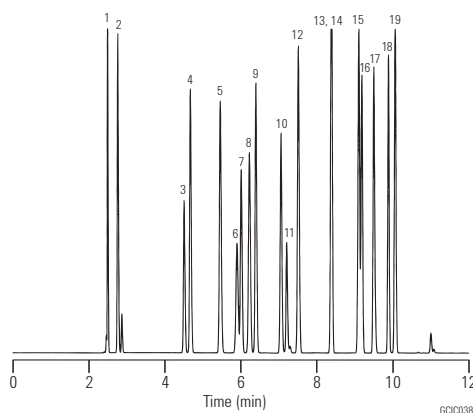
Oven: 50 °C for 5 min
50-170 °C at 10 °C/min

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/s

Oven: 45 °C for 7 min
45-145 °C at 20 °C/min

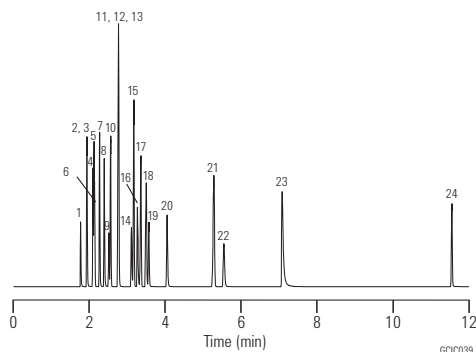
Injection: Split, 250 °C
Split ratio 1:100

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

Sample: 0.5 µL of 0.5-1.0 µg/µL
standard in water

Suggested Supplies

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



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

Solvents IV

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

Carrier: Helium, 30 psi

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

Injection: Split

Detector: TCD

Sample: 1 μ L

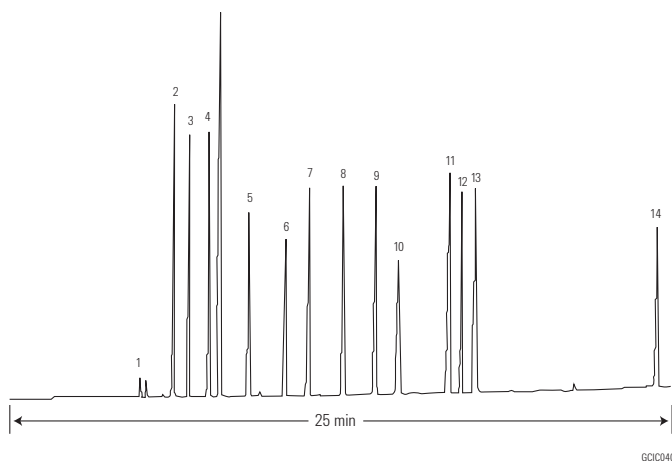
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

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

Seal: Gold plated seal, 18740-20885

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



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

Solvents

Column: PoraBOND Q PT
CP7348PT
25 m x 0.25 mm, 3.00 μ m

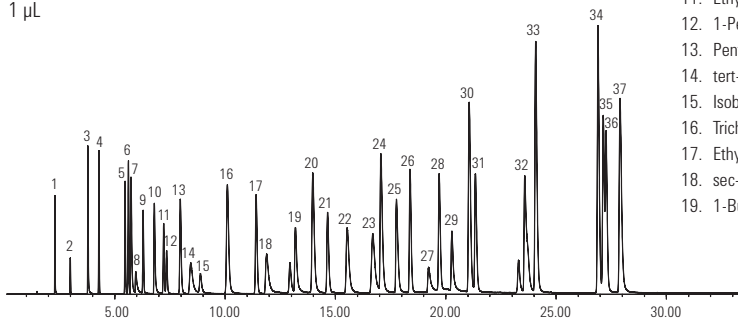
Carrier: Helium, 1.5 mL/min

Oven: 90 °C to 140 °C at 10 °C/min
140 °C for 5 min
140 °C to 210 °C at 4 °C/min
210 °C for 6 min

Injection: Split, 250 °C, split ratio 1:150

Detector: MSD, 280 °C transfer line
Full scan at m/z 30-350

Sample: 1 μ L



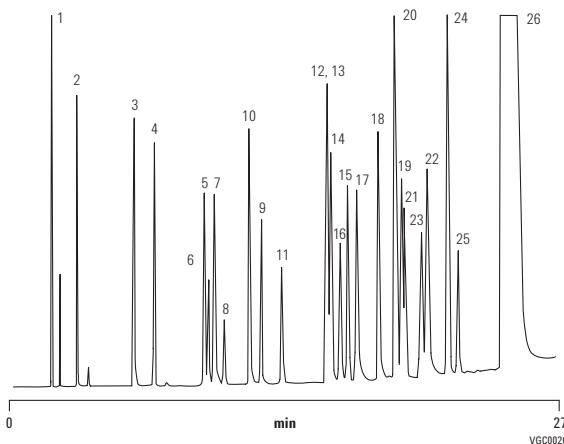
- | | |
|------------------------|----------------------------|
| 1. Methyl alcohol | 20. Benzene |
| 2. Acetaldehyde | 21. Hexane |
| 3. Ethanol | 22. 1,4-Dioxane |
| 4. Acetonitrile | 23. Ethyl tert-butyl ether |
| 5. Acetone | 24. Pyridine |
| 6. Methylene chloride | 25. N,N-dimethylformamide |
| 7. Isopropyl alcohol | 26. N-Propyl acetate |
| 8. 2-Propanamine | 27. 3-Methyl-1-butanol |
| 9. Ethyl formate | 28. n-Propyl ether |
| 10. 1-Propanol | 29. 1-Pentanol |
| 11. Ethyl ether | 30. Toluene |
| 12. 1-Pentene | 31. Heptane |
| 13. Pentane | 32. N,N-dimethylacetamide |
| 14. tert-Butyl alcohol | 33. Chlorobenzene |
| 15. Isobutyraldehyde | 34. Ethylbenzene |
| 16. Trichloromethane | 35. m-Xylene |
| 17. Ethyl acetate | 36. p-Xylene |
| 18. sec-Butyl alcohol | 37. o-Xylene |
| 19. 1-Butanol | |

Analysis of Solvents

Column: PoraBOND Q
CP7354
25 m x 0.53 mm, 10.00 µm

Sample: 5 µL
Sample Conc: 0.1% per compound
Solvent: DMSO
Carrier: He, 25 kPa (0.25 bar, 3.5 psi)
Oven: 100 °C (2 min) to 300 °C, 5 °C/min
Injection: Split, T=250 °C
Detector: FID, T=250 °C

1. Methane
2. Methanol
3. Ethanol
4. Acetonitrile
5. Acetone
6. Dichloromethane
7. 2-Propanol
8. Dimethyl sulfide
9. Diethyl ether
10. 1-Propanol
11. Pentane
12. 2-Butanone
13. Trichloromethane
14. Tetrahydrofuran
15. Ethyl acetate
16. 2-Methoxyethanol
17. Isobutanol
18. Butanol
19. Hexane
20. Benzene
21. Trichloroethylene
22. Cyclohexane
23. 1,4-Dioxane
24. Pyridine
25. N,N-dimethylformamide
26. Dimethyl sulfoxide



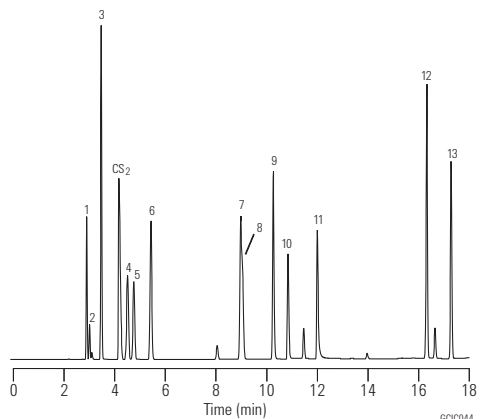
Nitrogen-based Solvents I

Column: DB-1
125-1034
30 m x 0.53 mm, 3.00 µm

Carrier: Helium at 30 cm/s,
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 μ m

Carrier: Helium at 30 cm/s,
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

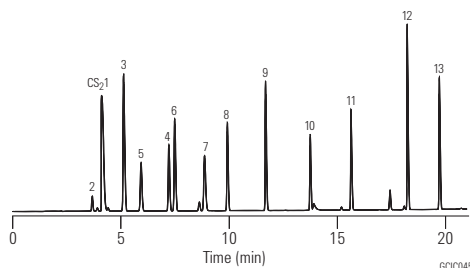
Suggested Supplies

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 μ L 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. Benzoinitrile
13. 1-Methyl-2-pyrrolidinone

Acrylate Impurities I

Column: DB-200
125-2032
30 m x 0.53 mm, 1.00 μ m

Carrier: Helium at 34.5 cm/s,
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

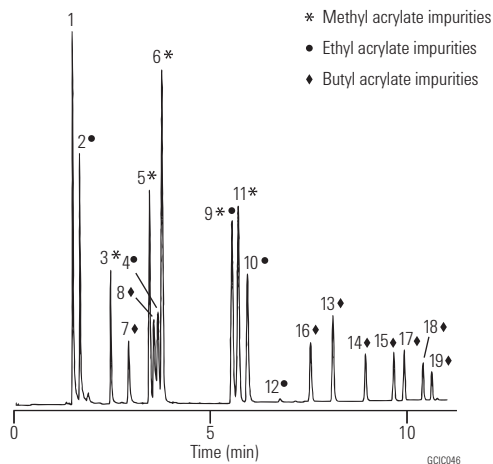
Suggested Supplies

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 μ L 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/s,
measured at 35 °C

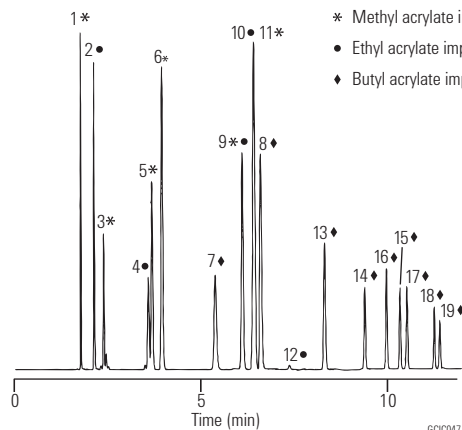
Oven: 35 °C for 5 min,
35-200 °C at 10 °C/min

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



* Methyl acrylate impurities
• Ethyl acrylate impurities
♦ Butyl acrylate impurities

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

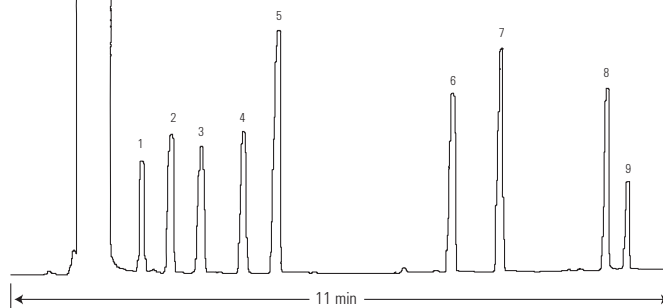
Carrier: Hydrogen

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/s,
measured at 50 °C

Oven: 50 °C for 2 min
50-340 °C at 20 °C/min
340 °C for 10 min

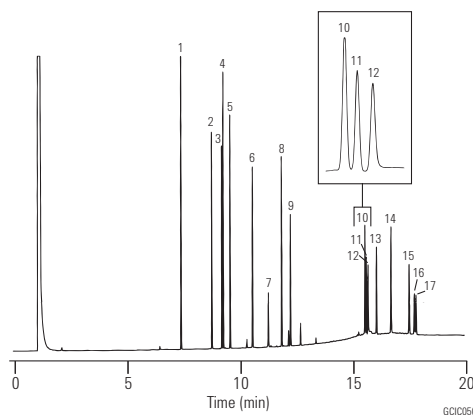
Injection: Splitless, 280 °C
0.50 min purge activation time

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/s,
measured at 150 °C

Oven: 40 °C for 5 min
40-290 °C at 12 °C/min
290 °C for 10 min

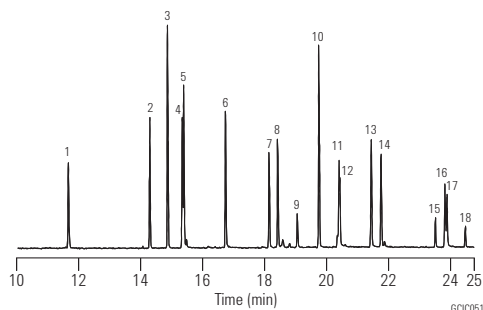
Injection: Splitless, 250 °C
30 s purge activation time

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/s,
measured at 100 °C

Oven: 100 °C for 1 min
100-270 °C at 10 °C/min

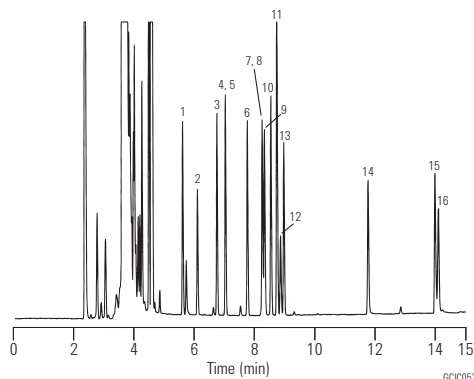
Injection: Split, 250 °C
Split ratio 1:50

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/s

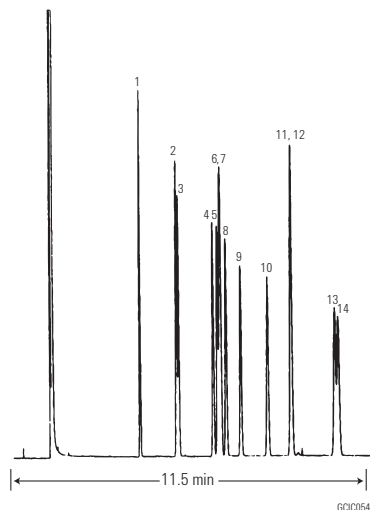
Oven: 165 °C isothermal

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/s

Oven: 130 °C for 4 min
130-225 °C at 10 °C/min
225 °C hold

Injection: Split, 250 °C
Split ratio 1:67

Detector: FID, 250 °C

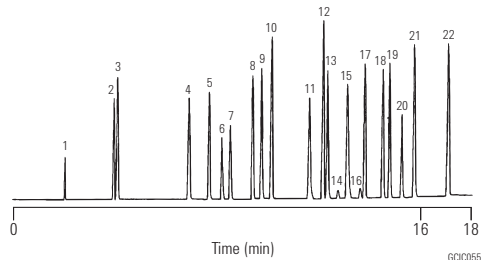
Sample: 1 µL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



- | | |
|---|---|
| 1. CH ₄ | 12. cis-ClCH=CHCl |
| 2. CHClF ₂ (Freon 22) | 13. CHCl ₃ |
| 3. CCl ₂ F ₂ (Freon 12) | 14. CCl ₄ |
| 4. ClCF ₂ CF ₂ Cl (Freon 114) | 15. CCl ₄ |
| 5. CHCl ₂ F (Freon 21) | 16. CCl ₄ |
| 6. CCl ₃ F (Freon 11) | 17. CH ₃ CH ₂ I |
| 7. CF ₂ Br ₂ (Freon 12B2) | 18. CH ₂ Br ₂ |
| 8. CH ₃ I | 19. CHCl ₂ Br |
| 9. CH ₂ Cl ₂ | 20. C ₄ F ₉ I |
| 10. trans-ClCH=CHCl | 21. CHClBr ₂ |
| 11. CF ₃ CCl ₃ (Freon 113) | 22. CH ₃ CH ₂ CH ₂ I |

Ethylene Oxide

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

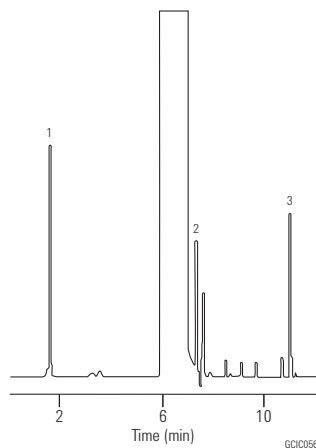
Carrier: Helium at 1 mL/min

Oven: 60 °C for 2 min
60-180 °C at 16 °C/min

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

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

Courtesy of J. Chromatogr. Sci., 28:97 [1990]



1. Ethylene oxide
2. 2-Chloroethanol
3. Ethylene glycol (solvent: dimethylformamide)

Impurities in Mixed Xylenes

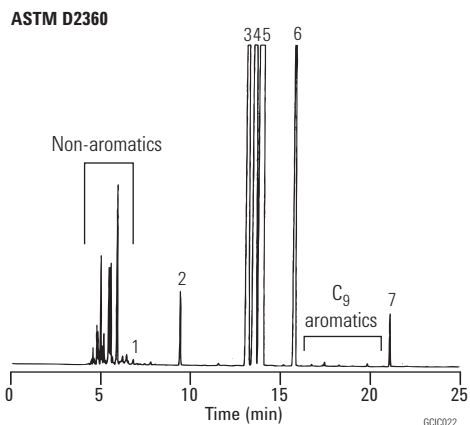
Column: DB-WAXetr
123-7362
60 m x 0.32 mm, 0.25 µm

Carrier: Helium at 20 cm/s,
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

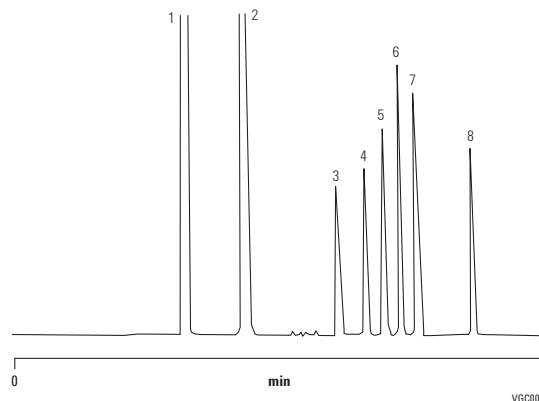
Sample Conc: 10-20%

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

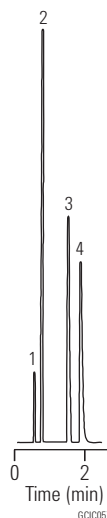
Carrier: Helium at 45 cm/s

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

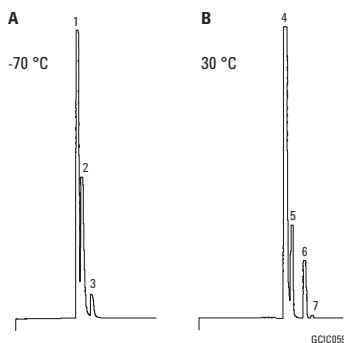
Liner: Direct, 1.5 mm id, 18740-80200

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/s
Oven: A: -70 °C isothermal
B: 30 °C isothermal
Injection: Split ratio 25:1
Detector: FPD, 535 µm filter
Sample: 1 µL

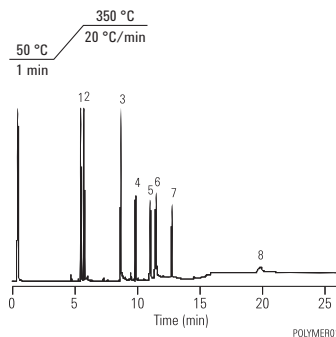


1. Arsine 0.1%
2. Phosphine 0.1%
3. Selenide 0.1%
4. Diborane 0.10 ppm
5. Tetraborane 0.10 ppm
6. Pentaborane 0.10 ppm
7. Dihydropentaborane 0.60 ppm

Polymer Additives

Column: HP-35 (use only 10 m)
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

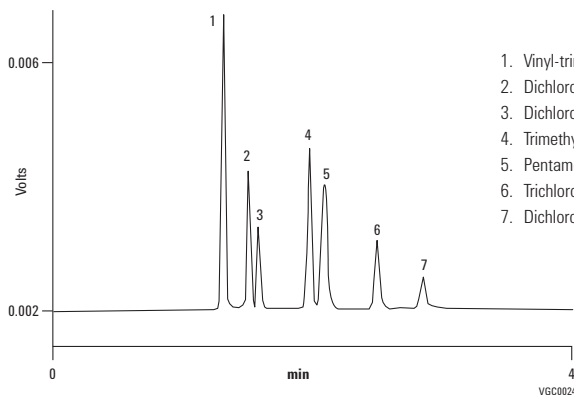


1. BHT
2. BHEB
3. Tinuvin P
4. Isonox 129
5. Irgafos 168
6. Irganox 1076
7. MD 1024
8. Irganox 1010

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

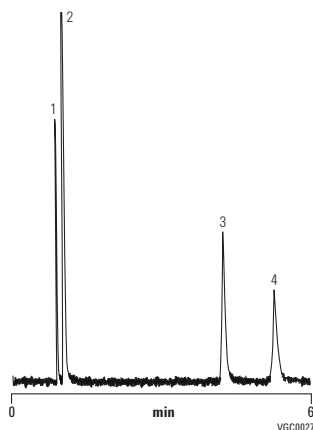
Sample: ±100 ppm

Carrier: H₂

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

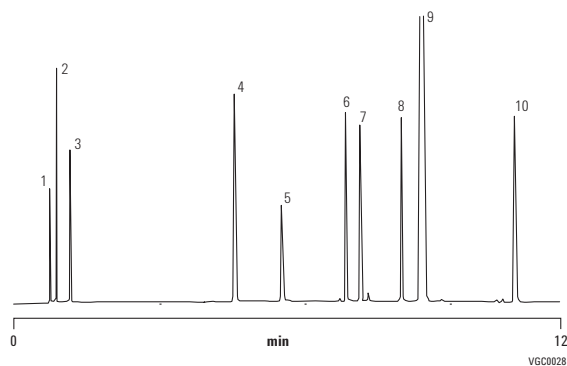
Carrier: Helium, 4 psig, 4 min to 11 psig, 0.5 psig/min, 2 min

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

Courtesy of J. Luong, Dow Chemical Canada



1. Methane
2. Ethane
3. Ethylene
4. n-Butane
5. Propadiene
6. 1-Butene
7. Iso-butene
8. 1,2-Butadiene
9. 1,3-Butadiene
10. Ethyl acetylene

Forensic Toxicology and Pharma Applications

DB-Select 624 UI for <467>

Megabore

Early Eluting Peaks

Column: DB-Select 624 Ultra Inert
125-0334UI
30 m x 0.53 mm, 3.00 µm

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

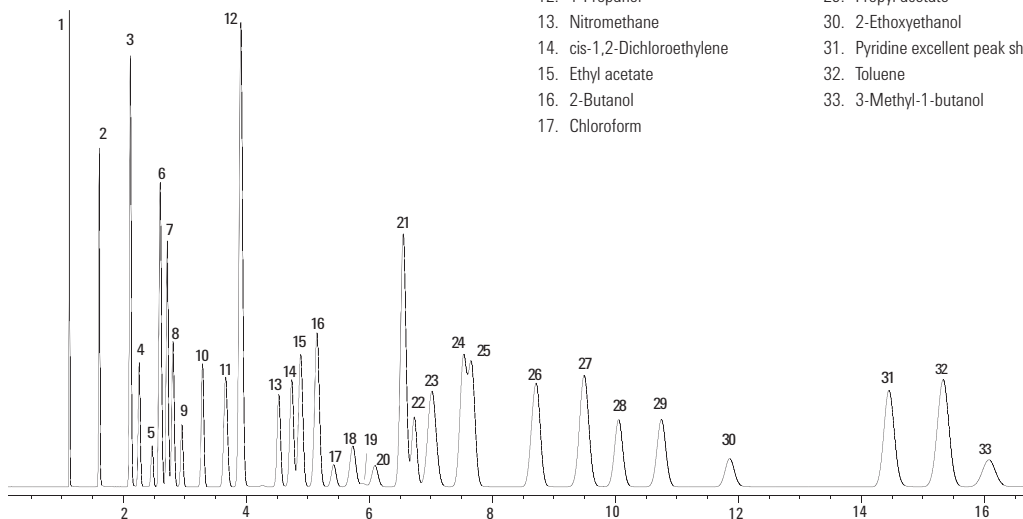
Oven: 40 °C 20 min hold, then 10°/min to 170 °C

Injection: 20 Hz

Detector: FID at 240 °C, H₂ at 30 mL/min
Air at 400 mL/min
N₂ makeup at 35 mL/min
(constant column + makeup)

Sample: FID signal

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



Benzodiazepines I

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

Carrier: Hydrogen, 53 cm/s, constant flow
1.6 for 11 min
1.6-2.4 at 60 mL/min, hold 2 min
2.4-5.0 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

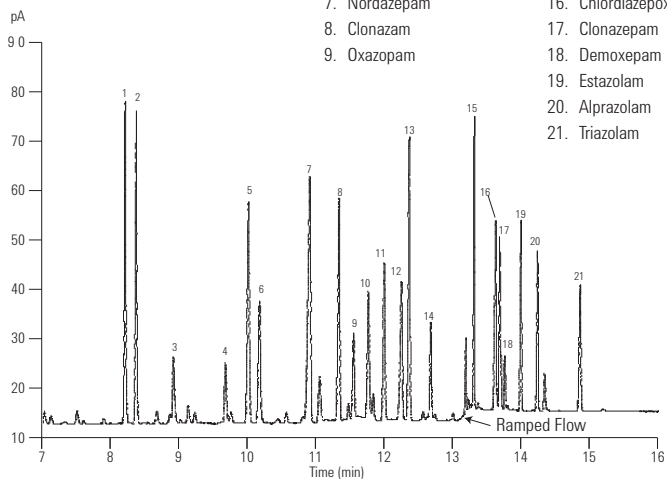
Injection: Pulsed splitless, 280 °C
20 psi pulse pressure for 0.38 min
50 mL/min purge at 0.40 min
Direct connect liner (p/n G1544-80730)

Detector: FID, 350 °C

Sample: 1 µL of 5-10 ppm

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.

- | | |
|-----------------------|----------------------|
| 1. Medazepam | 10. Temazepam |
| 2. Halazepam | 11. Flunitrazepam |
| 3. Oxazepam | 12. Bromazepam |
| 4. Lorazepam | 13. Prazepam |
| 5. Diazepam | 14. Lormetazepam |
| 6. Desalkyl aurazepam | 15. Nitrazepam |
| 7. Nordazepam | 16. Chlordiazepoxide |
| 8. Clonazam | 17. Clonazepam |
| 9. Oxazepam | 18. Demoxepam |
| | 19. Estazolam |
| | 20. Alprazolam |
| | 21. Triazolam |



BENZODIAZ

Amphetamines and Precursors – TMS Derivatives

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

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

Oven: 100-240 °C at 10 °C/min

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

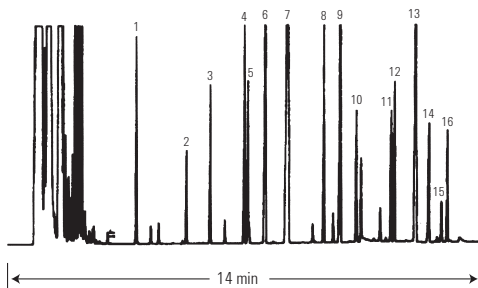
Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL of 2 µg/µL each in pyridine

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. 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



6CL5004

Barbiturates

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

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

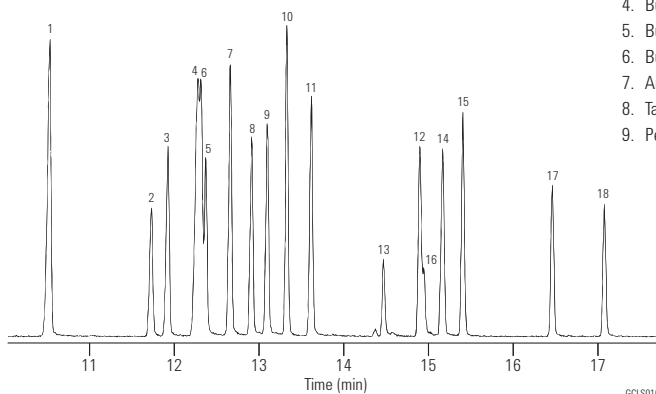
Oven: 50 °C for 0.5 min
50-150 °C at 25 °C/min
150-300 °C at 10 °C/min

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

Detector: MSD, 280 °C transfer line
full scan at m/z 40-270

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. Barbitol | 10. Methohexital |
| 2. Allobarbitol | 11. Secobarbitol |
| 3. Aprobarbitol | 12. Hexobarbitol |
| 4. Butabarbitol | 13. Thiopental |
| 5. Butethal | 14. Cyclopentylbarbitol |
| 6. Butalbitol | 15. Mephobarbitol |
| 7. Amobarbitol | 16. Thiamylal |
| 8. Talbutal | 17. Phenobarbitol |
| 9. Pentobarbitol | 18. Alphenal |

Narcotics

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

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

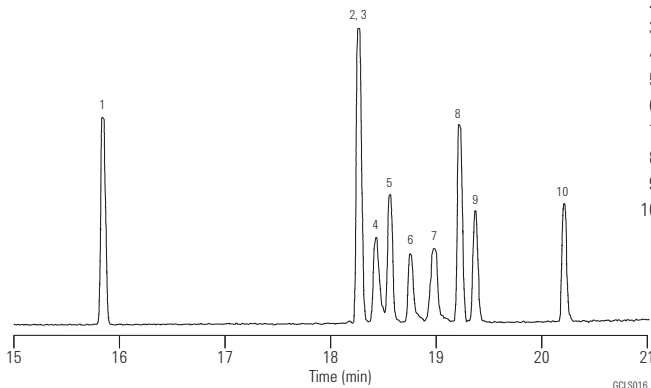
Oven: 50 °C for 0.5 min
50-150 °C at 25 °C/min
150-325 °C at 10 °C/min

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

Detector: MSD, 300 °C transfer line
full scan at m/z 40-380

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. Dextromethorphan
2. Codeine
3. Dihydrocodeine
4. Norcodeine
5. Ethylmorphine
6. Morphine
7. Normorphine
8. 6-Acetylcodeine
9. 6-Monoacetylmorphine
10. Heroin

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/s,
measured at 40 °C

Oven: 40 °C isothermal

Sampler: Headspace

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

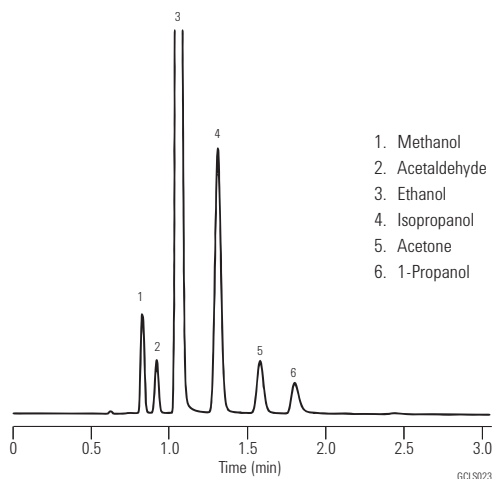
Detector: FID, 300 °C
Nitrogen makeup gas
at 23 mL/min

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/s,
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

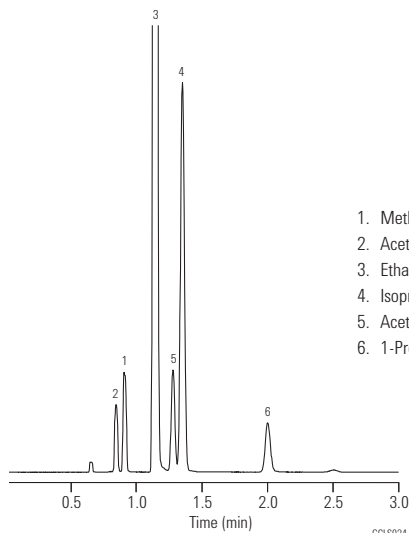
Sample: 0.1% Ethanol,
0.001% Others

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

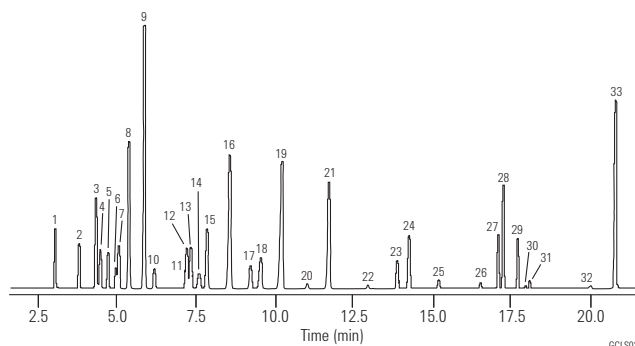
Sampler: Headspace
Plate 140 °C
Transfer line, valve 250 °C
Sample loop 2 mL

Injection: Split, 250 °C
Split ratio 1:18

Detector: FID, 270 °C
Nitrogen makeup

Sample: 5,000 ppm standard

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



Special thanks to Julie Kancler, Brian Wallace, Teledyne.

Suggested Supplies

Septum: 11 mm Advanced Green septa,
5183-4759

Liner: Direct, 1.5 mm id,
18740-80200

Seal: Gold plated seal, 18740-20885

Underivatized Drugs of Abuse – Agilent Fast Toxicology Analyzer

Column: DB-35ms 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,
(p/n 5181-3315)

Sample: Agilent GC/MS toxicology checkout mixture
(p/n 5190-0471)

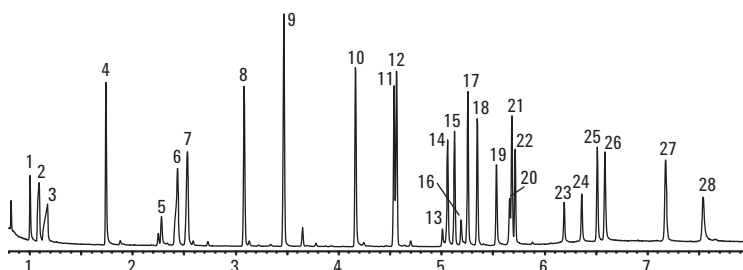
Backflush: Post run: 1 min 1 psi inlet, 75 psi aux EPC

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
Quadrupole: 180 °C scan mode
NPD: Bloss bead 300 °C H₂ 3 mL/min, 60 mL/min air,
11 mL/min makeup and column flow

CFT Device: 2-Way splitter with solvent venting between
MSD and NPD

- | | | |
|---|-----------------------------|----------------------|
| 1. Amphetamine | 9. Phencyclidine | 19. Oxycodone |
| 2. Phentermine | 10. Methadone | 20. Temazepam |
| 3. Methamphetamine | 11. Cocaine | 21. Diacetylmorphine |
| 4. Nicotine | 12. SKF-525a (RTL compound) | 22. Flunitrazepam |
| 5. Methylenedioxyamphetamine (MDA) | 13. Oxazepam | 23. Nitrazepam |
| 6. Methylenedioxymethamphetamine (MDMA) | 14. Tetrahydrocannabinol | 24. Clonazepam |
| 7. Methylenedioxyethylamphetamine | 15. Codeine | 25. Alprazolam |
| 8. Meperidine | 16. Lorazepam | 26. Verapamil |
| | 17. Diazepam | 27. Strychnine |
| | 18. Hydrocodone | 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

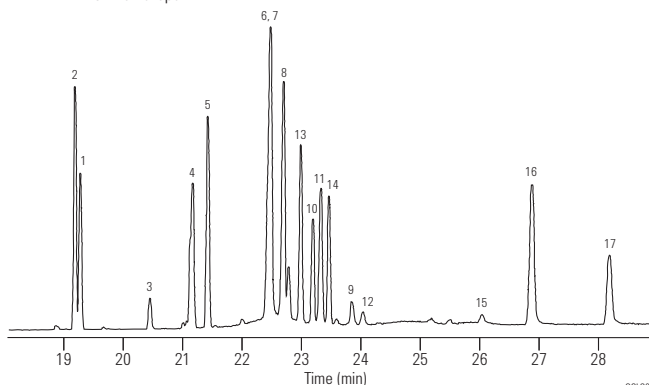
Carrier: Helium at 31 cm/s, measured at 50 °C

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 s purge activation time

Detector: MSD, 280 °C transfer line
full scan at m/z 40-400

- | | |
|----------------------|-------------------|
| 1. Medazepam | 10. Flunitrazepam |
| 2. Halazepam | 11. Delorazepam |
| 3. Oxazepam | 12. Bromazepam |
| 4. Lorazepam | 13. Prazepam |
| 5. Diazepam | 14. Flurazepam |
| 6. Demoxepam | 15. Clonazepam |
| 7. Desmethyldiazepam | 16. Alprazolam |
| 8. Clobazam | 17. Triazolam |
| 9. Temazepam | |



Suggested Supplies

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

Drug Screen

Column: DB-1ms
122-0132
30 m x 0.25 mm, 0.25 µm

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

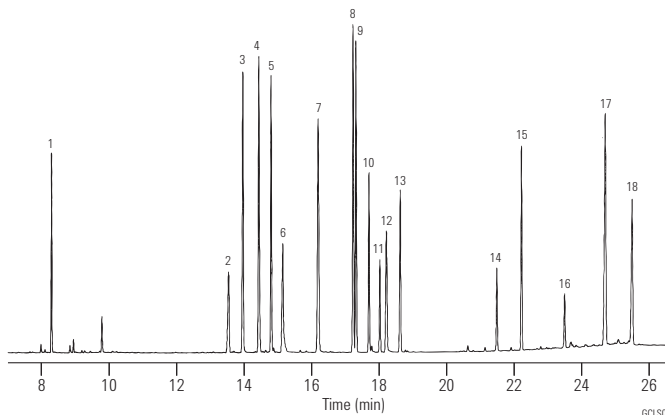
Oven: 50 °C for 1.0 min
50-125 °C at 25 °C/min
125-325 °C at 10 °C/min
325 °C for 5 min

Injection: Cold splitless
Optic II injector, 50-250 °C at 10 °C/s
45 s purge activation time

Detector: FID, 300 °C

Sample: 1 µL injection of 50-150 ppm standard

- | | |
|---------------------------------|-------------------|
| 1. Nicotine | 10. Cocaine |
| 2. Caffeine | 11. Desipramine |
| 3. Glutethimide | 12. Carbamazepine |
| 4. Lidocaine | 13. Trimipramine |
| 5. PCP | 14. Heroin |
| 6. Phenobarbital | 15. Fentanyl |
| 7. Methadone primary metabolite | 16. Ibogaine |
| 8. Methaqualone | 17. Triazolam |
| 9. Methadone | 18. LSD |



Common Drug Screen

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

Column: DB-17
122-1732
30 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen at 41 cm/s,
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

Suggested Supplies

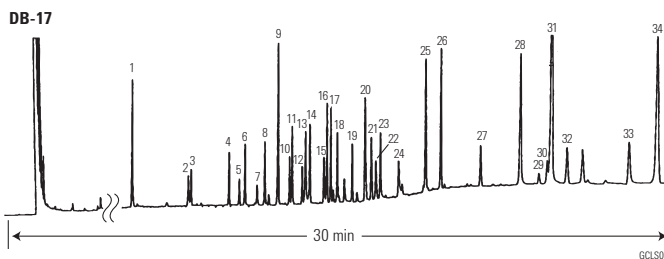
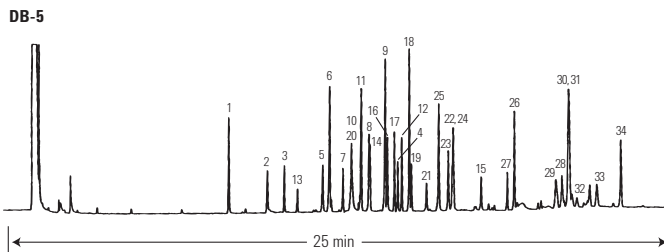
Septum: 11 mm Advanced Green septa, 5183-4759

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

Seal: Gold plated seal, 18740-20885

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

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



Urine Drug Screen

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

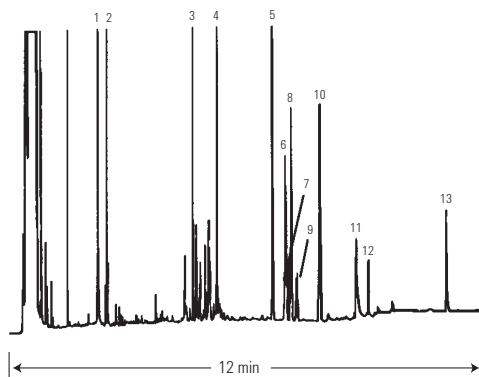
Carrier: Hydrogen, 80 cm/s

Oven: 45 °C for 1.5 min
45-300 °C at 6 °C/min

Injection: Splitless

Detector: FID

1. Amphetamine
2. Methamphetamine
3. Meperidine
4. Phencyclidine (PCP)
5. Methadone
6. Propoxyphene
7. Amitriptyline
8. Cocaine
9. Imipramine
10. Cyheptamide (ISTD)
11. Codeine
12. Diazepam
13. Flurazepam



GCL5003

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

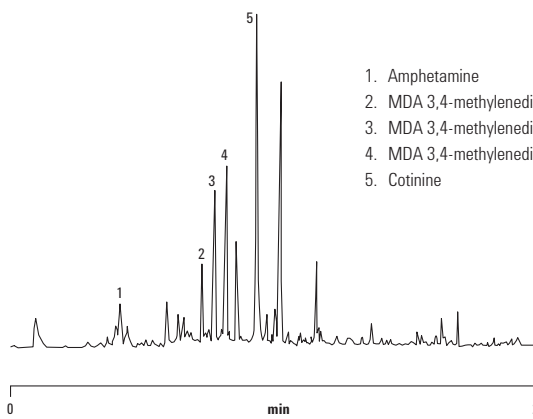
Pressure: 58.7 kPa, 2.2 min to 97 kPa, 58 kPa/min to 132 kPa,
3 kPa/min to 180 kPa, 12 kPa/min

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



VGC0032

Anesthetics

Column: DB-5ms EVDX
128-8522
25 m x 0.20 mm, 0.33 µm

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

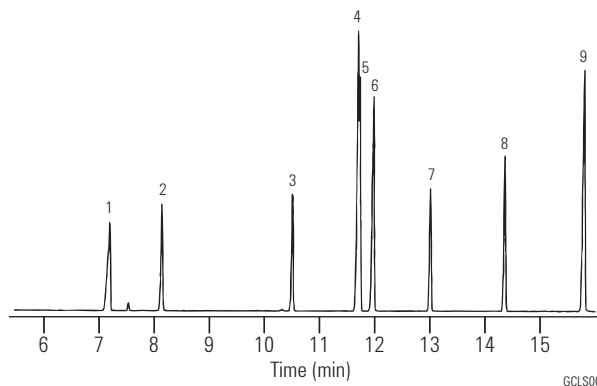
Oven: 55 °C for 1 min
55-130 °C at 25 °C/min
130-325 °C at 15 °C/min

Injection: Splitless, 250 °C
45 s 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

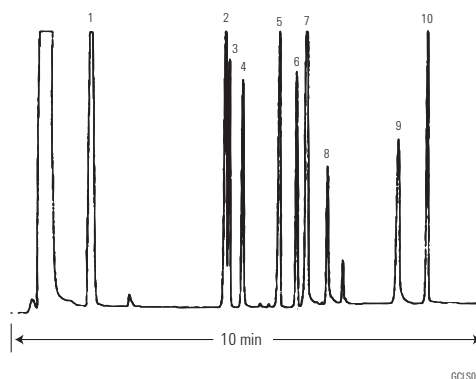
Oven: 160 °C for 2 min
160-275 °C at 15 °C/min

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/s, 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 s purge activation time

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

Sample: 1 µL of 50 ng/µL each in methanol

- | | |
|----------------------|--------------------|
| 1. Pheniramine | 13. Thonzylamine |
| 2. Dimenhydrinate | 14. Chlorcyclizine |
| 3. Diphenhydramine | 15. Pyrilamine |
| 4. Doxylamine | 16. Triprolidine |
| 5. Phenyltoloxamine | 17. Promethazine |
| 6. Tripelemnamine | 18. Antazoline |
| 7. Methapyrilene | 19. Clemizole |
| 8. Chlorpheniramine | 20. Hydroxyzine |
| 9. Cyclizine | 21. Meclizine |
| 10. Carbinoxamine | 22. Cinnanzine |
| 11. Diphenylpyraline | 23. Buclizine |
| 12. Bromopheniramine | |

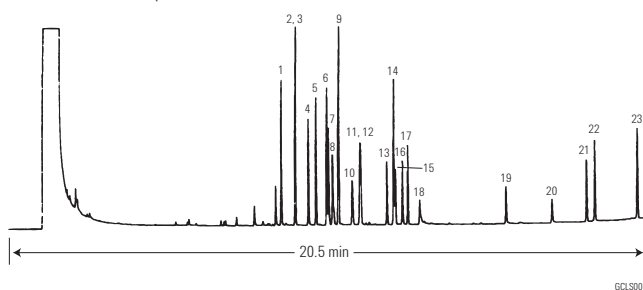
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

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

Seal: Gold plated seal, 18740-20885

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



GCL5007

Antiepileptic Drugs

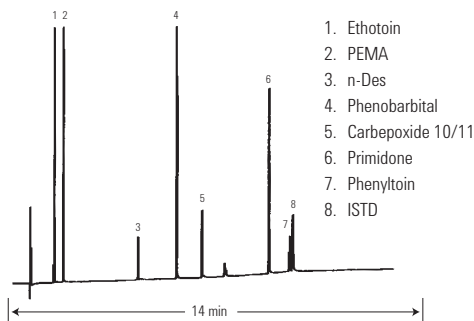
Column: Ultra 2
19091B-012
25 m x 0.32 mm, 0.17 µm

Carrier: Helium, 14 psi

Oven: 100-230 °C at 15 °C/min

Injection: Split ratio 35:1

Detector: NPD



GCL5009

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

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

Seal: Gold plated seal, 18740-20885

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

Tricyclic Antipsychotics

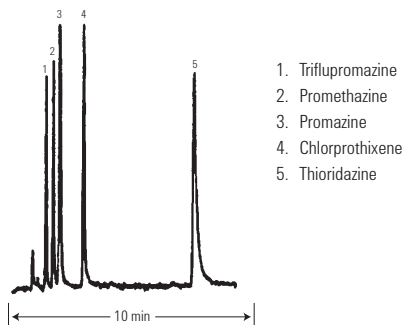
Column: Ultra 2
19091B-011
12 m x 0.20 mm, 0.33 µm

Carrier: Hydrogen, 106 cm/s

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



GCL5009

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

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

Seal: Gold plated seal, 18740-20885

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

Fentanyls

Column: DB-1701
125-0732
30 m x 0.53 mm, 1.00 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

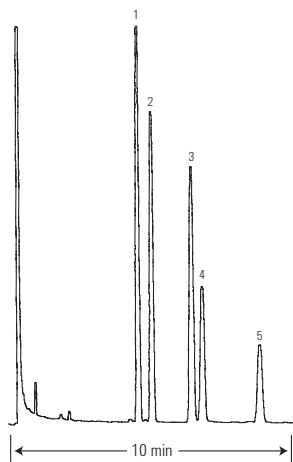
Suggested Supplies

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

GC15012

Tocopherols

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

Carrier: Helium at 40 cm/s,
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

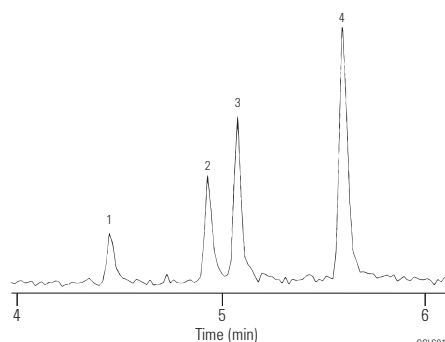
Suggested Supplies

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

GC15013

Hallucinogens

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

Carrier: Helium at 30 cm/s, 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

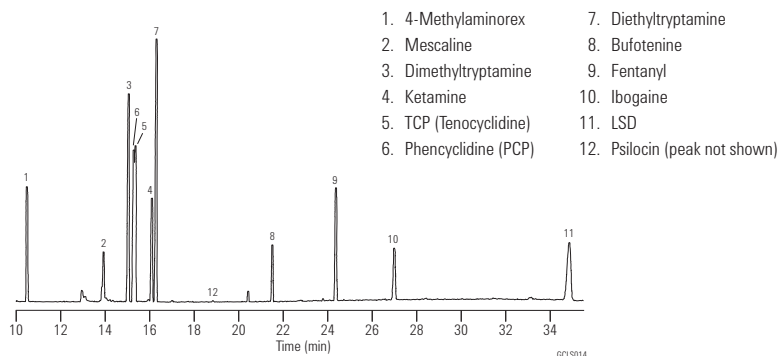
Injection: Splitless, 250 °C
30 s purge activation time

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

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

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/s, 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

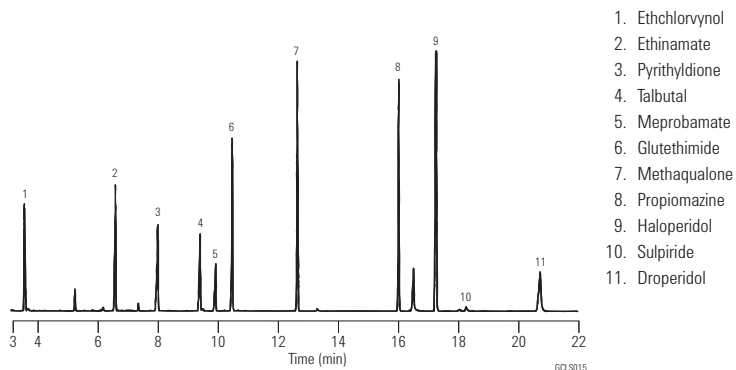
Injection: Splitless, 250 °C
45 s purge activation time

Detector: MSD, 280 °C transfer line
full scan at m/z 35-400

Sample: 1 µL of 50-100 ng/µL standard in methanol

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

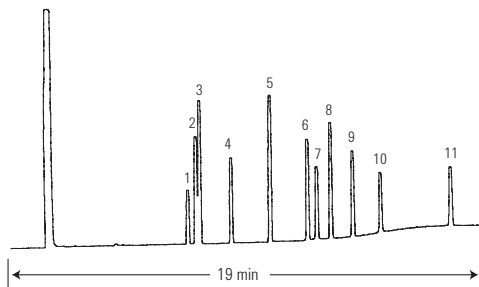
Carrier: Helium at 40 cm/s, measured at 140 °C

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

Injection: Split, 250 °C
Split ratio 1:75

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

Sample: 1 µL of 0.5 µg/µL each in methanol



- 1. Caffeine
- 2. Ketamine
- 3. Lidocaine
- 4. Procaine
- 5. Cocaine
- 6. Codeine
- 7. Morphine
- 8. 6-Acetylcodeine
- 9. Diacetylmorphine (heroin)
- 10. Quinine
- 11. Strychnine

GCL5017

Over-the-Counter Pain Killers – TMS Derivatives

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

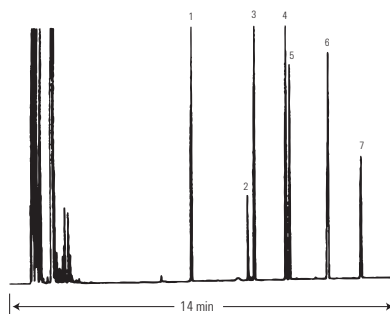
Carrier: Helium at 39 cm/s, measured at 100 °C

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



- 1. Nicotine
- 2. Unknown
- 3. Acetylsalicylic acid (aspirin)
- 4. Ibuprofen
- 5. Acetaminophen
- 6. Unknown
- 7. Caffeine

GCL5018

Aspirin and Ibuprofen in Methanol

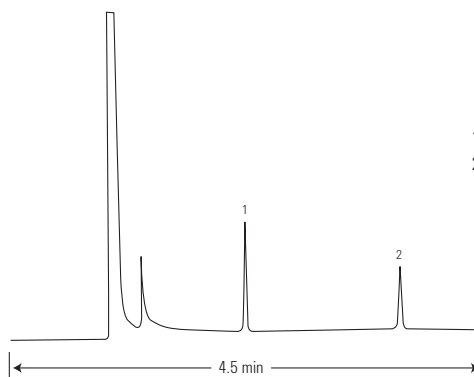
Column: DB-FFAP
122-3232
30 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen at 24 cm/s, 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



- 1. Aspirin
- 2. Ibuprofen

GCL5019

Free Steroids

Column: DB-17
122-1731
30 m x 0.25 mm, 0.15 µm

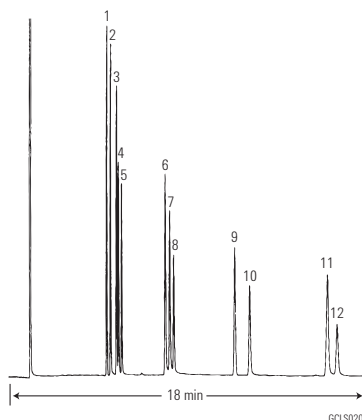
Carrier: Hydrogen at 44 cm/s

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. Coprostan (5-β-cholestane)
2. 5-β-Androsterone
3. 5-α-Cholestane
4. Androsterone
5. Epiandrosterone (trans-androsterone)
6. 17-α-Estradiol
7. β-Estradiol
8. Estrone
9. Progesterone
10. Cholesterol
11. Estriol
12. Stigmasterol

Anabolic Steroids

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

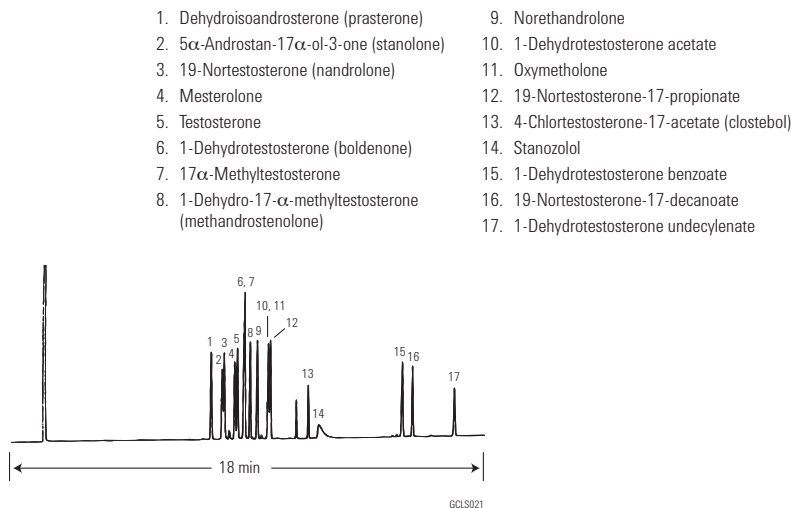
Carrier: Helium at 40 cm/s, measured at 180 °C

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) | 9. Norethandrolone |
| 2. 5α-Androstan-17α-ol-3-one (stanolone) | 10. 1-Dehydrotestosterone acetate |
| 3. 19-Nortestosterone (nandrolone) | 11. Oxymetholone |
| 4. Mesterolone | 12. 19-Nortestosterone-17-propionate |
| 5. Testosterone | 13. 4-Chlortestosterone-17-acetate (clostebol) |
| 6. 1-Dehydrotestosterone (boldenone) | 14. Stanozolol |
| 7. 17α-Methyltestosterone | 15. 1-Dehydrotestosterone benzoate |
| 8. 1-Dehydro-17-α-methyltestosterone (methandrostenolone) | 16. 19-Nortestosterone-17-decanoate |
| | 17. 1-Dehydrotestosterone undecylenate |

Marijuana (Δ^9 -THC) and Major Metabolites – TMS Derivatives

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

Carrier: Helium at 40 cm/s, 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 s purge activation time

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

Sample: 1 μ L of 0.1 μ g/ μ L each in pyridine

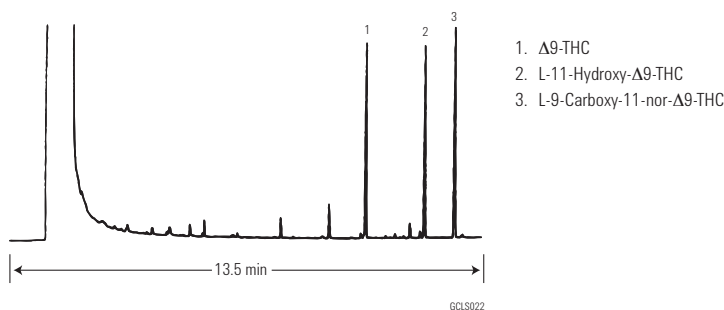
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

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

Seal: Gold plated seal, 18740-20885

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



Blood Pollutants I

Column: DB-ALC1
125-9134
30 m x 0.53 mm, 3.00 μ m

Carrier: Helium, 36 cm/s, 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

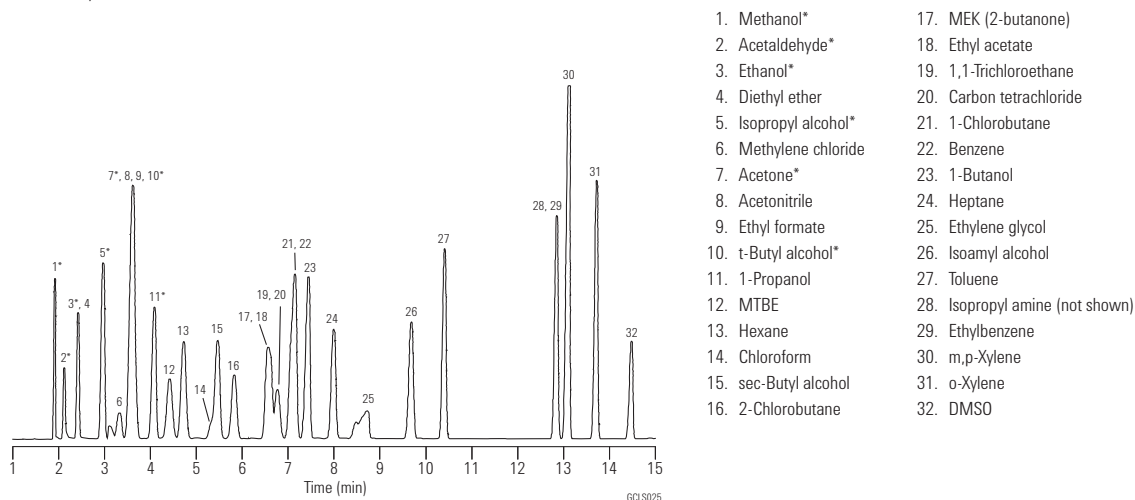
Detector: FID, 300 °C

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: DB-ALC2
125-9234
30 m x 0.53 mm, 2.00 µm

Carrier: Helium, 36 cm/s, 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

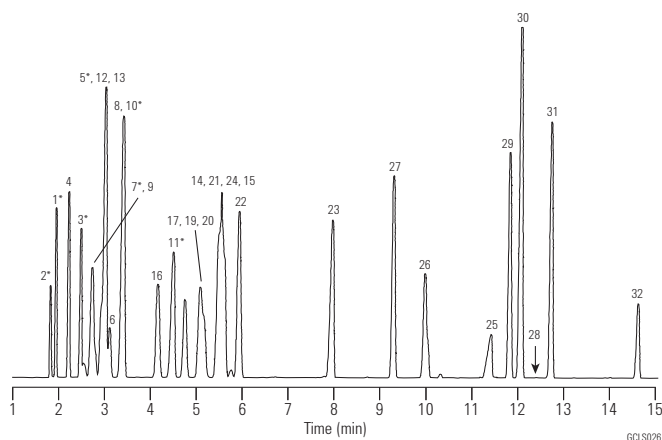
Detector: FID, 300 °C

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

Residual Solvents, USP 467

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

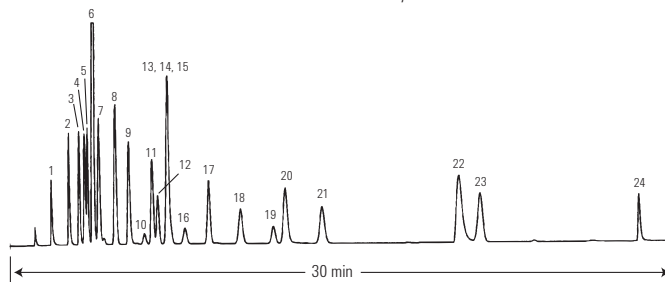
Carrier: Helium at 35 cm/s, measured at 40 °C

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



Column Performance for USP <467> Standards

Column: DB-Select 624 Ultra Inert
123-0334UI
30 m x 0.32 mm, 1.80 µm

Carrier: Helium, 2.2 mL/min
constant flow at 40 °C

Oven: 40 °C for 20 min, then
10 °C/min to 240 °C 5 min

Inlet: MMI, 140 °C, 1 µL split 5:1

Inlet liner: 1 mm straight single taper Ultra Inert liner

Sample Conc: 1.0 mL loop

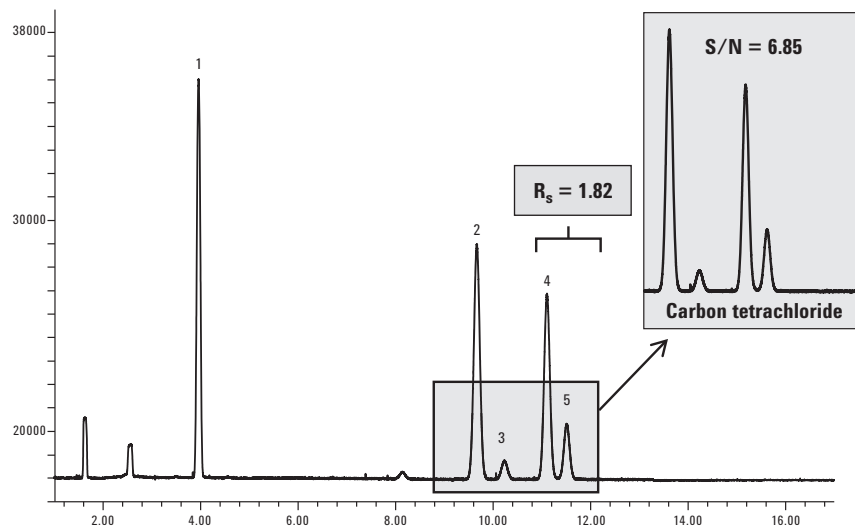
Detector: FID: 250 °C, H₂ 30 mL/min, air 400 mL/min,
N₂ constant col + makeup = 30 mL/min

Suggested Supplies

Septum: Non-stick bleed and temperature optimized (BTO) septa, 11 mm, 50/pk, 5183-4757

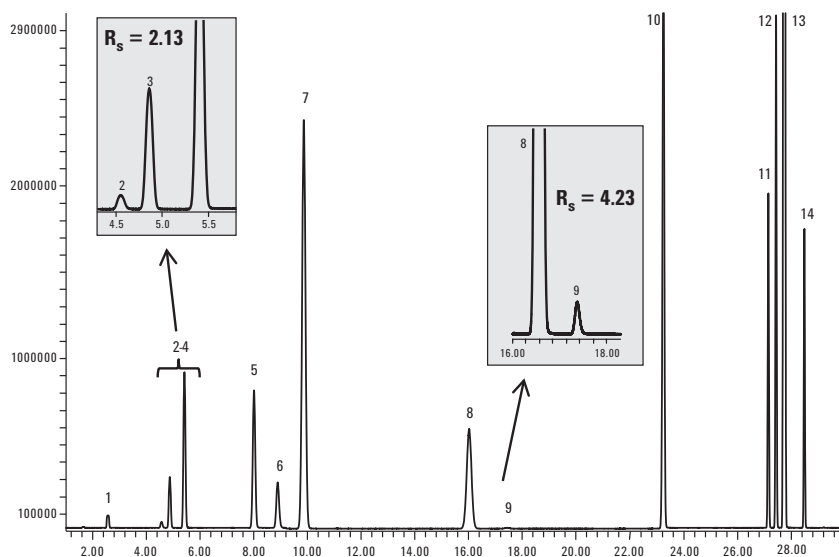
Liner: Liner, GC, Ultra Inert, straight, 1 mm id, 5190-4047

Seal: Certified gold plated seal kit, includes washer, 10/pk, 5190-2209



1. 1,1-Dichloroethene
2. 1,1,1-Trichloroethane
3. Carbon tetrachloride
4. Benzene
5. 1,2-Dichloroethane

FID trace of Class 1 solvent standard at USP <467> specified limits on an Agilent J&W DB-Select 624UI for USP <467>, 30 m x 0.32 mm, 1.80 µm column



1. Methanol
2. Acetonitrile
3. Dichloromethane
4. *trans*-1,2-Dichloroethane
5. *cis*-1,2-Dichloroethane
6. Tetrahydrofuran
7. Cyclohexane
8. Methylcyclohexane
9. 1,4-Dioxane
10. Toluene
11. Chlorobenzene
12. Ethylbenzene
13. *m/p*-Xylene
14. *o*-Xylene

FID trace of Class 2A solvent standard at USP <467> specified limits on an Agilent J&W DB-Select 624UI for USP <467>, 30 m x 0.32 mm, 1.80 µm column

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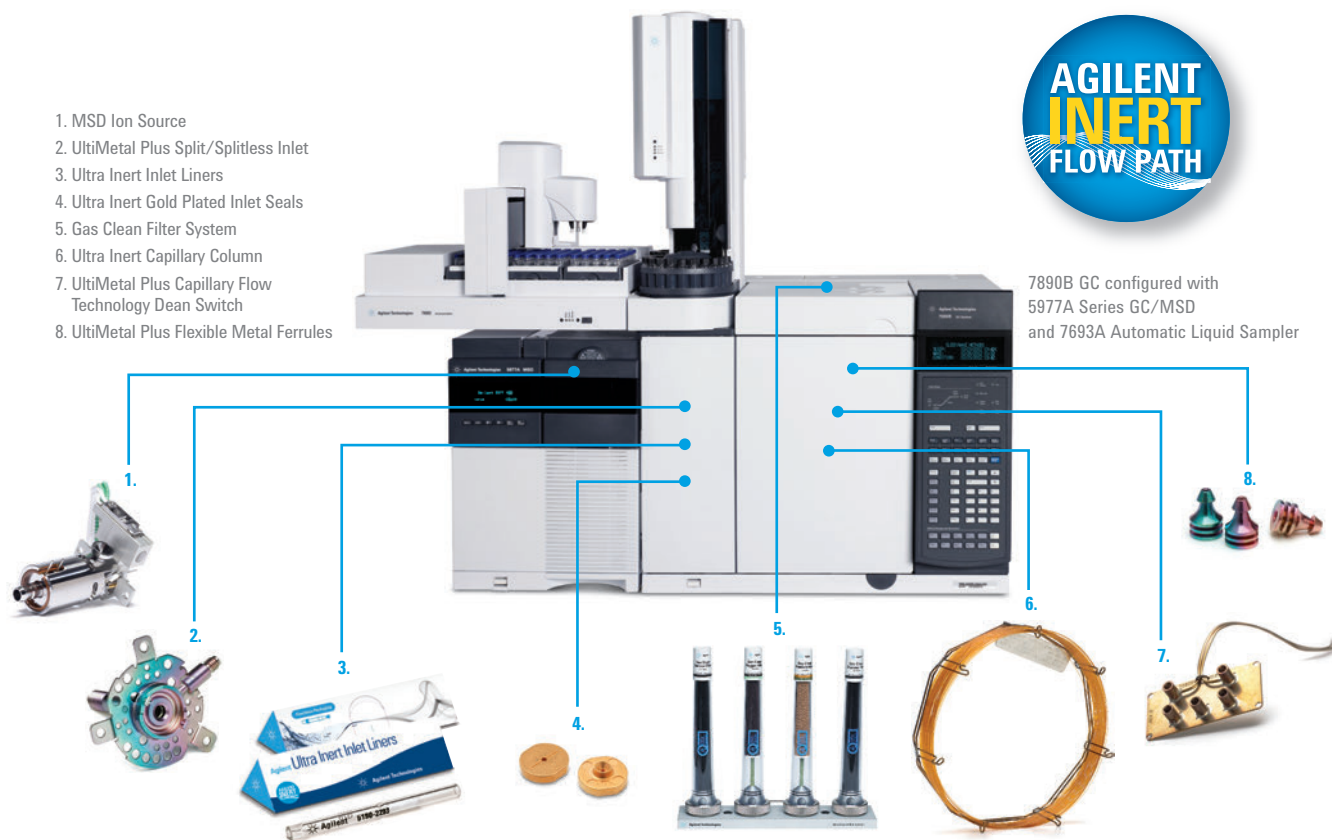
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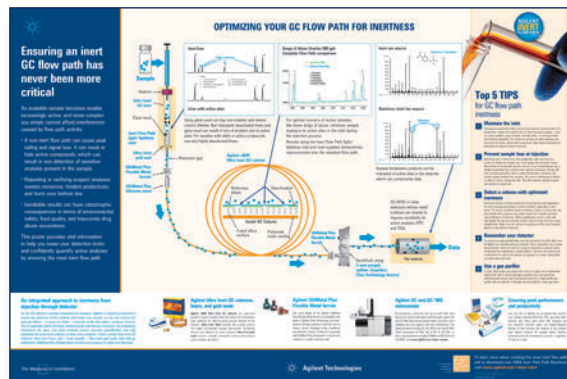
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