Packed Column GC Application Guide

SUPELCO

ISO 9001
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Bulletin 890A

Packed Column GC Application Guide

This guide to packed column applications provides information on the best approach to designing your application. It includes helpful information about packings, phases, tubing, and different types of deactivations. Nearly 200 different applications are organized according to type of analysis. In most cases, the catalog number for the packing is included with the application chromatogram.

Key Words
- packed column
- gas chromatography

What Makes a Good Column?

Tubing, support, and stationary phase are all that is needed to prepare a column, but to prepare a column that will provide the desired separation may require much more. First, the proper materials must be selected; this can be the most difficult part. Also, these ingredients must be combined in such a manner that optimum performance can be obtained; this can turn out to be more than one bargains for! Any compromise in materials or procedures yields a compromised performance.

The Rohrschneider and McReynolds Constants

An important feature is the use of the Rohrschneider and McReynolds Constants. Using these systems, most of the stationary phases now in use have been characterized by a series of constants. These constants provide the worker with a wealth of practical information to help solve problems in column selection. For more information and a listing of McReynolds values, request Bulletin 880.

The Support

The support plays a critical role in several ways in the performance of the column. First, it governs the efficiency of the column (narrowness of peaks). The structure of the support, and the manner in which it is coated, both contribute to the efficiency. Secondly, the wrong choice of support can interact with the sample to cause the chromatographic peaks to tail, i.e., they can be highly asymmetrical and consequently difficult or impossible to measure. Ideally, the support should not interact with the sample but, in practice, this does occur. By careful selection of the support and conditions, one can minimize this problem.

The tailing phenomenon is caused by active sites on the surface of the support. These sites are ones that can form a hydrogen bond; consequently samples that form a strong hydrogen bond tail badly. In practice, compounds such as water, glycols, alcohols, acids, and amines tail severely while carbonyl

compounds such as esters, ketones, and aldehydes tail to a lesser degree. Hydrocarbons that do not hydrogen bond are not bothered by tailing.

To eliminate or reduce the tailing problem one modifies the support surface by: 1) removing the active sites by acid and/or base washing, 2) modifying the surface by silanization, or 3) covering the active sites with the stationary phase having polar functional groups in it.

Acid washing is effective in removing mineral impurities from the support surface as well as miscellaneous extraneous material. Base washing does not impart any special advantage to the support that is not obtained with a well acid washed support. Acid washing by itself is not effective in reducing tailing but it is recommended where a polar phase is used, such as the polyesters and polyglycols.

Silanization, particularly with dimethyldichlorosilane (DMCS) is very effective in reducing tailing. Combined with acid washing and DMCS treatment, the resulting support is recommended for most columns. Silane treatment is a very difficult process to control and should not be attempted unless you wish to make a research project out of it. When silicone stationary phases are used, it is mandatory that an acid-washed and DMCS-treated support be used. The silicone stationary phases, particularly when used in the 1-5% level, are not effective in deactivating the support and require a silane-treated support. SUPELCOPORT is recommended where an acid-washed and DMCS-treated support is required.

The third procedure for deactivation, using a polar stationary phase, requires that the phase contain functional groups such as an ester, an ether, a hydroxyl, and an amine group. These functional groups have strong hydrogen bonding characteristics and tie up the active sites on the support surface. These phases do not require a silanized support, although, when they are used at a level of 5% or less, silanization can be useful. Normally we recommend using an acid-washed support with these phases.

When analyzing acids it is necessary that the stationary phase contain an acid to deactivate the support. See Bulletin 856.

When working with basic compounds such as amines, the stationary phase must contain a base to deactivate the support; otherwise severe tailing will result. KOH is frequently used at a 1-2% level for the purpose. A basic stationary phase such as polyethyleneimines also may be used.

Most of the GC supports in current use are made from diatomaceous earth, also called diatomite. The diatomite is processed in several ways producing two basic types of supports. These are conveniently recognized by their color.

The particle size of supports are generally expressed in terms of screen openings since screens are normally used to prepare them. The particle sizes normally used in GC are as follows:

60/80 mesh	250-177 microns
80/100 mesh	177-149 microns
100/120 mesh	149-125 microns

The designation 60/80 mesh means that the particles have passed through a 60 mesh screen (-60) and will not pass through the 80 mesh screen (+80). It then means that the particles are between 250-177 microns in size. The column efficiency improves with decreasing particle size. At present the 80/100 mesh is the most popular size, but 100/120 mesh is used with increasing frequency when more efficiency columns are desired.

Column Tubing

Glass, stainless steel, aluminum, and copper are the tubing materials commonly used for columns. While glass is the most inert of the tubing, stainless steel is the most widely used.

Glass is used in situations where the sample might interact with the walls of the tube. It is standard operating procedure to use glass columns when working with pesticides and biochemicals such as steroids and hormones. Glass is more inert then the metals and rarely causes tailing or decomposition of the samples. Glass columns are also used generally in situations where it is desirable that the sample be injected directly into the column. An alternative is to use a glass lined injection port to avoid the contact with metal since metal in the inlet can destroy certain samples or cause tailing. Glass columns also permit you to see how well a column has been packed.

Fused silica lined stainless steel tubing is a suitable substitute for glass tubing. When properly deactivated, it meets or exceeds the deactivation of conventional deactivated glass columns.

Metal columns are used where glass is not required. Stainless steel is generally considered more inert than aluminum or copper. We recommend stainless steel as the metal of choice because it is easier to prepare columns of higher efficiency with stainless steel than with aluminum or copper. The hardness of the material appears to be important in transmitting the vibrational energy when the column is vibrated or tapped. However, if in doubt . . . use glass . . . and silane treat it! (All Supelco glass columns are silane-treated.)

SP-Alloy T-1, our nickel alloy, approaches glass in inertness. Most newer instruments are designed to handle 1/8" OD metal columns. When glass columns are to be used, the instruments are usually equipped to handle 1/4" OD columns. Here the glass column can be made with a heavy glass wall cutting down considerably on the problem of breakage. Where 1/8" OD glass columns are used, the breakage problems are usually severe.

From our own experience we recommend using 2mm ID rather than 4mm ID glass columns because of the inherently higher efficiency. If you shift from 4mm to 2mm columns, remember to reduce the carrier gas flow rate to 1/4, not 1/2. A reasonable flow rate for 4mm columns is 80mL/min, while for 2mm columns a good rate is 20mL/min.

Upper Temperature Limit

Each stationary phase has an upper temperature limit above which the column should not be operated. Most stationary phases are polymers that consist of materials having a range of molecular weights. As the column temperature is increased, the more volatile portion of the polymer is swept out of the column by the carrier gas. The volatile products could also be formed by thermal degradation of the stationary phase while the column is being used. This is called bleed, and is seen on the recorder as a rise in the baseline or as noise. Above the maximum upper limit the bleed rate is very high and the column will have a relatively short life. In some cases the bleed rate is so high that it will not be possible to move the recorder pen off of full scale. Note that the reported maximum upper limits are approximate values. Each column produced is shipped with a conditioning sheet, and minimum/maximum operating temperature is indicated. For a listing of phases and their maximum/minimum operating temperatures, refer to our general catalog.

Conditioning the Column

Before a column is used for the first time, it must be conditioned for a period of hours to rid it of the very volatile portion of the stationary phase and also the last traces of solvent which were used in the coating step.

We recommend conditioning the column at the maximum isothermal column temperature *which you expect to reach.* One can start to use a column after it has been conditioned at that temperature after only 3-4 hours, but conditioning overnight is usually better. We recommend that you always condition the column with a flow of carrier gas. Others have recommended "no-flow' conditioning for such materials as UC W98 silicone. This might be necessary for technical grade silicone, but chromatographic grade silicones such as the SP™ and OV® phases, and most other phases, should not be subjected to this drastic treatment.

Many stationary phases are subject to oxidation and should not be exposed to air while hot. At all times when the column is hot, the carrier gas should be allowed to flow through it. Cutting back on the carrier gas overnight can be detrimental to the column. It may also be necessary to insert an oxygen scrubber in the carrier gas line.

The Lower Temperature Limit

Observing the lower temperature limit is also important to obtain good column performance. Some stationary phases are solids and are ineffective as a stationary phase in this form. They must be operated at a temperature above their melting point.

Selecting a Column

The simplest method of obtaining a column to handle a particular problem is to duplicate one that is referred to in the applications pages of this guide. Another method is to use the literature as a guide and then to substitute some of the newer, improved stationary phases and solid supports. If you cannot find the solution to your separation problem in the literature, the problem is more complex. When ordering the column, it is essential that you list all of the following:

a. the stationary phase
b. the support
c. the mesh range of the support
d. the treatment given the support
e. the percent coating of stationary phase
f. the tube composition, i.e., glass, stainless, etc.
g. the dimensions of the tube, i.e., length and diameter, both OD and ID if possible
h. the configuration of the column or instrument it is to be used with

Example: 3% SP-2100 on 100/120 mesh SUPELCOPORT™, 6' x 1/4" OD, 2mm ID, Glass for HP6890.

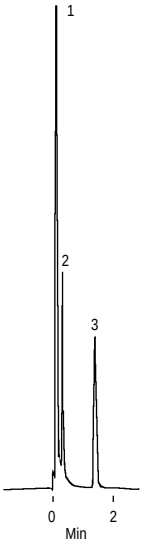
For a complete listing of our current line of columns, packings, and accessories, please refer to our general catalog.

Index to Chromatograms

Figure 1. Trace Acetaldehyde in Air (2500ppm)

Packing: **Hayesep® D, 100/120 mesh**
Cat. No.: **10293** (packing)
Column: 3' x 1/8" ID stainless steel
Oven: 100°C
Carrier: helium, 30cc/min
Det.: P.E. 900 TC, 225 ma, 140°C
Inj.: Valco® valve, 100mL, 140°C

1. Air
2. Water
3. Acetaldehyde (vol. 2500ppm)



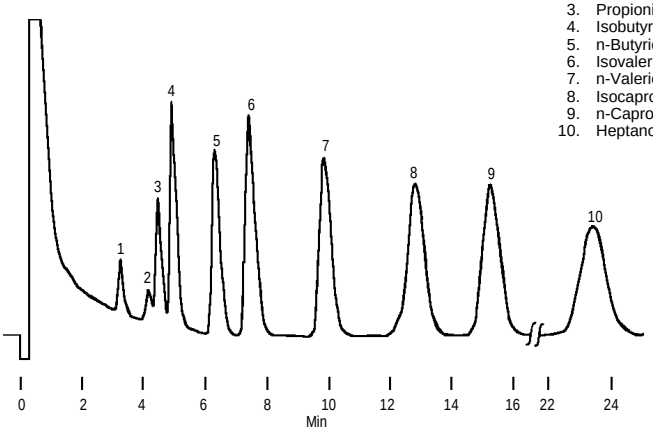
For more information, request Bulletins 790 and 816.
Chromatogram provided courtesy of Hayes Separations, Inc.

795-0144

Figure 2. Volatile Fatty Acids (C1-C7)

Packing: **10% SP-1000/1% H_3PO_4 on 100/120 Chromosorb® W AW**
Cat. No.: **11841** (packing)
Column: 6' x 4mm ID glass
Oven: Fisher Model 2400, 147°C
Carrier: helium, 86mL/min
Det.: TC
Inj.: 14µL

1. Acetic acid
2. Formic acid
3. Propionic acid
4. Isobutyric acid
5. n-Butyric acid
6. Isovaleric acid
7. n-Valeric acid
8. Isocaproic acid
9. n-Caproic acid
10. Heptanoic acid

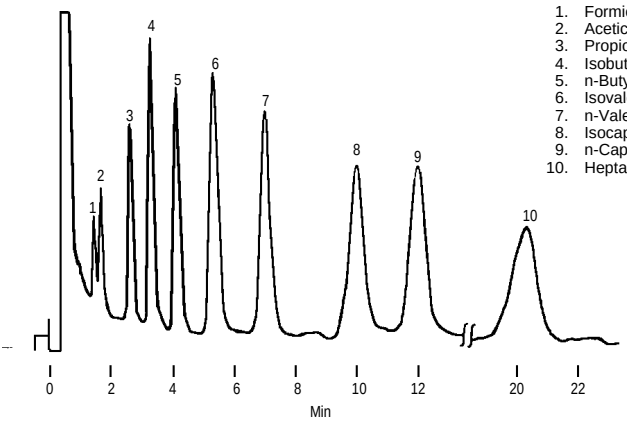


For more information, request Bulletin 856.

795-0077

Figure 3. Volatile Acid Standard Mix (C1-C7)

Packing: **15% SP-1220/1% H_3PO_4 on 100/120 Chromosorb W AW**
Cat. No.: **12144** (packing)
Column: 6' x 4mm ID glass
Oven: Fisher Model 2400, 145°C
Carrier: helium, 70mL/min
Det.: TC
Inj.: 14µL



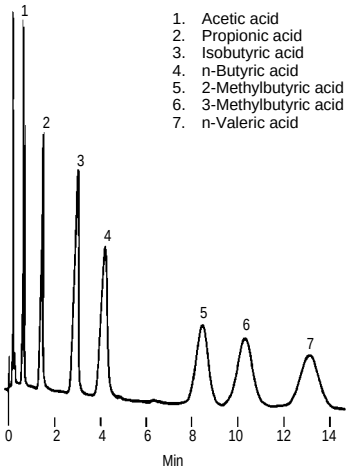
1. Formic acid
2. Acetic acid
3. Propionic acid
4. Isobutyric acid
5. n-Butyric acid
6. Isovaleric acid
7. n-Valeric acid
8. Isocaproic acid
9. n-Caproic acid
10. Heptanoic acid

For more information, request Bulletin 856.

795-0076

Figure 4. Volatile Fatty Acids in Sewage Effluents (ppm Levels)

Packing: **GP 60/80 Carbopack® C/0.3% Carbowax® 20M/0.1% H_3PO_4**
Cat. No.: **11825-U** (packing,15g/bottle)
Column: 30" x 4mm ID glass
Oven: 120°C
Carrier: nitrogen, 50mL/min
Det.: FID, 200°C
Inj.: 1µL water containing 50ppm each analyte, 200°C



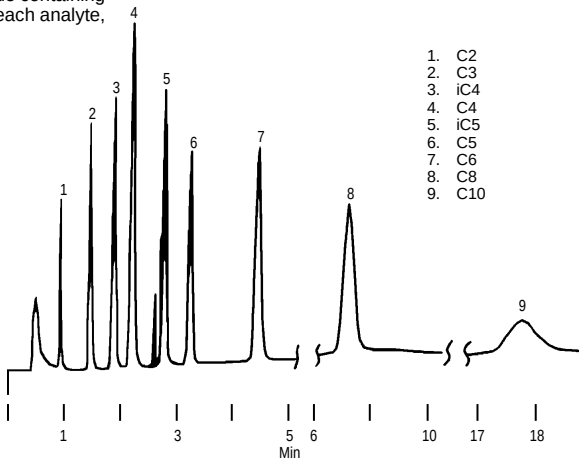
1. Acetic acid
2. Propionic acid
3. Isobutyric acid
4. n-Butyric acid
5. 2-Methylbutyric acid
6. 3-Methylbutyric acid
7. n-Valeric acid

Useful for analyses of sewage treatment effluents and other wastewater.
For trace analyses, use a glass column.
For more information, request Bulletin 856.

795-0078

Figure 5. Free Fatty Acids (C2-C10)

Packing: **GP 10% SP-1200/1% H_3PO_4 on 80/100 Chromosorb W AW**
Cat. No.: **11965** (packing, 20g/bottle)
Column: 6' x 1/8" stainless steel
Oven: 125°C to 175°C at 15°C/min
Carrier: nitrogen, 20mL/min
Det.: FID, 200°C
Inj.: 0.5µL carbon disulfide containing 0.1% each analyte, 150°C



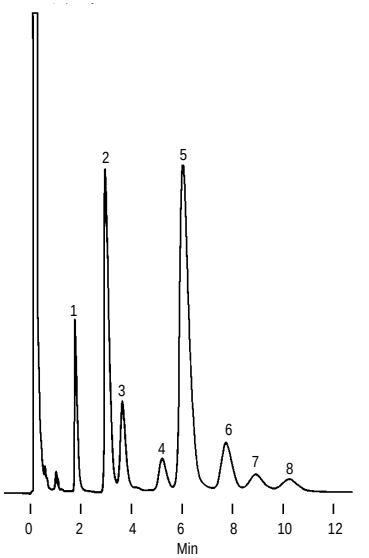
For more information, request Bulletin 856.

713-0963

Figure 6. Free Fatty Acids (C14:0 to C18:3)

Packing: **5% DEGS-PS on 100/120 SUPELCOPORT**
Cat. No.: **11870-U** (packing)
Column: 3' x 2mm ID glass
Oven: 200°C
Carrier: nitrogen, 20mL/min
Det.: FID, 210°C
Inj.: 1µL Qualmix™ FA

1. Myristic acid (C14:0)
2. Palmitic acid (C16:0)
3. Palmitoleic acid (C16:1)
4. Stearic acid (C18:0)
5. Oleic acid (C18:1)
6. Linoleic acid (C18:2)
7. Arachidic acid (C20:0)
8. Linolenic acid (C18:3)

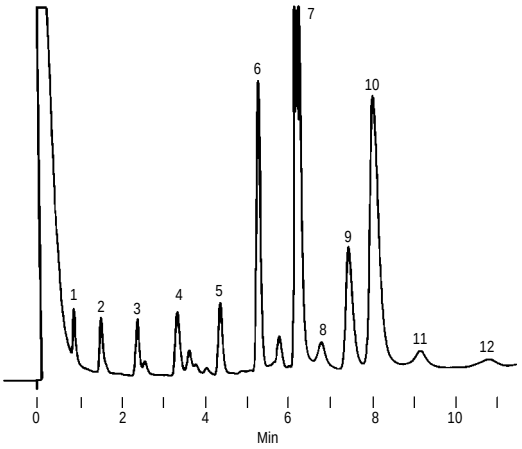


For more information, request Bulletin 856.

795-0079

Figure 7. Whole Milk Free Acids

Packing: **10% SP-216-PS on 100/120 SUPELCOPORT**
Cat. No.: **11879** (packing)
Column: 3' x 2mm ID glass
Det: FID, 200°C
Oven: 130°C to 200°C at 15°C/min
Carrier: nitrogen, 20mL/min
Inj.: 0.5µL carbon disulfide containing 0.1% each analyte, 150°C



1. C4:0
2. C6:0
3. C8:0
4. C10:0
5. C12:0
6. C14:0
7. C16:0
8. C16:1
9. C18:0
10. C18:1
11. C18:2
12. C18:3

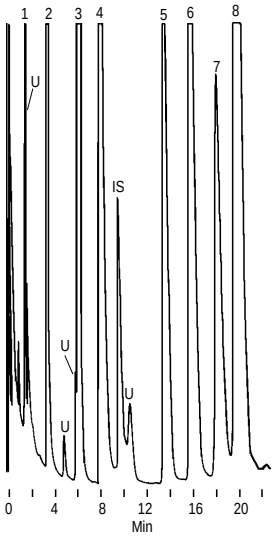
For more information, request Bulletin 856.

713-0962

Figure 8. Lactic Acid in Corn Silage (C2-C5)

Packing: **80/120 Carbopack B-DA/4% Carbowax 20M**
Cat. No.: **11889** (packing)
Column: 2m x 2mm ID TightSpec™ glass (stock column available)
Oven: 175°C
Carrier: nitrogen, 24mL/min
Det.: FID, 200°C
Inj.: 1µL aqueous mixture, 200°C

		Conc. (ppm)
U	Unknown	
1.	Acetic acid	370
2.	Propionic acid	78
3.	Isobutyric acid	282
4.	Butyric acid	1125
IS	Trimethylacetic acid (int. std.)	50
5.	2-Methylbutyric acid	220
6.	Isovaleric acid	284
7.	Lactic acid	710
8.	Valeric acid	465



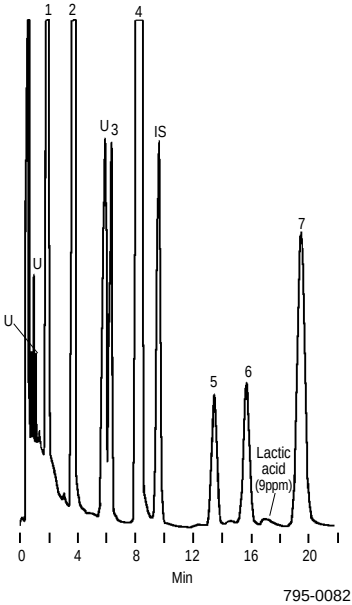
For more information, request Bulletin 856.

795-0080

Figure 9. Lactic Acid in Rumen Fluid

Packing: **80/120 Carbopack B-DA/4% Carbowax 20M**
Cat. No.: **11889** (packing)
Column: 2m x 2mm ID TightSpec glass (stock column available)
Oven: 175°C
Carrier: nitrogen, 24mL/min
Det.: FID, 200°C
Inj.: 1µL aqueous mixture, 200°C

		Conc. (ppm)
U	Unknown	
1.	Acetic acid	1300
2.	Propionic acid	1060
3.	Isobutyric acid	43
4.	Butyric acid	313
IS	Trimethylacetic acid (int. std.)	50
5.	2-Methylbutyric acid	60
6.	Isovaleric acid	41
7.	Valeric acid	70

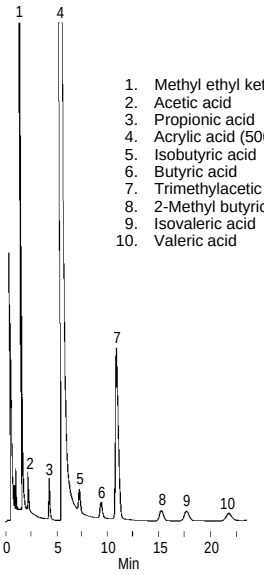


For more information, request Bulletin 856.

795-0082

Figure 10. Acrylic/Propionic Separation in C2-C5 Acids

Packing: **80/120 Carbopack B-DA/4% Carbowax 20M**
Cat. No.: **11889** (packing,15g/bottle)
Column: 2m x 2mm ID TightSpec glass (stock column available)
Oven: 175°C
Carrier: nitrogen, 24mL/min
Det.: FID, 200°C
Inj.: 1µL water, 10ppm each acid, 100ppm each internal standard, 200°C



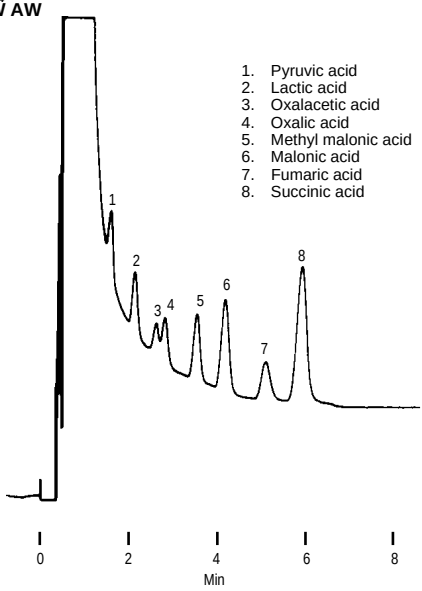
1. Methyl ethyl ketone (int. std.)
2. Acetic acid
3. Propionic acid
4. Acrylic acid (5000ppm)
5. Isobutyric acid
6. Butyric acid
7. Trimethylacetic acid (int. std.)
8. 2-Methyl butyric acid
9. Isovaleric acid
10. Valeric acid

For more information, request Bulletin 856.

713-0964

Figure 11. Nonvolatile Methylated Acids

Packing: **10% SP-1000/1% H_3PO_4 on 100/120 Chromosorb W AW**
Cat. No.: **11841** (packing)
Column: 6' x 4mm ID glass
Oven: 155°C
Carrier: helium, 86mL/min

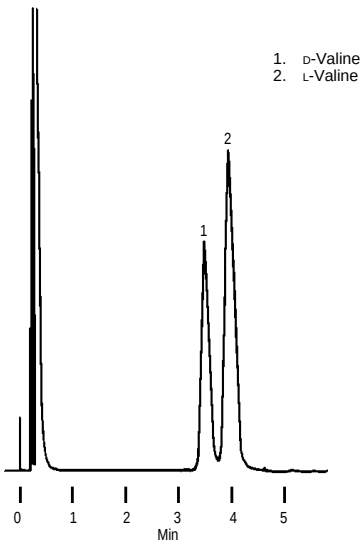


For more information, request Bulletin 856.

795-0081

Figure 12. N-TFA-O-Methyl Esters of D- & L-Valine Amino Acids

Packing: **5% SP-300 on 100/120 SUPELCOPORT**
Cat. No.: **11835-U** (packing)
Column: 6' x 2mm ID glass
Oven: 120°C
Carrier: nitrogen, 20mL/min
Inj.: 1µL (1µg/µL conc.)

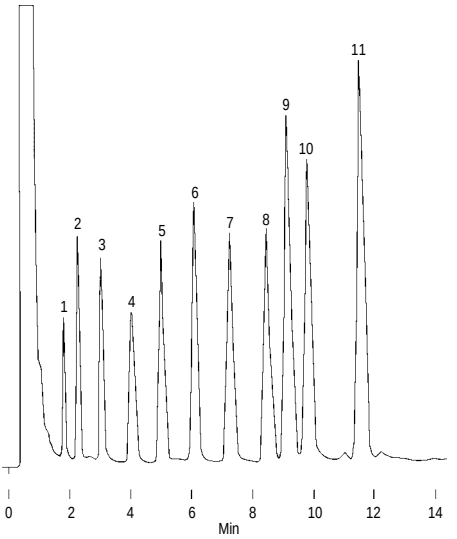


795-0158

Figure 13. Methyl Esters of Dibasic Acids

Packing: **10% SP-2340 on 100/120 Chromosorb W AW**
Cat. No.: **11852** (packing)
Column: 6' x 1/8" ID stainless steel
Oven: 170°C to 220°C at 4°C/min
Carrier: nitrogen, 20mL/min
Inj.: 0.75µL, 10mg/cc each acid

1. Dimethyl malonate (C3)
2. Dimethyl succinate (C4)
3. Dimethyl glutarate (C5)
4. Dimethyl adipate (C6)
5. Dimethyl pimelate (C7)
6. Dimethyl suberate (C8)
7. Dimethyl azelate (C9)
8. Dimethyl sebacate (C10)
9. Dimethyl terephthalate
10. Dimethyl isophthalate
11. Dimethyl phthalate

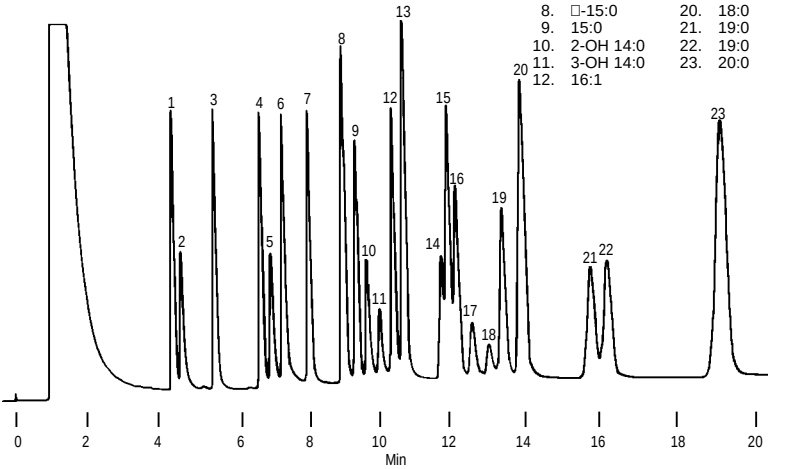


713-0976

Figure 14. Bacterial Acid Standard

Packing: **3% SP-2100 DOH on 100/120 SUPELCOPORT**
Cat. No.: **12101** (packing)
Column: 10' x 2mm ID glass
Oven: 150°C to 225°C at 4°C/min
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 1µL

1. 11:0
2. 2-OH 10:0
3. 12:0
4. 13:0
5. 2-OH 12:0
6. 3-OH 12:0
7. 14:0
8. □-15:0
9. 15:0
10. 2-OH 14:0
11. 3-OH 14:0
12. 16:1
13. 16:0
14. □-17:0
15. 17:0
16. 17:0
17. 2-OH 16:0
18. 3-OH 16:0
19. 18:1
20. 18:0
21. 19:0
22. 19:0
23. 20:0



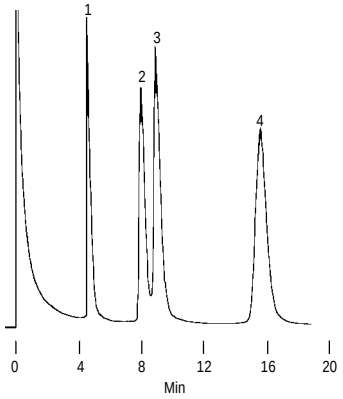
For more information, request Bulletin 856 and Application Note 50.

795-0159

Figure 15. Bile Acid Methyl Esters

Packing: **3% SP-2250 on 100/120 SUPELCOPORT**
Cat. No.: **11878** (packing, 20g/bottle)
Column: 3' x 2mm ID glass
Oven: 275°C
Carrier: helium, 40mL/min
Det.: FID

1. Methyl lithocholate (0.94µg/µL)
2. Methyl deoxycholate (1.25µg/µL)
3. Methyl chenodeoxycholate (1.57µg/µL)
4. Methyl cholate (2.50µg/µL)



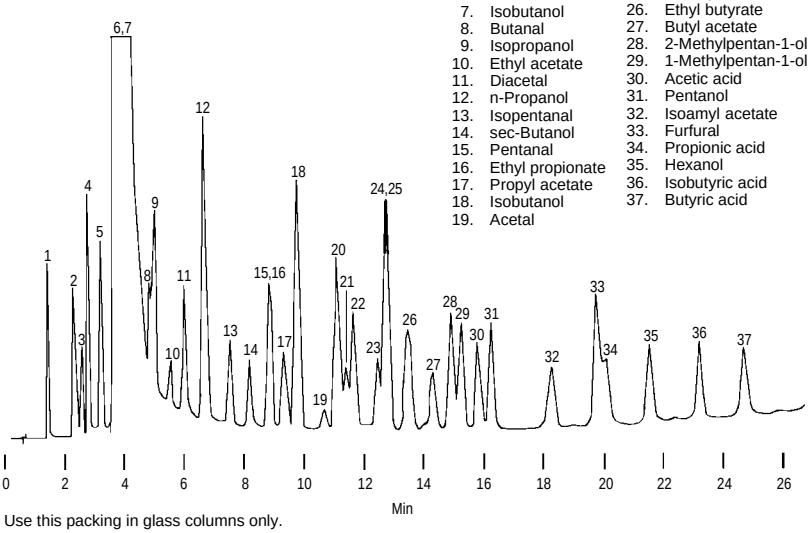
For more information, request Bulletin 856.

713-0977

Figure 16. Alcoholic Beverage/Fermentation Products

Packing: **80/120 Carbopack B AW/6.6% PEG 20M**
Cat. No.: **11814** (packing, 15g/bottle)
Column: 2m x 2mm ID glass
Oven: 80°C to 200°C at 4°C/min
Carrier: nitrogen
Det.: FID
Inj.: 1µL water:ethanol (50:50), 40-60ppm each analyte

1. Acetaldehyde
2. Methanol
3. Propanol
4. Acetone
5. Methyl acetate
6. Ethanol
7. Isobutanol
8. Butanal
9. Isopropanol
10. Ethyl acetate
11. Diacetal
12. n-Propanol
13. Isopentanal
14. sec-Butanol
15. Pentanal
16. Ethyl propionate
17. Propyl acetate
18. Isobutanol
19. Acetal
20. Butanol
21. Ethyl isobutyrate
22. 3-Methylbutan-2-ol
23. 3-Pentanol
24. 2-Pentanol
25. Isobutyl acetate
26. Ethyl butyrate
27. Butyl acetate
28. 2-Methylpentan-1-ol
29. 1-Methylpentan-1-ol
30. Acetic acid
31. Pentanol
32. Isoamyl acetate
33. Furfural
34. Propionic acid
35. Hexanol
36. Isobutyric acid
37. Butyric acid



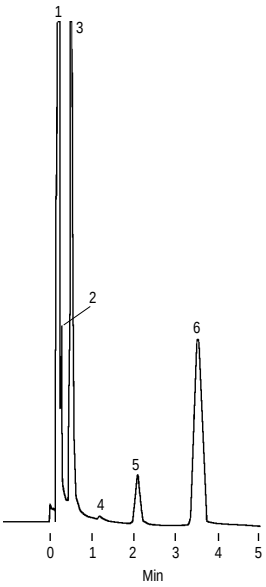
Use this packing in glass columns only.
For more information, request Bulletin 790.
Figure provided by Dr. Antonio DiCorcia and colleagues, University of Rome (used with permission of Elsevier Scientific Publishing Co., Amsterdam).

713-0711

Figure 17. Tequila Headspace

Packing: **HayeSep D, 80/120 mesh**
Cat. No.: **10293** (packing)
Column: 3' x 1/8" ID stainless steel
Oven: 100°C
Carrier: helium, 30cc/min
Det.: P.E. 900 T.C., 225 ma, 140°C
Inj.: Valco valve, 100µL, 140°C

1.	Air	(Att. x1)
2.	Carbon dioxide	(Att. x1)
3.	Water	(Att. x1)
4.	Methanol	(Att. x1)
5.	Acetaldehyde	(Att. x1)
6.	Ethanol	(Att. x8)



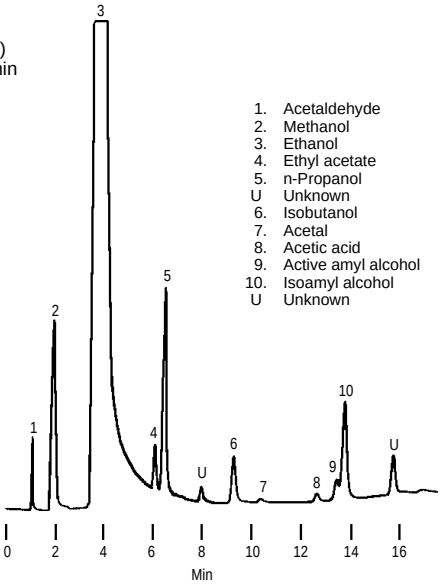
For more information, request Bulletin 790.
Chromatogram provided courtesy of Hayes Separations, Inc.

795-0160

Figure 18. Cherry Brandy

Packing: **80/100 Carbopack B AW/5% Carbowax 20M**
Cat. No.: **11812-U** (packing)
Column: 2m x 2mm ID glass
(stock column available)
Oven: 70°C to 170°C at 5°C/min
Carrier: helium, 20mL/min
Det.: FID
Inj.: 0.5µL cherry brandy

1.	Acetaldehyde
2.	Methanol
3.	Ethanol
4.	Ethyl acetate
5.	n-Propanol
U	Unknown
6.	Isobutanol
7.	Acetal
8.	Acetic acid
9.	Active amyl alcohol
10.	Isoamyl alcohol
U	Unknown



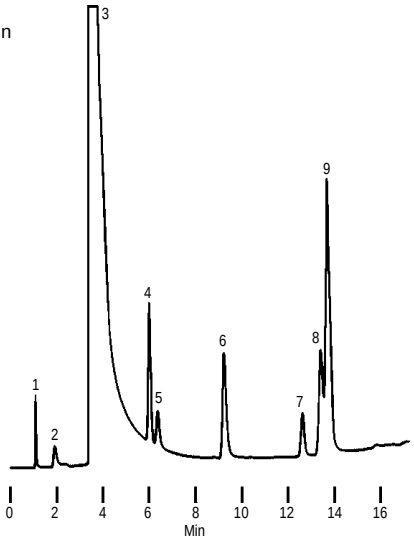
For more information, request Bulletin 790.

795-0083

Figure 19. Bourbon

Packing: **80/120 Carbopack B AW/5% Carbowax 20M**
Cat. No.: **11812-U** (packing)
Column: 2m x 2mm ID glass
(stock column available)
Oven: 70°C to 170°C at 5°C/min
Carrier: helium, 20mL/min
Det.: FID
Inj.: 0.5µL bourbon whiskey

1. Acetaldehyde
2. Methanol
3. Ethanol
4. Ethyl acetate
5. n-Propanol
6. Isobutanol
7. Acetic acid
8. Active amyl alcohol
9. Isoamyl alcohol



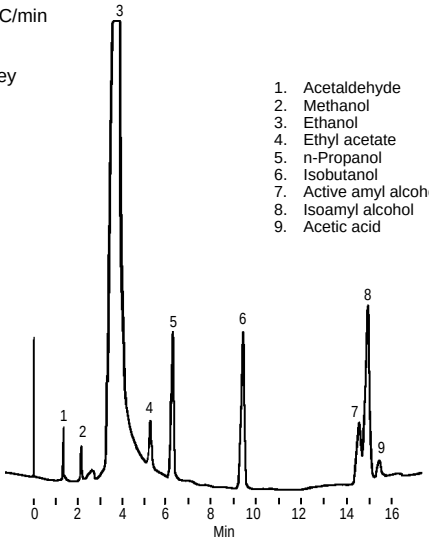
For more information, request Bulletin 790.

795-0084

Figure 20. Scotch Whiskey

Packing: **80/120 Carbopack B/6.6% Carbowax 20M**
Cat. No.: **11814** (packing)
Column: 2m x 2mm ID glass
Oven: 80°C to 150°C at 4°C/min
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.5µL Scotch whiskey

1. Acetaldehyde
2. Methanol
3. Ethanol
4. Ethyl acetate
5. n-Propanol
6. Isobutanol
7. Active amyl alcohol
8. Isoamyl alcohol
9. Acetic acid



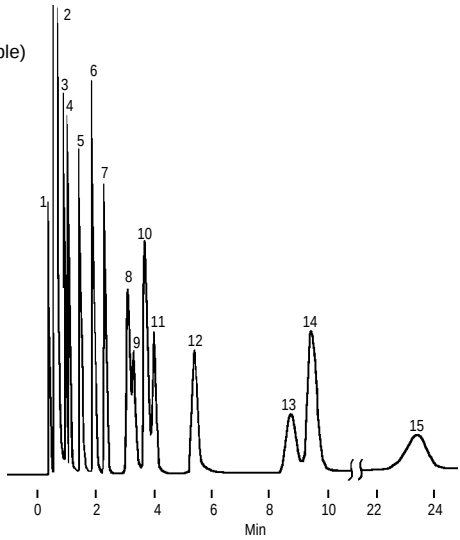
For more information, request Bulletin 790.

795-0085

Figure 21. Denaturants in Alcohol

Packing: **GP 80/100 Carbopack C/0.1% SP-1000**
Cat. No.: **11820** (packing)
Column: 6' x 2mm ID glass (stock column available)
Oven: 80°C
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 70% ethanol & 2% of each denaturant

1. Methanol
2. Ethanol
3. Acetone
4. Isopropanol
5. n-Propanol
6. tert-Butanol
7. Chloroform, methyl ester
8. Methyl Cellosolve®
9. sec-Butanol
10. Isobutanol
11. Ethyl acetate
12. n-Butanol
13. Ethyl Cellosolve
14. Benzene
15. Methyl isobutyl ketone



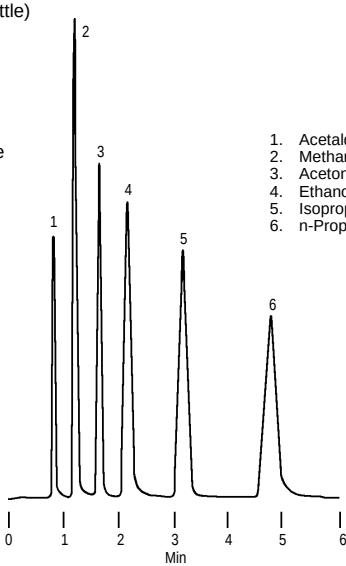
For more information, request Bulletin 790.

795-0161

Figure 22. Blood Alcohols

Packing: **60/80 Carbopack B/5% Carbowax 20M**
Cat. No.: **11766** ((packing, 15g/bottle)
Column: 6' x 2mm ID glass (stock column available)
Oven: 85°C
Carrier: helium, 20mL/min
Det.: FID
Inj.: 1µL water, 0.05-0.10% each analyte

1. Acetaldehyde
2. Methanol
3. Acetone
4. Ethanol
5. Isopropanol
6. n-Propanol



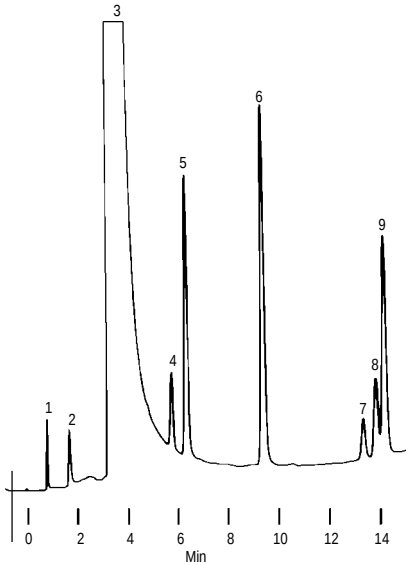
For more information, request Application Note 72.

713-0622

Figure 23. Alcohols (C1-C5) and Acetaldehyde

Packing: **80/120 Carbopack B AW/5% Carbowax 20M**
Cat. No.: **11812-U** (packing, 15g/bottle)
Column: 2m x 2mm ID glass (stock column available)
Oven: 70°C to 170°C at 5°C/min
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.5µL Scotch whiskey

1. Acetaldehyde
2. Methanol
3. Ethanol
4. Ethyl acetate
5. n-Propanol
6. Isobutanol
7. Acetic acid
8. Active amyl alcohol
9. Isoamyl alcohol



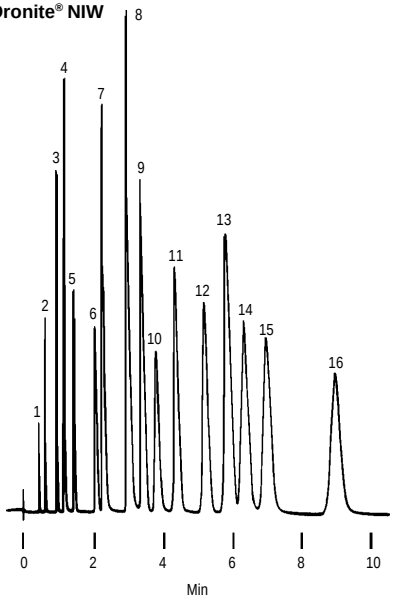
Use this packing in glass columns only.
For more information, request Bulletin 790.

713-0710

Figure 24. Isomeric Alcohols (C1-C5)

Packing: **80/100 Carbopack C/0.2% Oronite® NIW**
Column: 2m x 2mm ID glass
Oven: 125°C
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.1µL

1. Methanol
2. Ethanol
3. 2-Propanol
4. 1-Propanol
5. 2-Methyl-2-propanol (tert-butyl)
6. 2-Butanol (sec-butyl)
7. 2-Methyl-1-propanol (isobutyl)
8. 1-Butanol
9. 2-Methyl-2-butanol (tert-amyl)
10. 2,2-Dimethyl-1-propanol
11. 3-Methyl-2-butanol
12. 3-Pentanol
13. 2-Pentanol
14. 2-Methyl-1-butanol (active)
15. 3-Methyl-1-butanol
16. 1-Pentanol



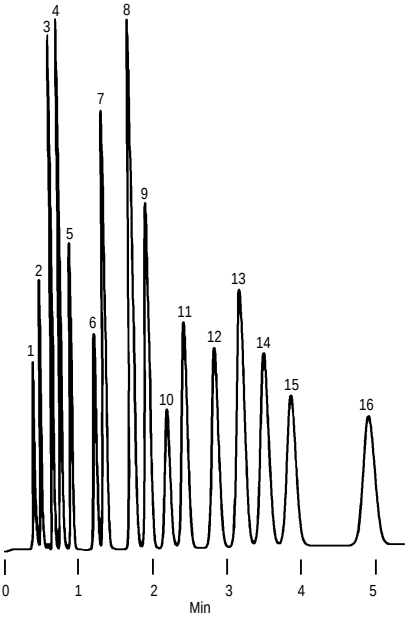
For more information, request Bulletin 790.

795-0162

Figure 25. Isomeric Alcohols (C1-C5)

Packing: **80/100 Carbopack F-SL**
Column: 2m x 2mm ID glass
Oven: 120°C
Carrier: nitrogen, 15mL/min
Det.: FID
Inj.: 0.1µL

1. Methanol
2. Ethanol
3. 2-Propanol
4. 1-Propanol
5. 2-Methyl-2-propanol (tert-butyl)
6. 2-Butanol (sec-butyl)
7. 2-Methyl-1-propanol (isobutyl)
8. 1-Butanol
9. 2-Methyl-2-butanol (tert-amyl)
10. 2,2-Dimethyl-1-propanol
11. 3-Methyl-2-butanol
12. 3-Pentanol
13. 2-Pentanol
14. 2-Methyl-1-butanol (active)
15. 3-Methyl-1-butanol
16. 1-Pentanol



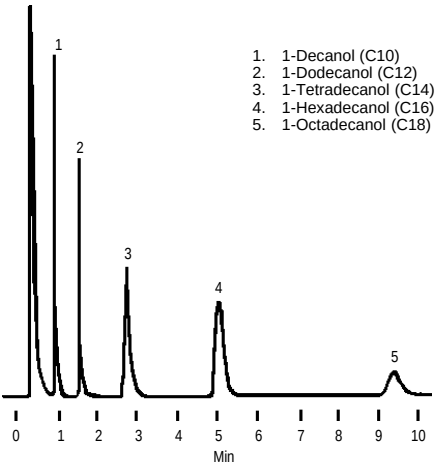
For more information, request Bulletin 790.

713-1069

Figure 26. Alcohols (C10-C18)

Packing: **10% SP-2100 on 80/100 SUPELCOPORT**
Cat. No.: **12140** (packing)
Column: 6' x 1/8" ID stainless steel
(stock column available)
Oven: 225°C
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.5µL, 0.1% each
in chloroform

1. 1-Decanol (C10)
2. 1-Dodecanol (C12)
3. 1-Tetradecanol (C14)
4. 1-Hexadecanol (C16)
5. 1-Octadecanol (C18)

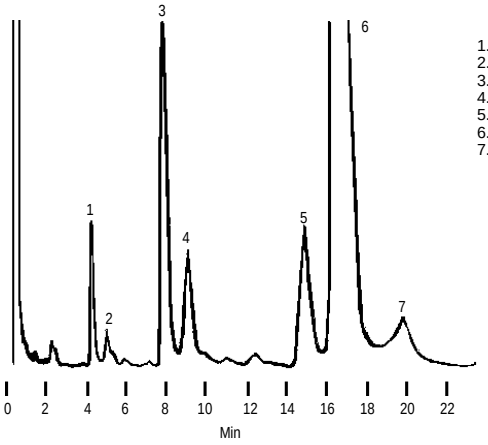


For more information, request Bulletin 790.

795-0163

Figure 27. Alcohols (C14:0-C18:0, C18:1, & C18:2)

Packing: **10% SP-2300 on 80/100 SUPELCOPORT**
Cat. No.: **12091** (packing)
Column: 6' x 1/8" ID stainless steel
Oven: 200°C
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 1µL, 1% total sample in chloroform

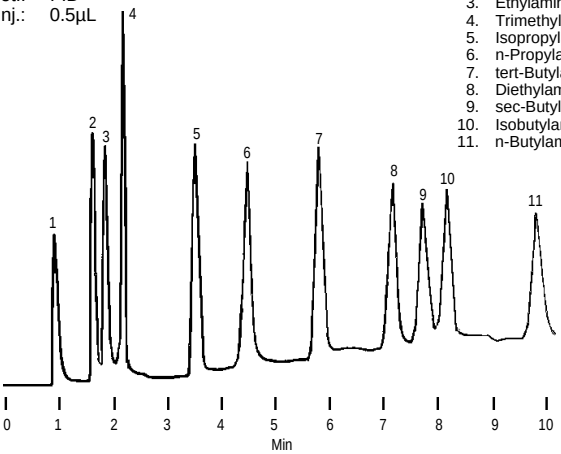


1. C14:0
2. C14:1
3. C16:0
4. C16:1
5. C18:0
6. C18:1
7. C18:2

795-0164

Figure 28. Aliphatic Amines in Water (100ppm)

Packing: **Carbopack B/4% Carbowax 20M/0.8% KOH**
Cat. No.: **11887** (packing)
Column: 6' x 2mm ID glass
(stock column available)
Oven: 90°C to 150°C at 4°C/min
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.5µL



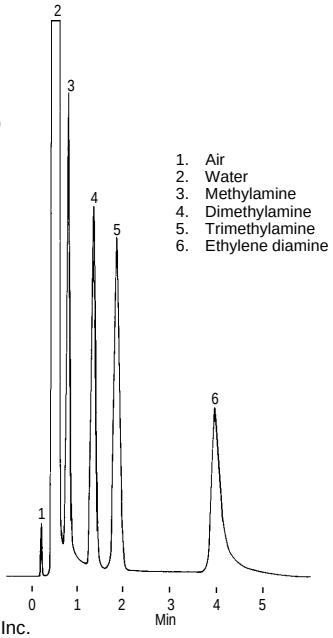
1. Methylamine
2. Dimethylamine
3. Ethylamine
4. Trimethylamine
5. Isopropylamine
6. n-Propylamine
7. tert-Butylamine
8. Diethylamine
9. sec-Butylamine
10. Isobutylamine
11. n-Butylamine

For more information, request Bulletin 737.

795-0165

Figure 29. Amines

Packing: **80/100 HayeSep B**
Cat. No.: **10286** (packing,75cc/bottle)
Column: 5' x 1/8" ID stainless steel
Oven: 140°C to 190°C at 16°C/min
Carrier: helium, 30cc/min
Det.: thermal conductivity (175ma, 180°C)
Inj.: 0.2µL, on-column injection, 150°C

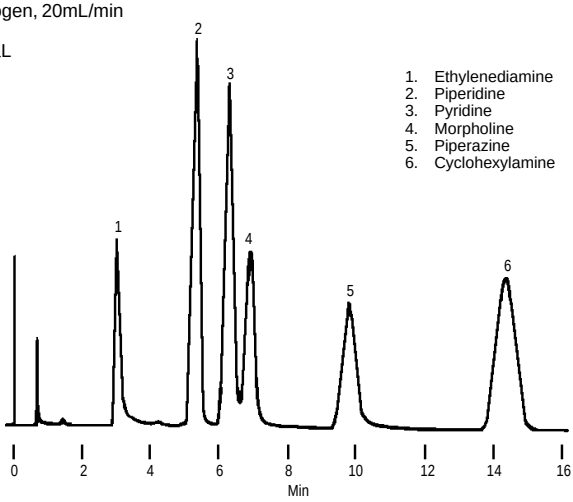


For more information, request Bulletin 737.
Chromatogram provided courtesy of Hayes Separations, Inc.

713-0717

Figure 30. Heterocyclic Amines in Water (1000ppm)

Packing: **Carbopack B/4% Carbowax 20M/0.8% KOH**
Cat. No.: **11887** (packing)
Column: 6' x 2mm ID glass
(stock column available)
Oven: 140°C
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.4µL



For more information, request Bulletin 737.

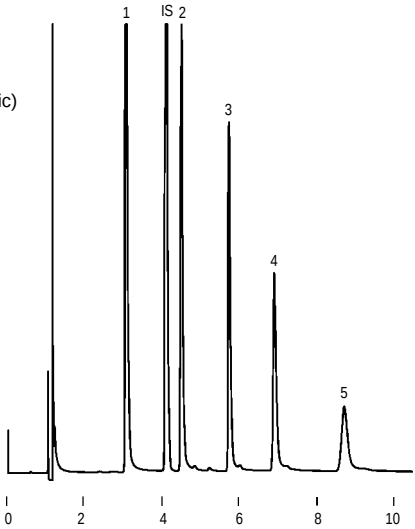
795-0166

Figure 31. Amines

Packing: **60/80 Carbopack B/4% Carbowax 20M/0.8% KOH**
Cat. No.: **11887** (packing, 15g/bottle)
Column: 2m x 2mm ID glass
(stock column available)
Oven: 100°C (2 min) to 220°C
at 16°C/min
Carrier: helium, 30mL/min
Det.: thermionic (nitrogen-specific)

11ng Each Amine

1. Butylamine
IS Triethylamine (int. std.)
2. n-Amylamine
3. n-Hexylamine
4. n-Heptylamine
5. n-Octylamine



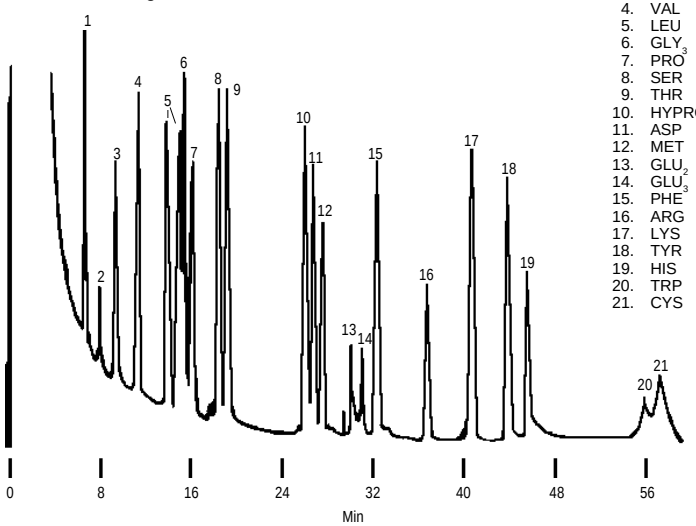
For more information, request Bulletin 737.

713-0715

Figure 32. TMS Amino Acids

Packing: **10% OV-11 on 100/120 SUPELCOPORT**
Cat. No.: **11961** (packing)
Column: 6' x 2mm ID glass
Oven: 100°C (5 min) to 230°C at 3°C/min
Carrier: nitrogen, 30mL/min

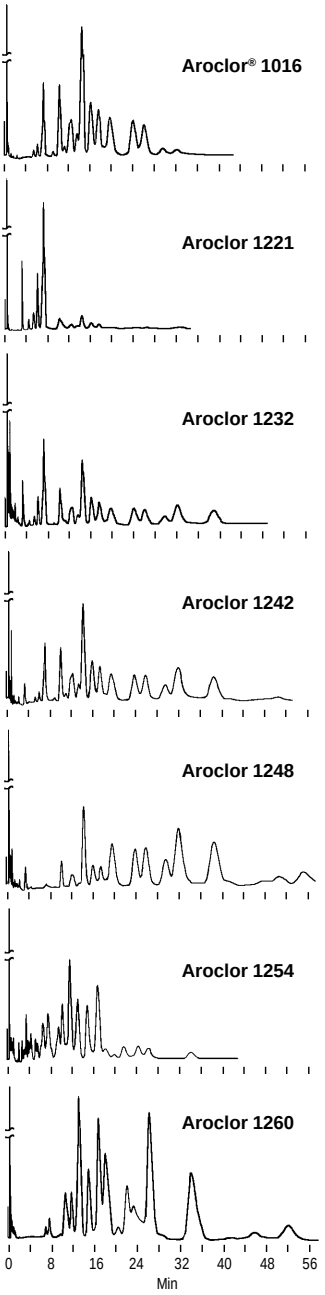
1. ALA
2. GLY_2
3. IMP
4. VAL
5. LEU
6. GLY_3
7. PRO
8. SER
9. THR
10. HYPRO
11. ASP
12. MET
13. GLU_2
14. GLU_3
15. PHE
16. ARG
17. LYS
18. TYR
19. HIS
20. TRP
21. CYS



795-0167

Figure 33. Aroclors

Packing:	**1.5% SP-2250/1.95% SP-2401 on 100/120 SUPELCOPORT**
Cat. No.:	**11947** (packing)
Column:	2m x 1/4" OD x 4mm ID TightSpec glass (stock column available)
Oven:	160°C (Aroclor 1016, 1221, 1232, 1242, 1248) 200°C (Aroclor 1254, 1260)
Carrier:	nitrogen, 60mL/min
Det.:	ECD
Inj.:	5ng each Aroclor in 5µL isooctane

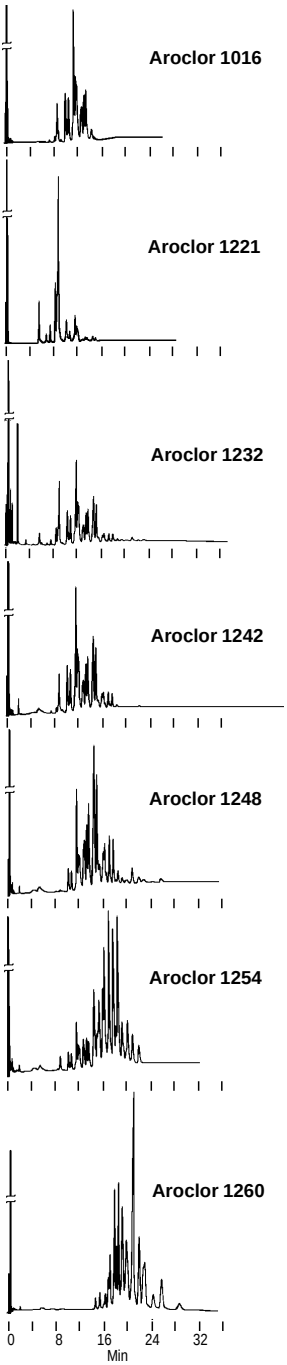


For more information, request Bulletin 817 and Application Note 67.

795-0170

Figure 34. Aroclors

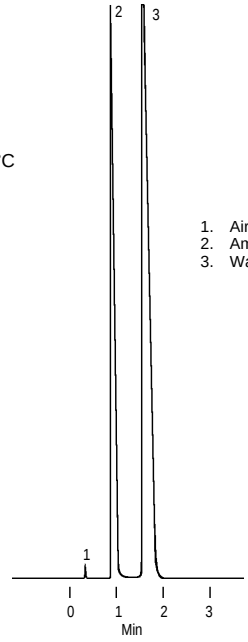
Packing:	**3% SP-2100 on 100/120 SUPELCOPORT**
Cat. No.:	**11738** (packing)
Column:	2m x 1/4" OD x 2mm ID TightSpec glass (stock column available)
Oven:	170°C (Aroclor 1016, 1242, 1248, 1254, 1260) 140°C (Aroclor 1221, 1232)
Carrier:	nitrogen, 40mL/min
Det.:	ECD
Inj.:	3ng each Aroclor in 3µL isooctane



For more information, request Bulletin 817 and Application Note 67.

Figure 35. Ammonia

Packing: **HayeSep P, 60/80 mesh**
Cat. No.: **10297** (packing)
Column: 8' x 1/8" ID stainless steel
Oven: 80°C
Carrier: helium, 30cc/min
Det.: T.C.(175ma), 200°C
Inj.: 0.1µL of NH_4OH, on-column, 150°C



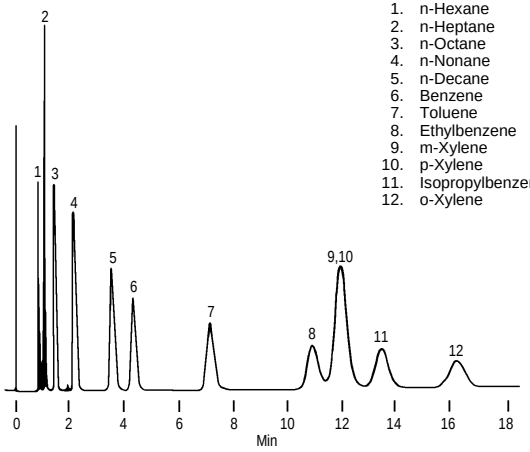
1. Air
2. Ammonia (35%)
3. Water (65%)

For more information, request Bulletin 786.

795-0168

Figure 36. Aromatics and Aliphatics

Packing: **10% TCEP on 100/120 Chromosorb P AW**
Cat. No.: **12106-U** (packing, 20g/bottle)
Column: 8' x 1/8" ID stainless steel
Oven: 80°C
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.2µL, approx. equal volumes each analyte



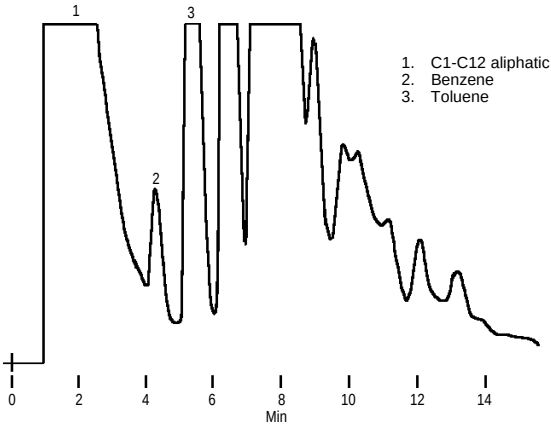
1. n-Hexane
2. n-Heptane
3. n-Octane
4. n-Nonane
5. n-Decane
6. Benzene
7. Toluene
8. Ethylbenzene
9. m-Xylene
10. p-Xylene
11. Isopropylbenzene
12. o-Xylene

For more information, request Bulletin 743.

713-0724

Figure 37. Aromatics in Gasoline

Packing: **35% BC-150 on 100/120 Chromosorb P AW**
Cat. No.: **11840-U** (packing)
Column: 10' x 1/8" ID stainless steel
Oven: 150°C (5 min) to 200°C at 16°C/min
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.5µL gasoline



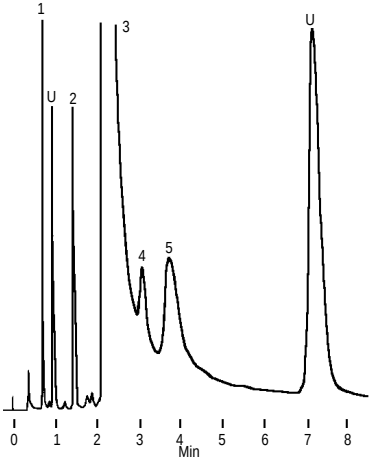
1. C1-C12 aliphatic hydrocarbons
2. Benzene
3. Toluene

For more information, request Bulletin 743.

795-0169

Figure 38. Aromatic Impurities in Ethylbenzene

Packing: **80/100 Carbopack C/0.1% SP-1000**
Cat. No.: **11820** (packing)
Column: 6' x 1/8" ID stainless steel
Cat. No.: **12495-U** (general configuration stock column; other stock columns available)
Oven: 225°C
Carrier: nitrogen, 20mL/min at 42psi



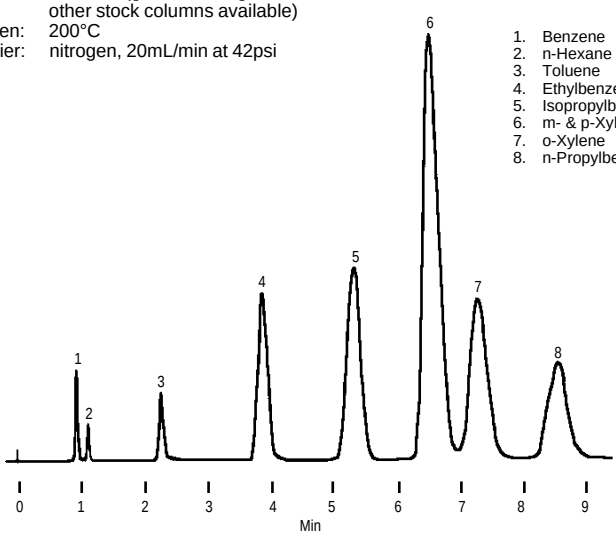
1. Benzene
U Unknown
2. Toluene
3. Ethylbenzene
4. Isopropylbenzene
5. Xylenes
U Unknown

For more information, request Bulletin 743.

711-0097

Figure 39. Aromatics

Packing: **80/100 Carbopack C/0.1% SP-1000**
Cat. No.: **11820** (packing)
Column: 6' x 1/8" ID stainless steel
Cat. No.: **12495-U** (general configuration stock column; other stock columns available)
Oven: 200°C
Carrier: nitrogen, 20mL/min at 42psi

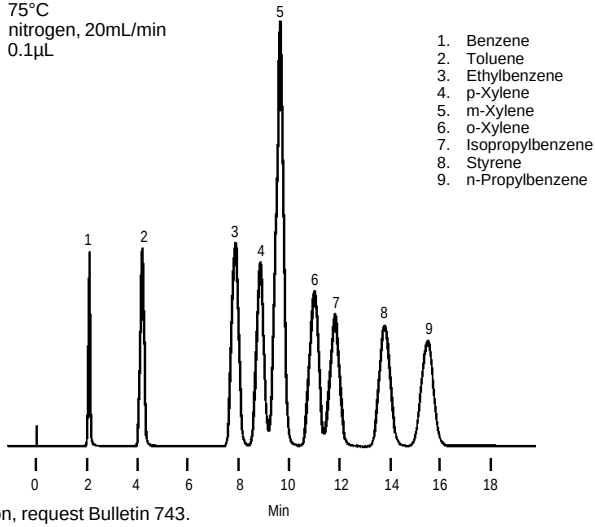


For more information, request Bulletin 743.

711-0096

Figure 40. Aromatics

Packing: **5.0% SP-1200/1.75% Bentone® 34 on 100/120 SUPELCOPORT**
Cat. No.: **12134** (packing)
Column: 6' x 1/8" ID stainless steel
Cat. No.: **12721** (general configuration stock column; other stock columns available)
Oven: 75°C
Carrier: nitrogen, 20mL/min
Inj.: 0.1µL



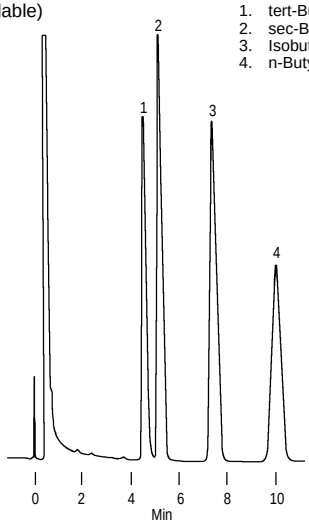
For more information, request Bulletin 743.

711-0094

Figure 41. Butylbenzenes

Packing: **80/100 Carbopack C/0.1% SP-1000**
Cat. No.: **11820** (packing, 15g/bottle)

Column: 6' x 1/8" ID stainless steel
Cat. No.: **12495-U** (general configuration stock column, other stock columns available)
Oven: 225°C
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 1µL chloroform (~0.1% each analyte)



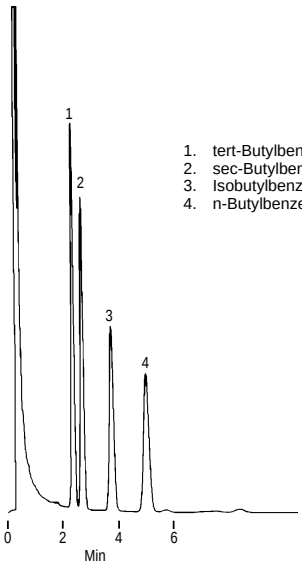
1. tert-Butylbenzene
2. sec-Butylbenzene
3. Isobutylbenzene
4. n-Butylbenzene

For more information, request Bulletin 743.

713-0721

Figure 42. Butylbenzenes

Packing: **60/80 Carbopack F-TA**
Cat. No.: packing available in packed columns only
Column: 2m x 2mm ID glass
Oven: 225°C
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.05µL methyl ethyl ketone (5% each analyte)



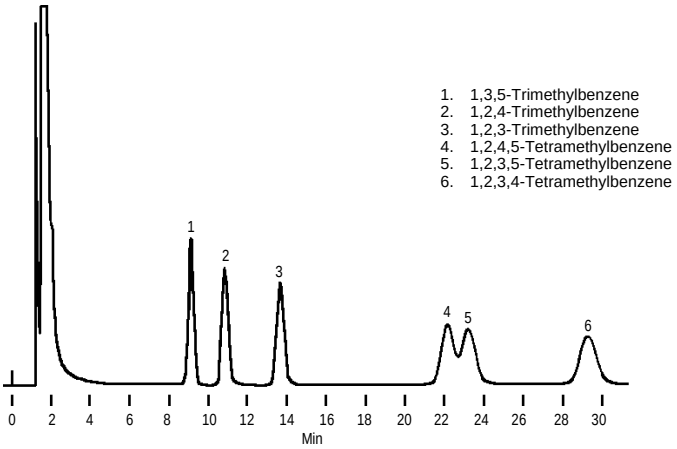
1. tert-Butylbenzene
2. sec-Butylbenzene
3. Isobutylbenzene
4. n-Butylbenzene

For more information, request Bulletin 743.

713-0720

Figure 43. Tri- and Tetramethylbenzenes

Packing: **10% SP-2250 on 100/120 SUPELCOPORT**
Cat. No.: **12132** (packing)
Column: 10' x 1/8" ID stainless steel
Oven: 110°C
Carrier: nitrogen, 20mL/min
Inj.: 0.6µL, solution 0.1% each component in $CHCl_3$

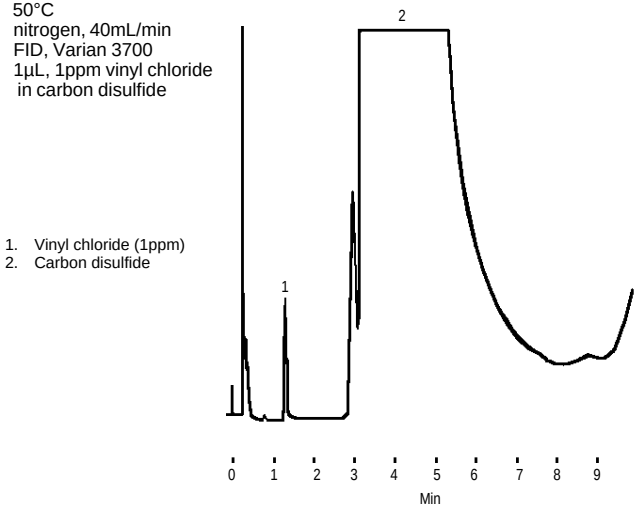


For more information, request Bulletin 743.

711-0100

Figure 44. Vinyl Chloride

Packing: **80/100 Carbopack C/0.19% picric acid**
Cat. No.: **11824** (packing)
Column: 6' x 1/8" ID stainless steel
Cat. No.: **13867** (general configuration stock column only)
Oven: 50°C
Carrier: nitrogen, 40mL/min
Det.: FID, Varian 3700
Inj.: 1µL, 1ppm vinyl chloride in carbon disulfide

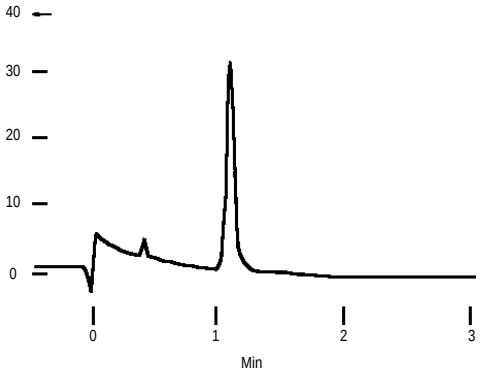


For more information, request Bulletin 846.

795-0172

Figure 45. Vinyl Chloride

Packing:	**60/80 Carbopack C/0.2% Carbowax 1500**
Cat. No.:	**11826** (packing)
Column:	6' x 1/8" ID stainless steel
Cat. No.:	**13860-U** (general configuration stock column; other stock columns available)
Oven:	room temperature
Carrier:	nitrogen, 20mL/min
Det.:	FID
Inj.:	1mL nitrogen containing 1ppm VC

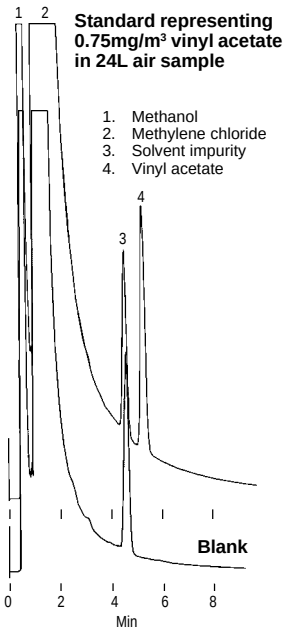


For more information, request Bulletins 846, and 866.

795-0173

Figure 46. Methylene Chloride and Vinyl Chloride by OSHA Method 51

Sample:	Carboxen™-564 spiked with vinyl acetate (18ng) and desorbed with methanol:methylene chloride (5:95)
Sampling Tube:	**ORBO™-92**
Cat. No.:	**20362**
Packing:	**80/100 Carbopack C/ 0.2% Carbowax 1500**
Cat. No.:	**11827** (packing, 15g/bottle)
Column:	6' x 2mm ID glass
Oven:	90°C
Carrier:	nitrogen, 20mL/min
Det.:	FID
Inj.:	1µL



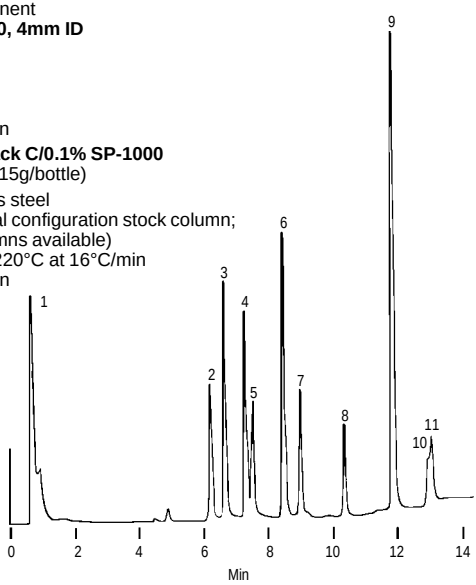
For more information, request Bulletins 846 and 861.

713-0694,0695

Figure 47. Chlorinated Volatile Hydrocarbons by US EPA Method TO-1

Sample:	2ng each component
Desorption Tube:	**Carbotrap™ 300, 4mm ID**
Cat. No.:	**20379**
Thermal Desorption:	330°C, 4 min
Transfer Line Temp.:	220°C
Carrier (desorption tube to column):	helium, 20mL/min
Packing:	**80/100 Carbopack C/0.1% SP-1000**
Cat. No.:	**11820** (packing, 15g/bottle)
Column:	6' x 1/8" stainless steel
Cat. No.:	**12495-U** (general configuration stock column; other stock columns available)
Oven:	35°C (2 min) to 220°C at 16°C/min
Carrier:	helium, 20mL/min
Det.:	FID

1. Methanol (carrier solvent)
2. Chloroform
3. 1,2-Dichloropropane
4. 1,1,1-Trichloroethane
5. Carbon tetrachloride
6. 1,2-Dichloroethane
7. Trichloroethylene
8. Bromoform
9. Tetrachloroethylene
10. Impurity
11. Chlorobenzene



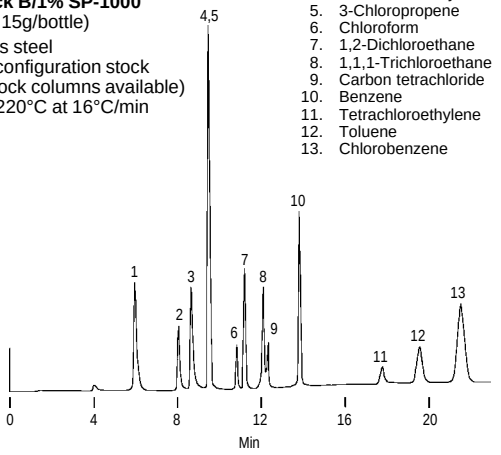
For more information, request Bulletins 846 and 861.

713-0702

Figure 48. Volatile Compounds by US EPA Methods TO-2 and TO-3

Sample:	1-5ng each component
Desorption Tube:	**Carbotrap 300, 4mm ID**
Cat. No.:	**20379**
Carrier:	helium, 20mL/min
Packing:	**60/80 Carbopack B/1% SP-1000**
Cat. No.:	**11815** (packing, 15g/bottle)
Column:	8' x 1/8" stainless steel
Cat. No.:	**12543** (general configuration stock column; other stock columns available)
Oven:	35°C (2 min) to 220°C at 16°C/min
Det.:	FID

1. Vinyl chloride
2. Dichloromethane
3. Acrylonitrile
4. 1,1-Dichloroethylene
5. 3-Chloropropene
6. Chloroform
7. 1,2-Dichloroethane
8. 1,1,1-Trichloroethane
9. Carbon tetrachloride
10. Benzene
11. Tetrachloroethylene
12. Toluene
13. Chlorobenzene



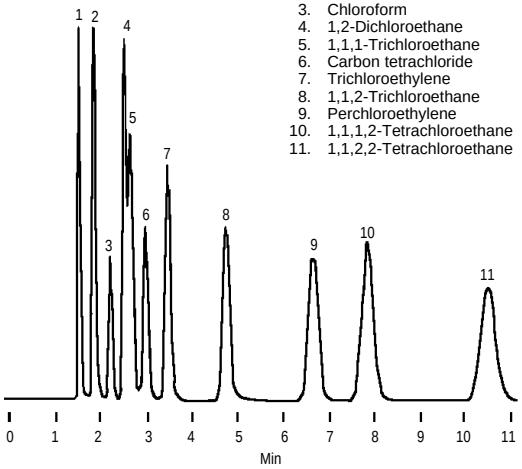
For more information, request Bulletins 846 and 861.

713-0709

Figure 49. Chlorinated Solvents

Packing: **20% SP-2100/0.1% Carbowax 1500 on 100/120 SUPELCOPORT**
Cat. No.: **11821** (packing)
Column: 10' x 1/8" ID stainless steel
Cat. No.: **12718-U** (general configuration stock column; other stock columns available)
Oven: 100°C
Carrier: nitrogen, 20mL/min
Det.: FID

1. Methylene chloride
2. 1,1-Dichloroethane
3. Chloroform
4. 1,2-Dichloroethane
5. 1,1,1-Trichloroethane
6. Carbon tetrachloride
7. Trichloroethylene
8. 1,1,2-Trichloroethane
9. Perchloroethylene
10. 1,1,1,2-Tetrachloroethane
11. 1,1,2,2-Tetrachloroethane



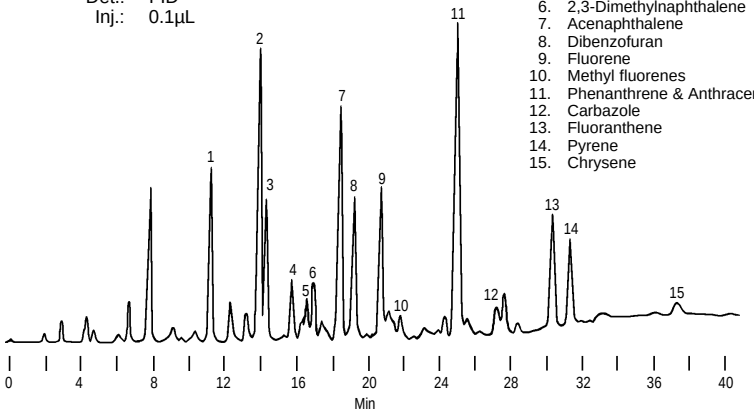
For more information, request Bulletin 824.

795-0174

Figure 50. Creosote

Packing: **10% SP-2100 on 100/120 SUPELCOPORT**
Cat. No.: **11989** (packing)
Column: 10' x 1/8" ID stainless steel
Cat. No.: **12717** (general configuration stock column; other stock columns available)
Oven: 100°C to 300°C at 6°C/min
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.1µL

1. Naphthalene
2. 2-Methylnaphthalene
3. 1-Methylnaphthalene
4. Biphenyl
5. 2,6-Dimethylnaphthalene
6. 2,3-Dimethylnaphthalene
7. Acenaphthalene
8. Dibenzofuran
9. Fluorene
10. Methyl fluorenes
11. Phenanthrene & Anthracene
12. Carbazole
13. Fluoranthene
14. Pyrene
15. Chrysene



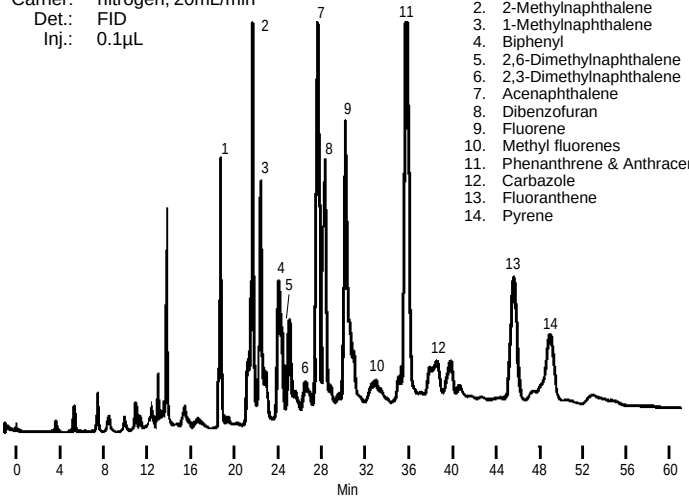
For more information, request Bulletin 743 and Application Note 108.

713-0749

Figure 51. Creosote

Packing: **10% SP-2250 on 100/120 SUPELCOPORT**
Cat. No.: **12132** (packing)
Column: 10' x 1/8" ID stainless steel
Oven: 100°C to 300°C at 6°C/min
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.1µL

1. Naphthalene
2. 2-Methylnaphthalene
3. 1-Methylnaphthalene
4. Biphenyl
5. 2,6-Dimethylnaphthalene
6. 2,3-Dimethylnaphthalene
7. Acenaphthalene
8. Dibenzofuran
9. Fluorene
10. Methyl fluorenes
11. Phenanthrene & Anthracene
12. Carbazole
13. Fluoranthene
14. Pyrene



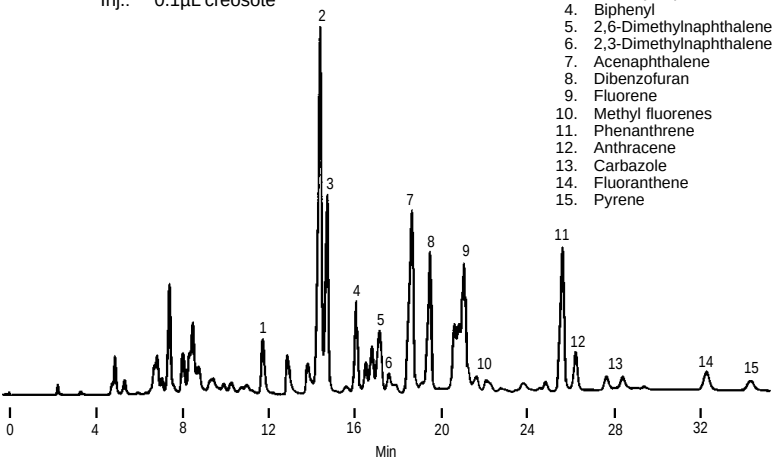
For more information, request Bulletin 743 and Application Note 108.

711-0099

Figure 52. Creosote with Liquid Crystal Phase

Packing: **1.5% SP-2100/1% BMBT on 100/120 SUPELCOPORT**
Cat. No.: **custom**
Column: 10' x 1/8" ID stainless steel
Oven: 85°C to 225°C at 6°C/min
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.1µL creosote

1. Naphthalene
2. 2-Methylnaphthalene
3. 1-Methylnaphthalene
4. Biphenyl
5. 2,6-Dimethylnaphthalene
6. 2,3-Dimethylnaphthalene
7. Acenaphthalene
8. Dibenzofuran
9. Fluorene
10. Methyl fluorenes
11. Phenanthrene
12. Anthracene
13. Carbazole
14. Fluoranthene
15. Pyrene

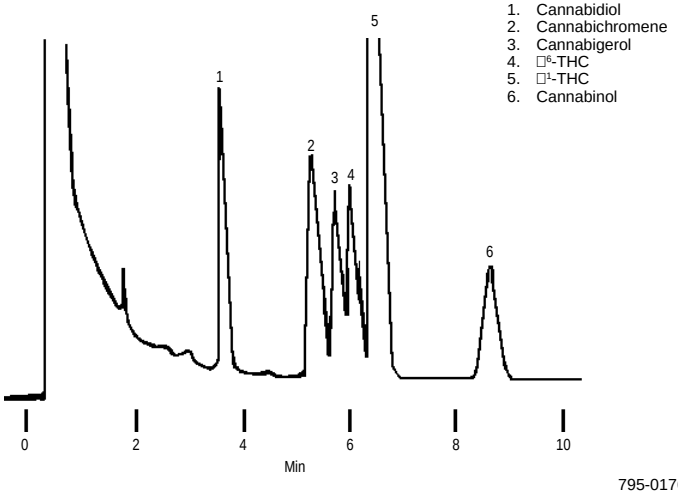


For more information, request Bulletin 743.

795-0175

Figure 53. Cannibinoids as TMS Derivatives

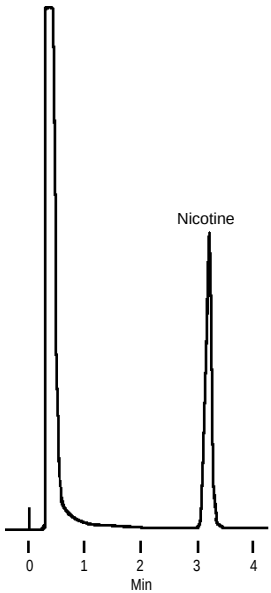
Packing: **3% SP-2250 on 100/120 SUPELCOPORT**
Cat. No.: **11875** (packing)
Column: 6' x 2mm ID glass
Oven: 235°C
Carrier: nitrogen, 20mL/min
Det.: FID, 275°C



795-0176

Figure 54. Nicotine

Packing: **10% Carbowax 20M/2% KOH on 80/100 Chromosorb W AW**
Cat. No.: **11805** (packing)
Column: 6' x 2mm ID
Oven: 200°C
Carrier: 20mL/min
Inj.: 1µL



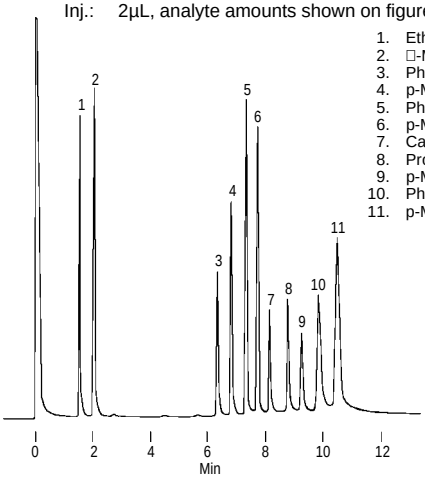
For more information, request Bulletin 737.

795-0177

Figure 55. Anticonvulsant Drugs, Underivatized

Packing: **2% SP-2110/1% SP-2510-DA on 100/120 SUPELCOPORT**
Cat. No.: **11768** (packing, 20g/bottle)
Column: 3' x 2mm ID glass
Oven: 120°C to 250°C at 16°C/min, hold 4 min
Carrier: helium, 50mL/min
Det.: FID
Inj.: 2µL, analyte amounts shown on figure

1. Ethosuximide, 1.0µg
2. □-Methyl,□-propyl succinimide (int. std.), 1.0µg
3. Phenylethylmalonamide (PEMA), 0.2µg
4. p-Methyl PEMA (int. std.), 0.2µg
5. Phenobarbital, 0.5µg
6. p-Methyl phenobarbital (int. std.), 0.5µg
7. Carbamazepine, 0.2µg
8. Promidone, 0.2µg
9. p-Methyl primidone (int. std.), 0.2µg
10. Phenytoin, 0.3µg
11. p-Methyl phenytoin (int. std.), 0.5µg

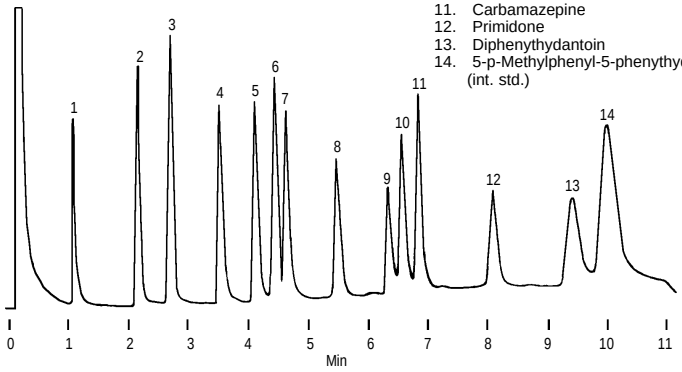


713-0625

Figure 56. Anticonvulsant Drugs, Underivatized

Packing: **2% SP-2510-DA on 100/120 SUPELCOPORT**
Cat. No.: **11776** (packing, 20g/bottle)
Column: 3' x 2mm ID glass
Oven: 150°C to 265°C at 16°C/min, hold 4 min
Carrier: nitrogen, 50mL/min
Det.: FID
Inj.: 2µL

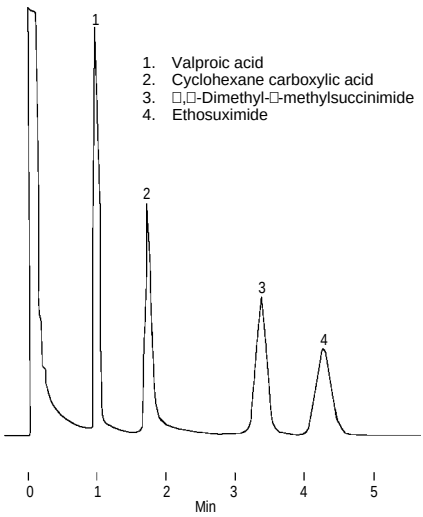
1. Ethosuximide
2. Methsuximide
3. Phensuximide
4. Barbital (int. std.)
5. N-Desmethyl methsuximide
6. Mephenytoin
7. N-Desmethyl phensuximide
8. Phenylethylmalonamide
9. 5-Methyl-5-phenythydantoin (int. std.)
10. Phenobarbital
11. Carbamazepine
12. Primidone
13. Diphenythydantoin
14. 5-p-Methylphenyl-5-phenythydantoin (int. std.)



713-0626

Figure 57. Anticonvulsant Drugs

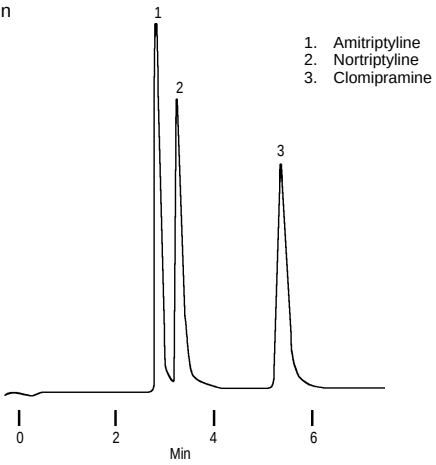
Packing: **10% SP-1000 on 80/100 SUPELCOPORT**
Cat. No.: **11872** (packing)
Column: 3' x 2mm ID glass
Oven: 190°C
Carrier: helium, 40mL/min
Det.: FID, 250°C
Inj.: 0.25µg/mL each drug



713-0675

Figure 58. Psychotropic Drugs, Antidepressants, Underivatized

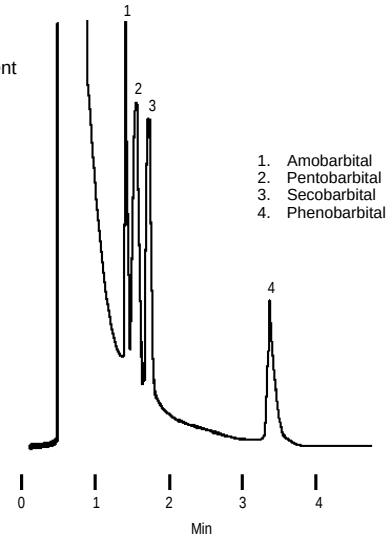
Packing: **3% SP-2250 on 80/100 SUPELCOPORT**
Cat. No.: **11767** (packing, 20g/bottle)
Column: 6' x 2mm ID glass
Oven: 250°C
Carrier: helium, 40mL/min
Det.: NPD
Inj.: 5µL methanol, 10ng each drug



713-0676

Figure 59. Barbiturates

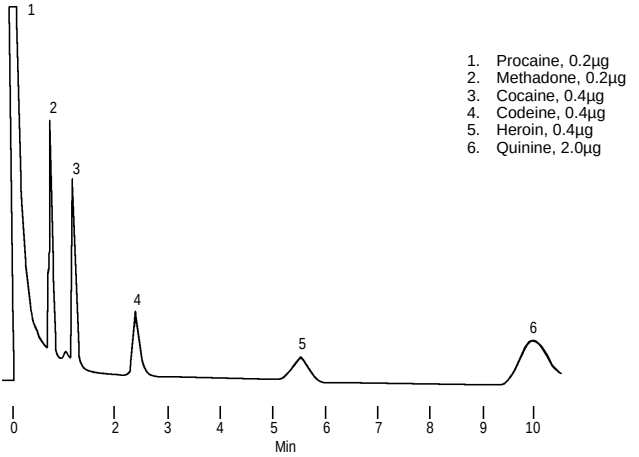
Packing: **3% SP-2250 DA on 100/120 SUPELCOPORT**
Cat. No.: **11981** (packing)
Column: 6' x 2mm ID glass
Oven: 230°C
Carrier: nitrogen, 20mL/min
Inj.: 1µL, 0.1µg/µL each component



795-0178

Figure 60. Alkaloids

Packing: **3% SP-2250 DB on 100/120 SUPELCOPORT**
Cat. No.: **11983** (packing, 20g/bottle)
Column: 3' x 2mm ID glass
Oven: 230°C
Carrier: nitrogen, 40mL/min
Det.: FID
Inj.: 1µL methanol, analyte quantities shown on figure

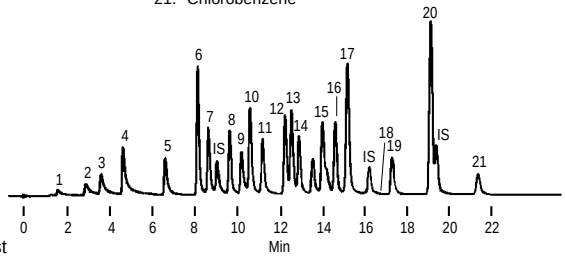


713-0664

Figure 61. US EPA Method 601, Purgeable Halocarbons

Packing: **60/80 Carbopack B/1% SP-1000**
Cat. No.: **11815** (packing)
Column: 8' x 1/8" OD stainless steel
Cat. No.: **12543** (general configuration stock column; other stock columns available)
Oven: 45°C (3 min) to 220°C at 8°C/min, 15 min hold
Carrier: nitrogen, 40mL/min
Det.: Hall®, 85°C
Inj.: 1µL of a synthetic mixture of volatile pollutants in dodecane, 200-500ng/µL each component, 200°C

1. Chloromethane
2. Bromomethane
3. Vinyl chloride & Dichlorofluoromethane
4. Chloroethane
5. Methylene chloride
6. Trichlorofluoromethane
7. 1,1-Dichloroethylene
IS Bromochloromethane (int. std.)
8. 1,1-Dichloroethane
9. trans-1,2-Dichloroethylene
10. Chloroform
11. 1,2-Dichloroethane
12. 1,1,1-Trichloroethane
13. Carbon tetrachloride
14. Bromodichloromethane
15. 1,2-Dichloropropane & trans-1,3-Dichloropropene
16. Trichloroethylene
17. cis-1,3-Dichloropropene, 1,1,2-Trichloroethane, & Chlorodibromomethane
IS 1-Chloro-2-bromopropane (int. std.)
18. 2-Chloroethyl vinyl ether
19. Bromoform
20. 1,1,2,2-Tetrachloroethylene & 1,1,2,2-Tetrachloroethane
IS 1,4-Dichlorobutane (int. std.)
21. Chlorobenzene



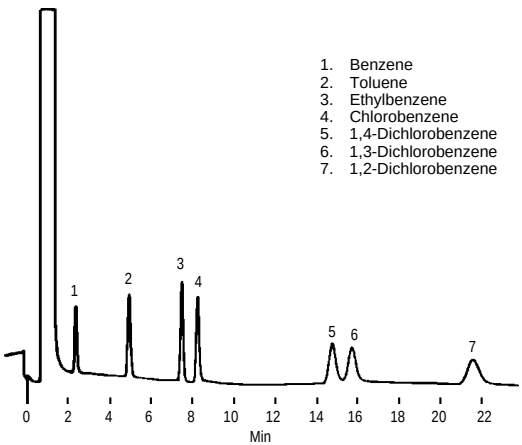
For more information, request Bulletins 775 and 865.

795-0179

Figure 62. US EPA Method 602, Purgeable Aromatics

Packing: **5% SP-1200/1.75% Bentone 34 on 100/120 SUPELCOPORT**
Cat. No.: **12134** (packing)
Column: 6' x 1/8" ID stainless steel
Cat. No.: **12721** (general configuration stock column; other stock columns available)
Oven: 50°C (2 min) to 90°C at 6°C/min and hold
Carrier: helium, 36mL/min
Det.: FID
Inj.: 1µL of 0.2mg/mL standard of each purgeable aromatic in methanol

1. Benzene
2. Toluene
3. Ethylbenzene
4. Chlorobenzene
5. 1,4-Dichlorobenzene
6. 1,3-Dichlorobenzene
7. 1,2-Dichlorobenzene

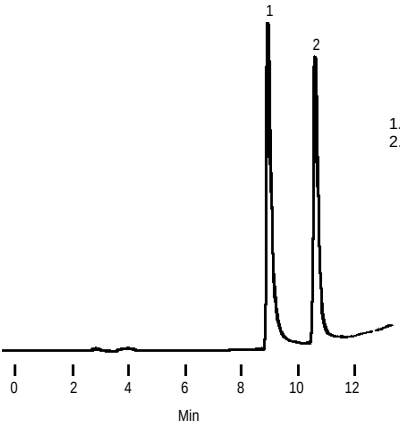


For more information, request Bulletins 775 and 865.

795-0180

Figure 63. US EPA Method 603, Acrolein and Acrylonitrile

Packing: **80/100 Chromosorb 101**
Cat. No.: **20214** (packing)
Column: 6' x 1/8" OD stainless steel
Cat. No.: **12712** (general configuration stock column; other stock columns available)
Oven: 100°C (5 min) to 140°C at 10°C/min and hold
Carrier: helium, 45mL/min
Det.: FID
Inj.: 2µL synthetic standard in water



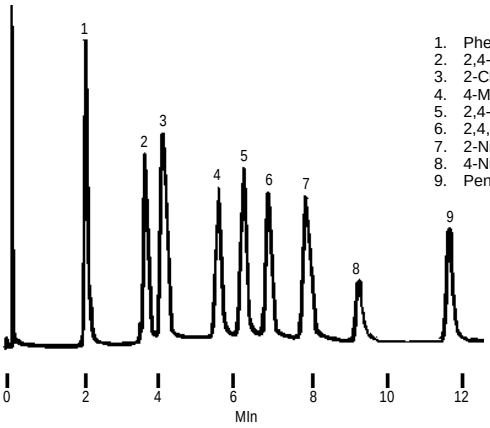
1. Acrolein, 3mg/mL
2. Acrylonitrile, 1mg/mL

For more information, request Bulletins 775 and 865.

795-0181

Figure 64. US EPA Method 604, Derivatives of Phenols

Packing: **5% SP-2250 on 80/100 SUPELCOPORT**
Cat. No.: **11737** (packing)
Column: 1.8m x 2mm ID glass
Oven: 160°C (2 min) to 240°C at 8°C/min
Carrier: nitrogen, 30mL/min
Det.: EC
Inj.: 0.1µL with 0.2µg/mL of each component in methanol



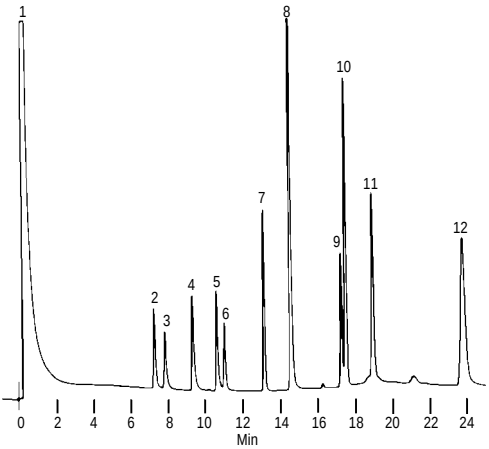
1. Phenol
2. 2,4-Dimethylphenol
3. 2-Chlorophenol
4. 4-Methyl-3-chlorophenol
5. 2,4-Dichlorophenol
6. 2,4,6-Trichlorophenol
7. 2-Nitrophenol
8. 4-Nitrophenol
9. Pentachlorophenol

For more information, request Bulletins 775 and 865.

795-0182

Figure 65. US EPA Method 604, Phenols

Packing: **1% SP-1240-DA on 100/120 SUPELCOPORT**
Cat. No.: **11832** (packing, 20g/bottle)
Column: 2m x 2mm ID glass
Oven: 70°C (2 min) to 200°C at 8°C/min and hold
Carrier: helium, 30mL/min
Det.: FID, 250°C
Inj.: 0.5µL EPA Phenols Mix (Cat. No. 48859)



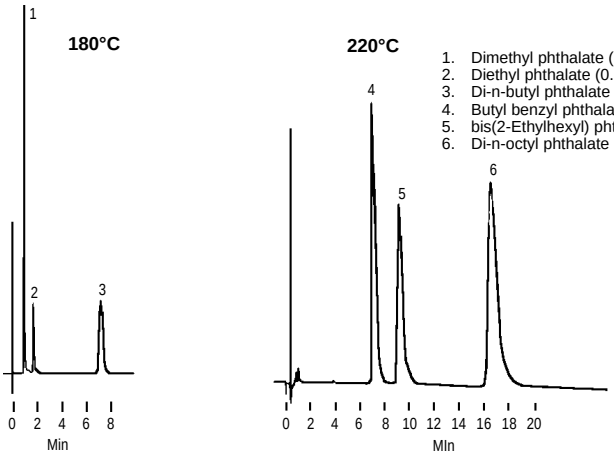
1. Methanol
2. o-Chlorophenol (0.25µg)
3. 2-Nitrophenol (0.25µg)
4. Phenol (0.25µg)
5. 2,4-Dimethylphenol (0.25µg)
6. 2,4-Dichlorophenol (0.25µg)
7. 2,4,6-Trichlorophenol (0.75µg)
8. 4-Chloro-m-cresol (1.25µg)
9. 2,4-Dinitrophenol (0.75µg)
10. 4,6-Dinitro-p-cresol (1.25µg)
11. Pentachlorophenol (1.25µg)
12. Nitrophenol (1.25µg)

For more information, request Bulletins 775 and 865.

713-1032

Figure 66. US EPA Method 606, Phthalates

Packing: **1.5% SP-2250/1.95% SP-2401 on 100/120 SUPELCOPORT**
Cat. No.: **11947** (packing)
Column: 2m x 4mm ID glass (stock column available)
Oven: 180°C and 220°C
Carrier: nitrogen, 60mL/min
Det.: ECD, 250°C
Inj.: 1µL of phthalate mixture at concentrations indicated



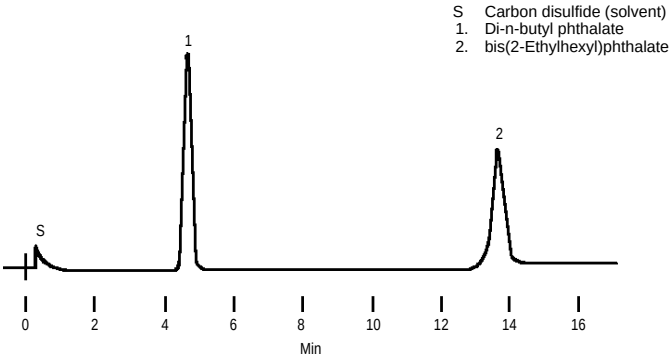
1. Dimethyl phthalate (1.0ppm)
2. Diethyl phthalate (0.2ppm)
3. Di-n-butyl phthalate (1.0ppm)
4. Butyl benzyl phthalate (1.0ppm)
5. bis(2-Ethylhexyl) phthalate (0.4ppm)
6. Di-n-octyl phthalate (1.0ppm)

For more information, request Bulletins 775 and 865.

795-0183

Figure 67. Phthalates

Packing: **5% SP-2100 on 100/120 SUPELCOPORT**
Cat. No.: **11782-U** (packing)
Column: 6' x 1/8" stainless steel
Oven: 200°C (10 min) to 250°C at 4°C/min
Carrier: nitrogen, 25mL/min
Det.: FID
Inj.: 1µL of 75ng/µL each component in carbon disulfide

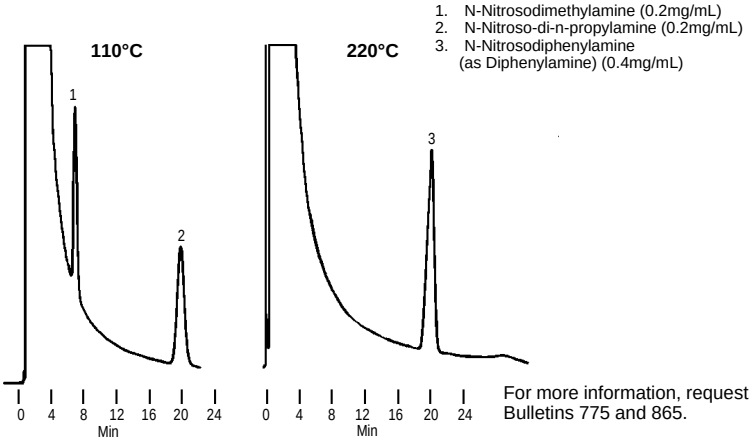


For more information, request Bulletins 775 and 865.

795-0184

Figure 68. US EPA Method 607, Nitrosamines

Packing: **10% Carbowax 20M/2% KOH on 80/100 Chromosorb W AW**
Cat. No.: **11739** (packing)
Column: 2m x 4mm ID glass
Oven: 110°C and 220°C
Carrier: helium, 40mL/min
Det.: FID
Inj.: 2µL of 0.2mg/mL standard in methanol at concentrations indicated

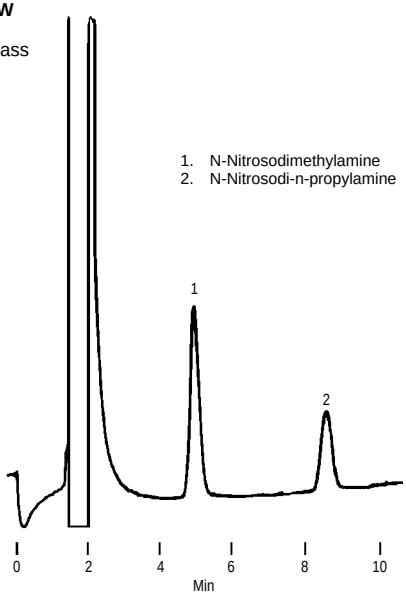


For more information, request Bulletins 775 and 865.

795-0185

Figure 69. N-Nitrosamines

Packing: **10% Carbowax 20M/2% KOH on 80/100 Chromosorb W AW**
Cat. No.: **11739** (packing)
Column: 2m x 4mm ID TightSpec glass
Oven: 150°C
Carrier: helium, 40mL/min
Det.: Hewlett-Packard NPD
Inj.: 1ng each componetnt in 2µL methylene chloride

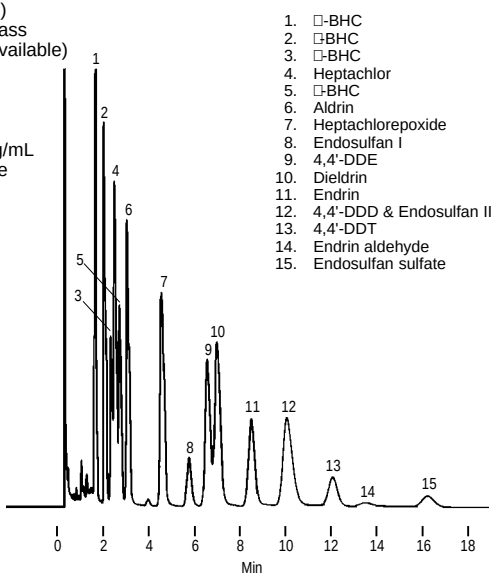


For more information, request Bulletin 775.

795-0186

Figure 70. US EPA Method 608, Pesticides

Packing: **1.5% SP-2250/1.95% SP-2401 on 100/120 SUPELCOPORT**
Cat. No.: **11947** (packing)
Column: 2m x 4mm ID glass (stock column available)
Oven: 200°C
Carrier: argon:methane (95:5), 6mL/min
Det.: EC Ni63
Inj.: 0.5µL of 0.02mg/mL of each pesticide



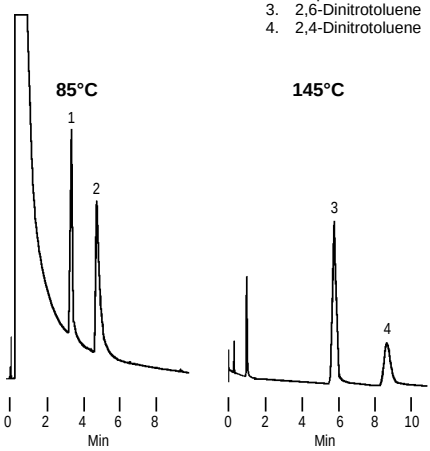
For more information, request Bulletin 775.

795-0187

Figure 71. US EPA Method 609, Nitroaromatics and Isophorone

Packing: **1.5% SP-2250/1.95% SP-2401 on 100/120 SUPELCOPORT**
Cat. No.: **11947** (packing)
Column: 2m x 4mm ID glass (stock column available)
Oven: 85°C and 145°C
Carrier: nitrogen, 44mL/min
Det.: FID for nitrobenzene & isophorone
EC for dinitrotoluenes
Inj.: 2µL of 0.2mg/mL standard on FID
0.5µL of 2ng/µL standard on EC

1. Nitrobenzene
2. Isophorone
3. 2,6-Dinitrotoluene
4. 2,4-Dinitrotoluene



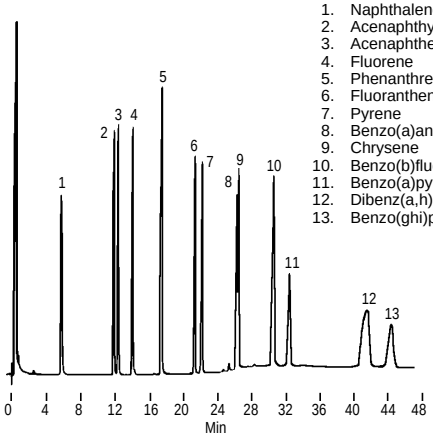
For more information, request Bulletin 775.

795-0188

Figure 72. US EPA Method 610, Polynuclear Aromatic Hydrocarbons

Packing: **3% SP-2250 on 100/120 SUPELCOPORT**
Cat. No.: **11744** (packing)
Column: 2m x 2mm ID glass
Oven: 100°C (4 min) to 280°C at 8°C/min and hold
Carrier: nitrogen, 40mL/min
Det.: FID
Inj.: 0.2µg each component in 1µL methanol/methylene chloride

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

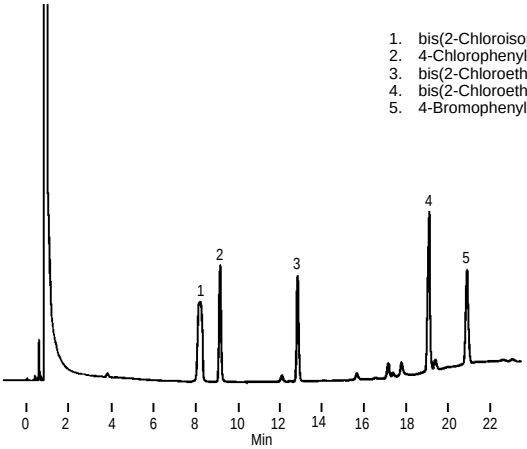


For more information, request Bulletin 775.

795-0189

Figure 73. US EPA Method 611, Haloethers

Packing: **3% SP-1000 on 100/120 SUPELCOPORT**
Cat. No.: **11746** (packing)
Column: 2m x 2mm ID glass
Oven: 60°C (2 min) to 230°C at 8°C/min and hold
Carrier: helium, 40mL/min
Det.: FID
Inj.: 1µL of 0.2mg/mL of each haloether in methanol



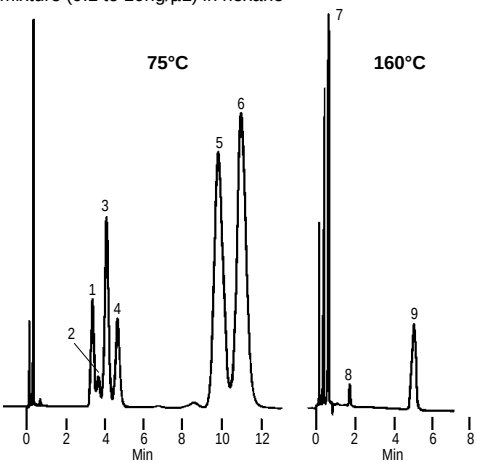
For more information, request Bulletins 775 and 865.

795-0190

Figure 74. US EPA Method 612, Chlorinated Hydrocarbons

Packing: **1.5% OV-1/1.5% OV-225 on 80/100 SUPELCOPORT**
Cat. No.: **custom** (packing)
Column: 2m x 2mm ID glass
Oven: 75°C and 160°C
Carrier: argon:methane (95:5), 30mL/min
Det.: EC
Inj.: 2µL of synthetic mixture (0.1 to 10ng/µL) in hexane

1. 1,3-Dichlorobenzene
2. 1,4-Dichlorobenzene
3. Hexachloroethane
4. 1,2-Dichlorobenzene
5. Hexachlorobutadiene
6. 1,2,4-Trichlorocyclopentadiene
7. Hexachlorocyclopentadiene
8. 2-Chloronaphthalene
9. Hexachlorobenzene



For more information, request Bulletins 775 and 865.

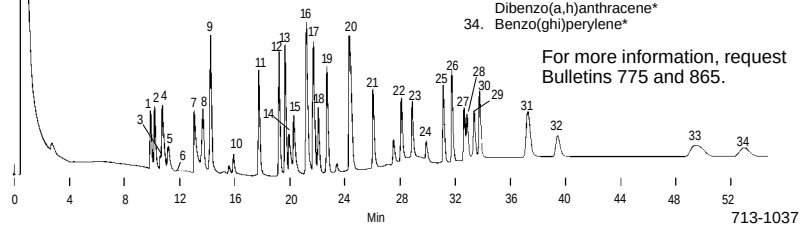
795-0191

Figure 75. US EPA Method 625, Base/Neutrals

Packing: **3% SP-2250 on 100/120 SUPELCOPORT**
Cat. No.: **11756** (packing)
Column: 2m x 2mm ID glass
Oven: 50°C (4 min) to 270°C at 8°C/min
Carrier: nitrogen, 30mL/min
Det.: FID, 300°C
Inj.: 1µL methylene chloride, 0.125µg or 0.063µg (*) each analyte

1. 1,3-Dichlorobenzene
2. 1,4-Dichlorobenzene-d_4
3. Bis(2-chloroethyl)ether
4. Hexachloroethane & 1,2-Dichlorobenzene
5. Bis(methyl-2-chloroethyl)ether
6. N-Nitroso-di-n-propylamine
7. Nitrobenzene & Hexachlorobutadiene
8. 1,2,4-Trichlorobenzene & Isophorone
9. Naphthalene & Bis(2-chloroethoxy)methane
10. Hexachlorocyclopentadiene
11. 2-Chloronaphthalene
12. Acenaphthylene
13. Acenaphthene
14. Dimethylphthalate
15. 2,6-Dinitrotoluene
16. Fluorene & 4-Chlorophenylphenyl ether
17. 2,4-Dinitrotoluene
18. Diethylphthalate & N-Nitrosodiphenylamine
19. 4-Bromophenylphenyl ether & Hexachlorobenzene
20. Phenanthrene & Anthracene
21. Di-n-butyl phthalate
22. Fluoranthene*
23. Pyrene*
24. Benzidine
25. Butyl benzyl phthalate
26. Bis(2-ethylhexyl)phthalate
27. Benzo(a)fluoranthene*
28. Chrysene*
29. 3,3'-Dichlorobenzidine
30. Di-n-octyl phthalate
31. Benzo(b)fluoranthene* & Benzo(k)fluoranthene*
32. Benzo(a)pyrene
33. Indeno(1,2,3-cd)pyrene* & Dibenzo(a,h)anthracene*
34. Benzo(ghi)perylene*

For more information, request Bulletins 775 and 865.



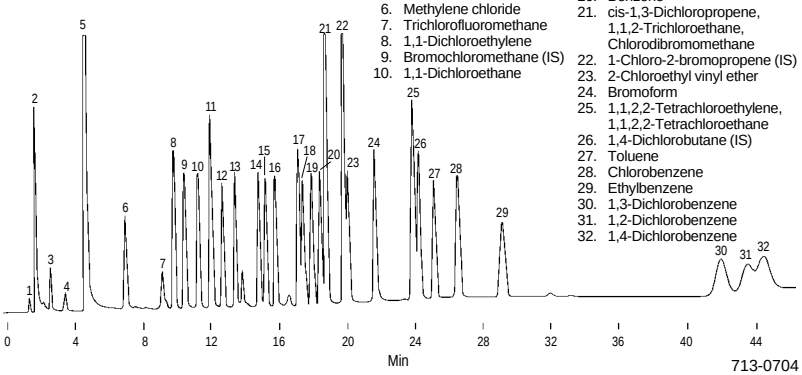
713-1037

Figure 76. US EPA Method 624, Volatiles

Packing: **60/80 Carbopack B/1% SP-1000**
Cat. No.: **11815** (packing, 15g/bottle)
Column: 8' x 1/8" stainless steel
Cat. No.: **12543** (general configuration stock column; other stock columns available)
Oven: 45°C (3 min) to 220°C at 8°C/min (hold 15 min)
Carrier: helium, 40mL/min
Det.: FID, 250°C
Inj.: 1µL of a synthetic mixture of volatile pollutants in dodecane, 200-500ng/µL each, 200°C

1. Chloromethane
2. Methanol
3. Bromomethane
4. Vinyl chloride, Dichlorofluoromethane
5. Chloroethane
6. Methylene chloride
7. Trichlorofluoromethane
8. 1,1-Dichloroethylene
9. Bromochloromethane (IS)
10. 1,1-Dichloroethane
11. trans-1,2-Dichloroethylene
12. Chloroform
13. 1,2-Dichloroethane
14. 1,1,1-Trichloroethane
15. Carbon tetrachloride
16. Bromodichloromethane
17. 1,2-Dichloropropane
18. trans-1,3-Dichloropropene
19. Trichloroethylene
20. Benzene
21. cis-1,3-Dichloropropene, 1,1,2-Trichloroethane, Chlorodibromomethane
22. 1-Chloro-2-bromopropene (IS)
23. 2-Chloroethyl vinyl ether
24. Bromoform
25. 1,1,2,2-Tetrachloroethylene, 1,1,2,2-Tetrachloroethane
26. 1,4-Dichlorobutane (IS)
27. Toluene
28. Chlorobenzene
29. Ethylbenzene
30. 1,3-Dichlorobenzene
31. 1,2-Dichlorobenzene
32. 1,4-Dichlorobenzene

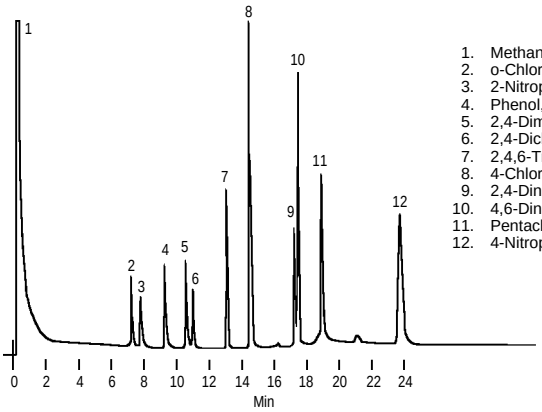
For more information, request Bulletins 775 and 865.



713-0704

Figure 77. US EPA Method 625, Phenols

Packing: **1% SP-1240-DA on 100/120 SUPELCOPORT**
Cat. No.: **11832** (packing)
Column: 2m x 2mm ID glass
Oven: 70°C (2 min) to 200°C at 8°C/min
Carrier: helium, 30mL/min
Det.: FID
Inj.: 0.5µL of a standard phenol mixture (Cat. No. 48859)



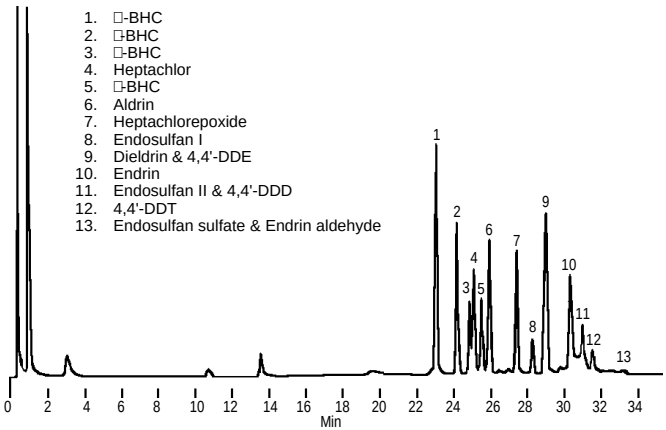
1. Methanol
2. o-Chlorophenol, 0.5mg/mL
3. 2-Nitrophenol, 0.5mg/mL
4. Phenol, 0.5mg/mL
5. 2,4-Dimethylphenol, 0.5mg/mL
6. 2,4-Dichlorophenol, 0.5mg/mL
7. 2,4,6-Trichlorophenol, 1.5mg/mL
8. 4-Chloro-m-cresol, 2.5mg/mL
9. 2,4-Dinitrophenol, 1.5mg/mL
10. 4,6-Dinitro-o-cresol, 2.5mg/mL
11. Pentachlorophenol, 2.5mg/mL
12. 4-Nitrophenol, 2.5mg/mL

For more information, request Bulletins 775 and 865.

795-0194

Figure 78. US EPA Method 625, Pesticides

Packing: **3% SP-2250 on 100/120 SUPELCOPORT**
Cat. No.: **11878** (packing)
Column: 2m x 2mm ID glass
Oven: 50°C (4 min) to 270°C at 8°C/min
Carrier: nitrogen, 30mL/min
Det.: FID
Inj.: 0.1µL of a synthetic mixture of pesticides (1ng/µL each)



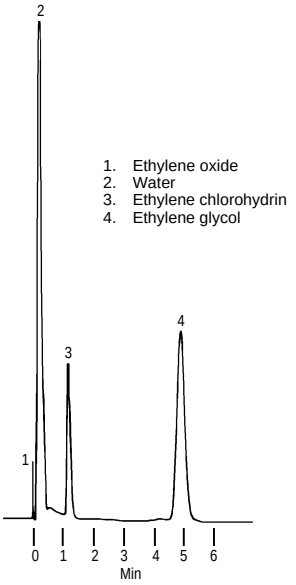
1. □-BHC
2. □-BHC
3. □-BHC
4. Heptachlor
5. □-BHC
6. Aldrin
7. Heptachlorepoxide
8. Endosulfan I
9. Dieldrin & 4,4'-DDE
10. Endrin
11. Endosulfan II & 4,4'-DDD
12. 4,4'-DDT
13. Endosulfan sulfate & Endrin aldehyde

For more information, request Bulletins 775 and 865.

795-0193

Figure 79. Ethylene Oxide and Ethylene Oxide Residues

Packing: **80/100 Carbopack C/0.8% THEED**
Cat. No.: **11880-U** (packing)
Column: 1m x 2mm ID glass
(stock column available)
Oven: 115°C
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 1µL water containing
50ppm each component



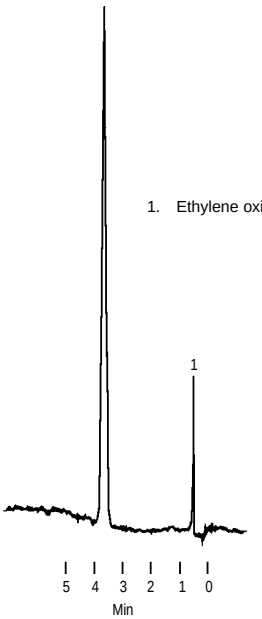
1. Ethylene oxide
2. Water
3. Ethylene chlorohydrin
4. Ethylene glycol

For more information, request Application Note 109.

713-0732

Figure 80. Trace Ethylene Oxide in Nitrogen

Packing: **HayeSep D**
Cat. No.: **10292** (packing)
Column: 10' x 1/8" stainless steel
Oven: 130°C
Carrier: helium, 30mL/min
Det.: FID, 140°C
Inj.: 250mL Valco valve, 100°C



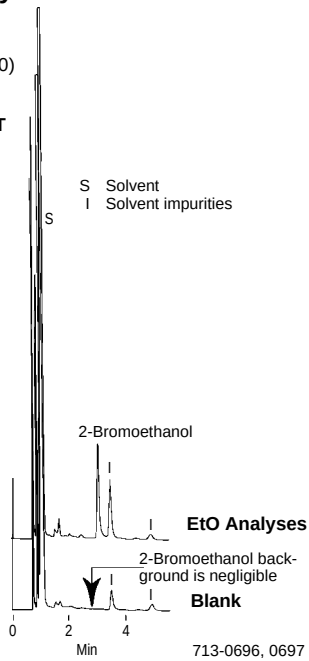
1. Ethylene oxide, 23ppm

For more information, request Application Note 109.

795-0195

Figure 81. Ethylene Oxide by US Army Method

Sample: HBr-coated Carboxen-564 spiked with 2-bromoethanol (1.2ng) and desorbed with toluene:acetonitrile (50:50)
Sampling Tube: **ORBO-78**
Cat. No.: **20355**
Packing: **10% DEGS on 80/100 SUPELCOPORT**
Cat. No.: **11999** (packing, 20g/bottle)
Column: 12' x 1/8" stainless steel
Oven: 155°C
Carrier: nitrogen, 30mL/min
Det.: ECD

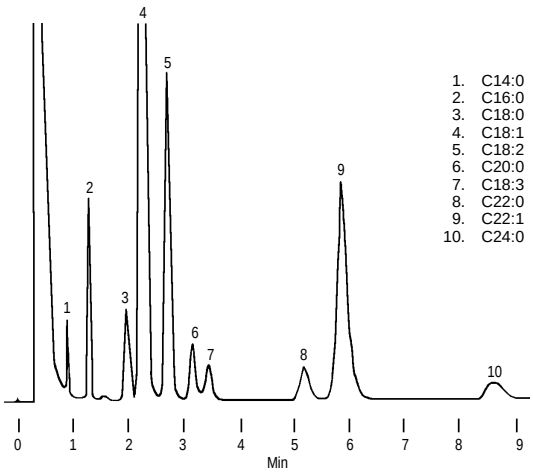


713-0696, 0697

For more information, request Application Note 109.

Figure 82. Fatty Acid Methyl Esters of Rapeseed Oil Mixture

Packing: **5% DEGS-PS on 100/120 SUPELCOPORT**
Cat. No.: **11870-U** (packing, 20g/bottle)
Column: 6' x 1/8" stainless steel
Oven: 200°C
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.5µL RM-3 Mix (Cat. No. O7256-1AMP), 10µg FAMEs/µL in chloroform

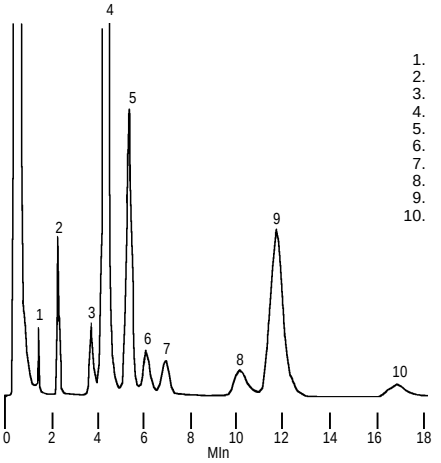


For more information, request Bulletin 856.

713-0973

Figure 83. Fatty Acid Methyl Esters of Rapeseed Oil Mixture

Packing: **GP 10% DEGS-PS on 80/100 SUPELCOPORT**
Cat. No.: **11999** (packing, 20g/bottle)
Column: 6' x 1/8" stainless steel
Oven: 200°C
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.5µL RM-3 Mix (Cat. No. O7256-1AMP), 10µg FAMEs/µL in chloroform

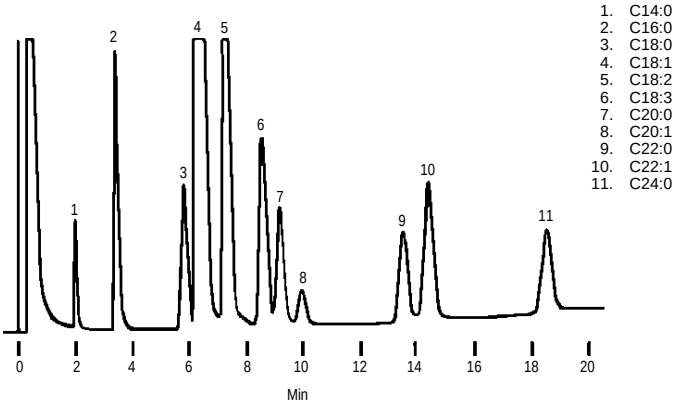


For more information, request Bulletin 856.

713-1072

Figure 84. C18:3, C20:0, and C20:1 Methyl Esters

Packing: **GP 3% SP-2310/2% SP-2300 on 100/120 Chromosorb W AW**
Cat. No.: **11833** (packing)
Column: 6' x 1/8" stainless steel
Oven: 190°C (2 min) to 220°C at 2°C/min
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 5µg mixed esters in 0.5µL methylene chloride

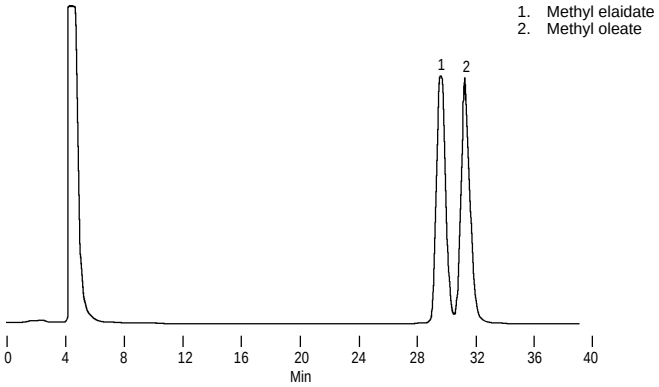


For more information, request Bulletin 856.

795-0260

Figure 85. Methyl Elaidate and Oleate FAMEs

Packing: **15% OV-275 on 100/120 Chromosorb P AW DMCS**
Cat. No.: **11844-U** (packing, 20g/bottle)
Column: 20' x 1/8" stainless steel
Oven: 220°C
Carrier: nitrogen, 10mL/min
Det.: FID
Inj.: 0.5µL isooctane containing 5µg each analyte

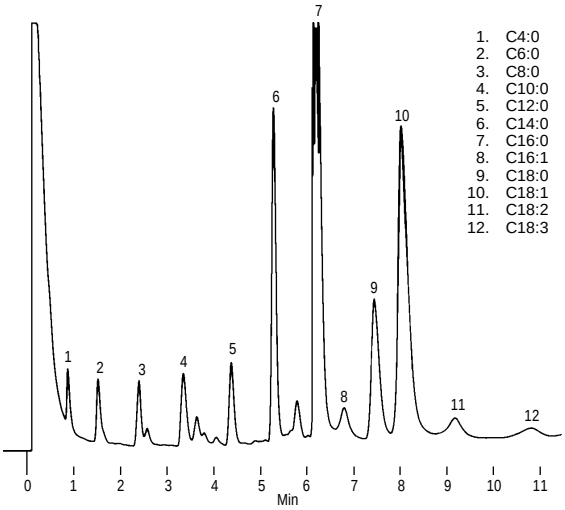


For more information, request Bulletin 856.

713-0974

Figure 86. Whole Milk Free Acids

Packing: **10% SP-216-PS on 100/120 SUPELCOPORT**
Cat. No.: **11879** (packing)
Column: 3' x 2mm ID glass
Oven: 130°C to 200°C at 15°C/min
Carrier: nitrogen, 20mL/min

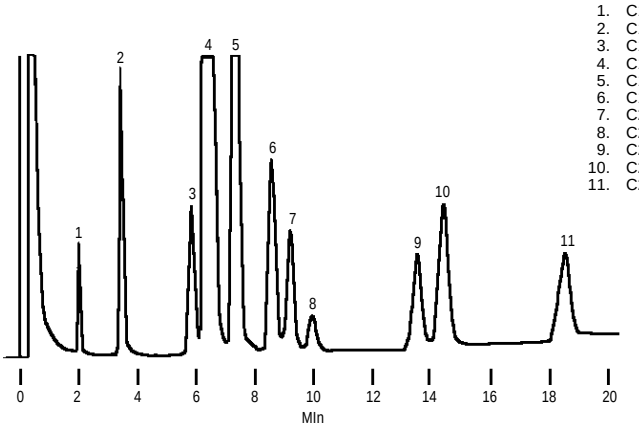


For more information, request Bulletin 856.

795-0197

Figure 87. C18:3, C20:0, and C20:1 Methyl Esters

Packing: **GP 3% SP-2310/2% SP-2300 on 100/120 Chromosorb W AW**
Cat. No.: **11833** (packing)
Column: 6' x 1/8" stainless steel
Oven: 190°C (2 min) to 220°C at 2°C/min
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 5µg mixed esters in 0.5µL methylene chloride

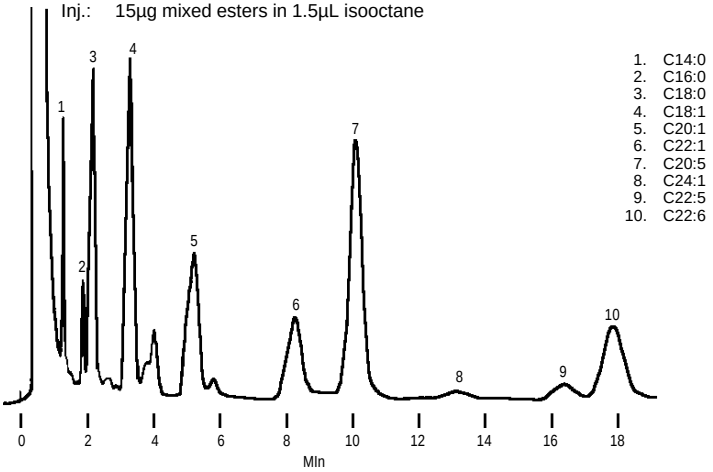


For more information, request Bulletin 856.

795-0198

Figure 88. Polyunsaturated FAMEs

Packing: **10% SP-2330 on 100/120 Chromosorb W AW**
Cat. No.: **11851** (packing)
Column: 6' x 1/8" stainless steel
Cat. No.: **13775** (general configuration stock column; other stock columns available)
Oven: 210°C
Inj.: 15µg mixed esters in 1.5µL isooctane

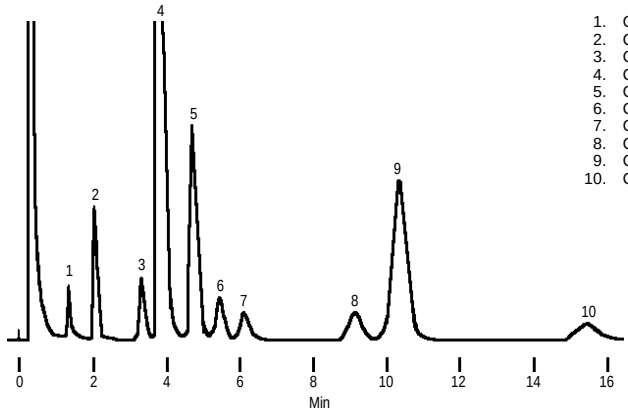


For more information, request Bulletin 856.

795-0199

Figure 89. Reference Standard: RM-3 Peanut Oil Type

Packing: **10% SP-2340 on 100/120 Chromosorb W AW**
Cat. No.: **11852** (packing)
Column: 2 meter x 2mm ID glass
Oven: 195°C
Carrier: nitrogen, 20mL/min
Inj.: 0.5µL, 10mg/cc isooctane

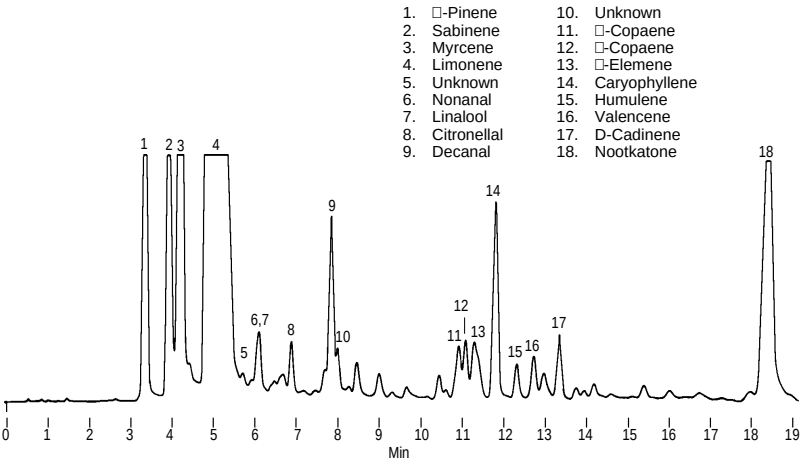


For more information, request Bulletin 856.

795-0200

Figure 90. Grapefruit Oil

Packing: **5% SP-2100/0.1% SP-401 on 100/120 SUPELCOPORT**
Cat. No.: **11839** (packing)
Column: 6' x 2mm ID glass
Oven: 75°C (2 min) to 175°C at 4°C/min
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.2µL

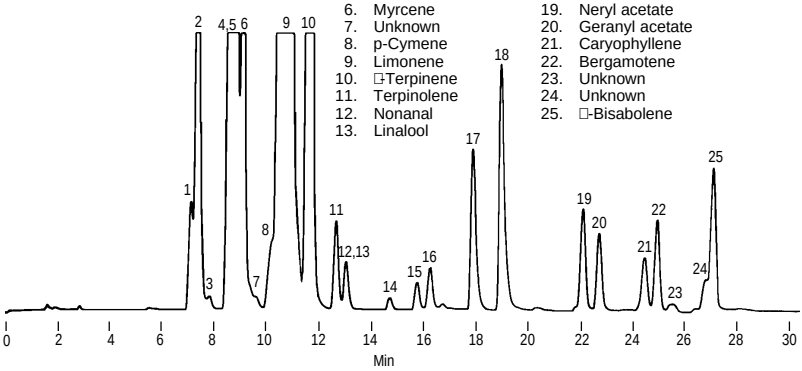


795-0201

Figure 91. Lemon Oil

Packing: **5% SP-2100/0.1% SP-401 on 100/120 SUPELCOPORT**
Cat. No.: **11839** (packing)
Column: 6' x 2mm ID glass
Oven: 75°C (2 min) to 175°C at 4°C/min
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.2µL

1. □-Thujene
2. □-Pinene
3. Camphene
4. Sabinene
5. □-Pinene
6. Myrcene
7. Unknown
8. p-Cymene
9. Limonene
10. □-Terpinene
11. Terpinolene
12. Nonanal
13. Linalool
14. Unknown
15. Terpinene-4-ol
16. □-Terpineol
17. Neral
18. Geranial
19. Neryl acetate
20. Geranyl acetate
21. Caryophyllene
22. Bergamotene
23. Unknown
24. Unknown
25. □-Bisabolene



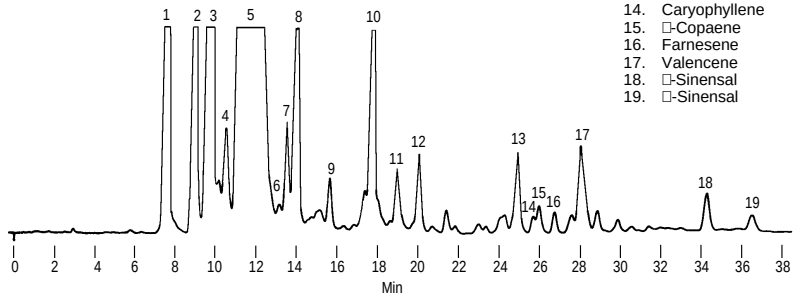
For more information, request Bulletin 856.

795-0203

Figure 92. Orange Oil

Packing: **5% SP-2100/0.1% SP-401 on 100/120 SUPELCOPORT**
Cat. No.: **11839** (packing)
Column: 6' x 2mm ID glass
Oven: 75°C (2 min) to 175°C at 4°C/min
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.2µL

1. □-Pinene
2. Sabinene
3. Myrcene/Octanal
4. Phellandrene
5. Limonene
6. Unknown
7. Nonanal
8. Linalool
9. Citronellal
10. Decanal
11. Neral
12. Geranial
13. Dodecanal
14. Caryophyllene
15. □-Copaene
16. Farnesene
17. Valencene
18. □-Sinensal
19. □-Sinensal

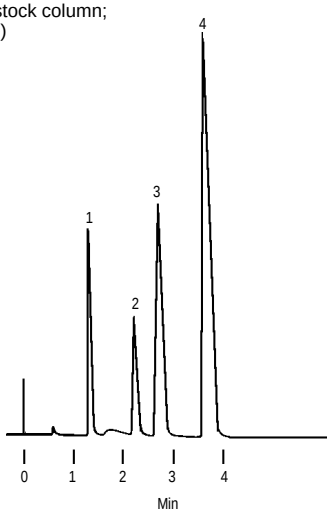


795-0202

Figure 93. Freon® and Chlorinated Hydrocarbons

Packing: **80/100 Carbopack B/1% SP-1000**
Cat. No.: **11815** (packing)
Column: 6' x 1/8" stainless steel
Cat . No.: **12485** (general configuration stock column; other stock columns available)
Oven: 70°C
Carrier: nitrogen, 20mL/min
Det.: FID

1. Methyl chloride
2. Methyl bromide
3. Vinyl chloride & Freon 12
4. Chloroethane



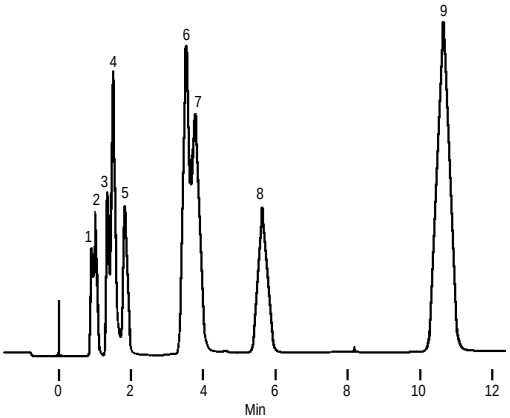
For more information, request Bulletin 786.

795-0204

Figure 94. Freon Gases

Packing: **60/80 Carbopack C/0.2% Carbowax 1500**
Cat. No.: **11826** (packing)
Column: 6' x 1/8" stainless steel
Cat . No.: **13860-U** (general configuration stock column; other stock columns available)
Oven: 65°C to 150°C at 8°C/min
Carrier: nitrogen, 20mL/min
Det.: FID

1. Freon 23
2. Freon 13
3. Freon 22
4. Freon 115
5. Freon 12
6. Freon 21
7. Freon 114
8. Freon 11
9. Freon 113

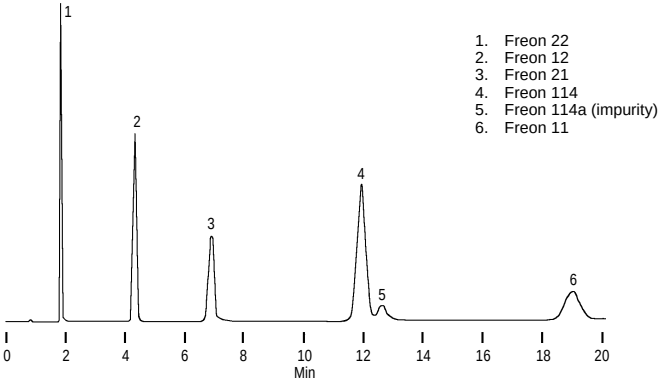


For more information, request Bulletin 786.

795-0205

Figure 95. Freon Gases

Packing: **60/80 Carbopack B/5% Fluorcol®**
Column: **10' x 1/8" SP alloy**
Cat. No.: **12425**
(general configuration stock column only)
Oven: 50°C
Carrier: nitrogen, 30mL/min
Det.: FID
Inj.: 10µL synthetic mixture (appr. 20% each compound)



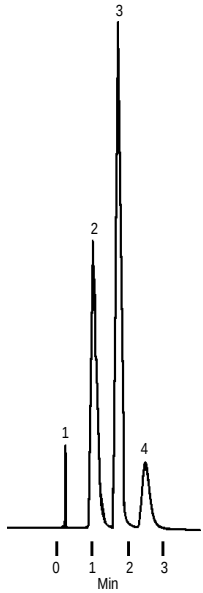
For more information, request Bulletin 786.
Figure provided by J.L. Glajch and W.G. Schindel, I.I. du Pont de Nemours and Co., Inc., Experimental Station, Wilmington, DE, USA.

713-0705

Figure 96. Formaldehyde

Packing: **100/120 HayeSep T**
Cat. No.: **10311** (packing, 75cc/bottle)
Column: 5' x 1/8" stainless steel
Oven: 132°C
Carrier: helium, 30cc/min
Det.: thermal conductivity (175mA)
Inj.: 0.2µL (165°C)

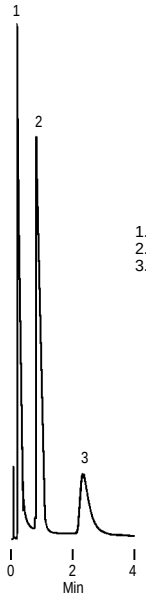
1. Air
2. Formaldehyde
3. Water
4. Methanol



713-0690

Figure 97. Formalin Solution

Packing: **45/60 Carboxen-1000**
Column: **2' x 1/8" stainless steel**
Cat. No.: **12370-U** (general configuration stock column; other stock columns available)
Oven: 150°C
Carrier: helium, 30mL/min
Det.: TCD
Inj.: 0.2µL formalin solution



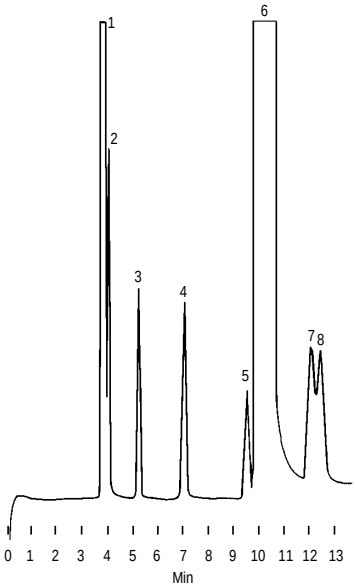
1. Water
2. Formaldehyde
3. Methanol

795-0206

Figure 98. Ethylene and Scott® Mix 216

Packing: **100/120 HayeSep DB**
Cat. No.: **custom**
Column: 30' x 1/8" stainless steel
Oven: 120°C
Carrier: helium, 30mL/min
Det.: P.E. 900 T.C., 300ma
Inj.: 250mL Valco valve, 120°C

1. Nitrogen
2. Carbon monoxide
3. Methane
4. Carbon dioxide
5. Acetylene (0.24ppm)
6. Ethylene
7. Water
8. Ethane

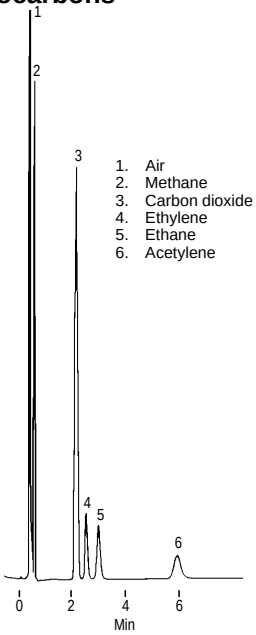


For more information, request Application Note 10.

795-0207

Figure 99. Carbon Dioxide and C2 Hydrocarbons

Packing: **HayeSep T**
Cat. No.: **10311** (packing)
Column: 5' x 1/8" stainless steel
Oven: 32°C
Carrier: helium, 30mL/min
Det.: 180°C
Inj.: 50mL



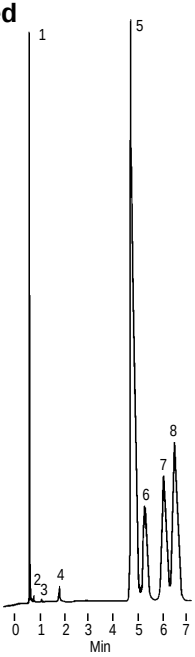
For more information, request Application Note 10.

795-0208

Figure 100. Mapp Gases, C1-C3 Unsaturated Hydrocarbons and CO_2

Packing: **HayeSep R**
Cat. No.: **10304** (packing)
Column: 10' x 1/8" stainless steel
Oven: 80°C
Carrier: helium, 30mL/min
Inj.: 15mL

1. Air
2. Methane
3. Carbon dioxide
4. Ethane
5. Propylene
6. Propane
7. Propadiene
8. Methyl acetylene



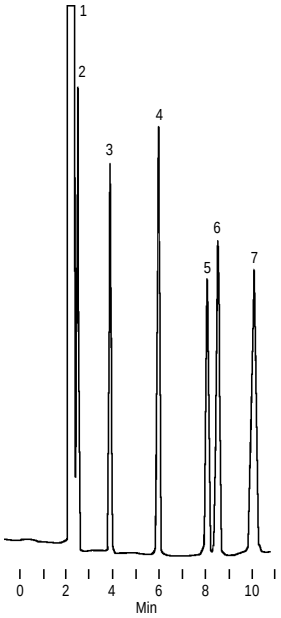
For more information, request Application Note 10.

795-0209

Figure 101. Scott Mix 216, C1-C2, CO, and CO_2

Packing: **HayeSep D**
Cat. No.: **10293** (packing)
Column: 20' x 1/8" Ni
Oven: 40°C (2 min) to 110°C at 24°C/min
Carrier: helium, 30mL/min
Det.: P.E. 900 T.C., 225ma, 140°C
Inj.: 100mL, Valco valve, ambient

1. Nitrogen (balance)
2. Carbon monoxide, 1%
3. Methane, 1%
4. Carbon dioxide, 1%
5. Acetylene, 1%
6. Ethylene, 1%
7. Ethane, 1%



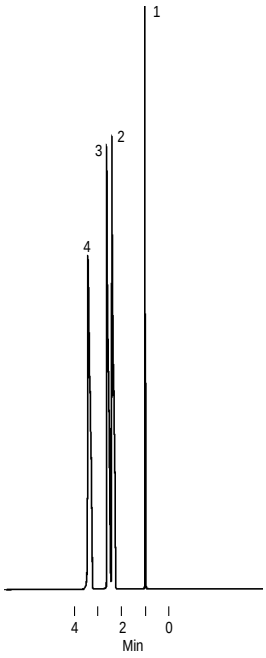
For more information, request Application Note 10.

795-0210

Figure 102. C1-C2 Hydrocarbons

Packing: **100/120 HayeSep D**
Cat. No.: **10293** (packing)
Column: 10' x 1/8" stainless steel
Oven: 80°C
Carrier: helium, 35mL/min
Det.: FID (3700 Varian)

1. Methane, 1%
2. Acetylene, 1%
3. Ethylene, 1%
4. Ethane, 1%

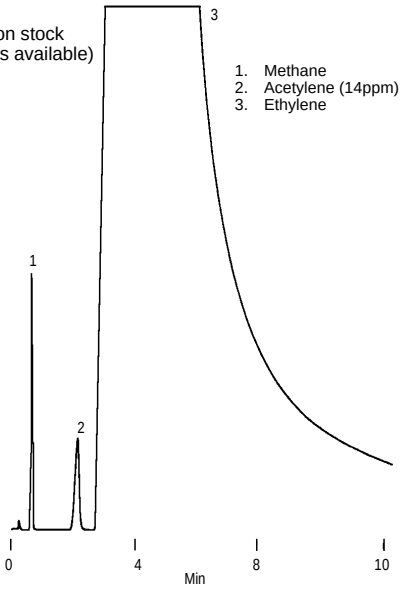


For more information, request Application Note 10.

795-0211

Figure 103. Trace Acetylene in Ethylene

Packing: **45/60 Carboxen-1000**
Column: **5' x 1/8" stainless steel**
Cat. No.: **12380** (general configuration stock column; other stock columns available)
Oven: 160°C
Carrier: helium, 30mL/min
Det.: FID
Inj.: 0.5mL ethylene with trace impurities

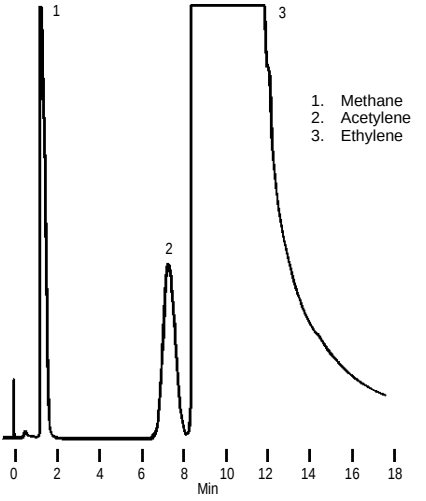


For more information, request Application Note 10.

795-0212

Figure 104. Trace Acetylene in Ethylene

Packing: **60/80 Carbosieve S-II**
Cat. No.: **custom**
Column: 5' x 1/8" stainless steel
Oven: 125°C
Carrier: nitrogen, 30mL/min
Det.: FID
Inj.: 1mL, 100ppm acetylene in ethylene

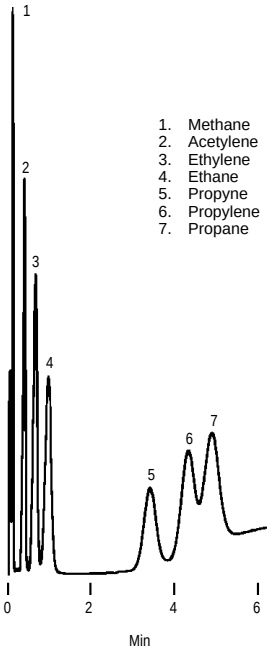


For more information, request Application Note 10.

795-0213

Figure 105. C1-C3 Hydrocarbons

Packing: **45/60 Carboxen-1000**
Column: **2' x 1/8" stainless steel**
Cat. No.: **12370-U** (general configuration stock column; other stock columns available)
Oven: 165°C (1 min) to 220°C at 16°C/min
Carrier: helium, 60mL/min
Det.: FID
Inj.: 0.6mL Scott Gas Mix (Cat. No. 2-3470), 15ppm each component, appr. 10ng each component on column

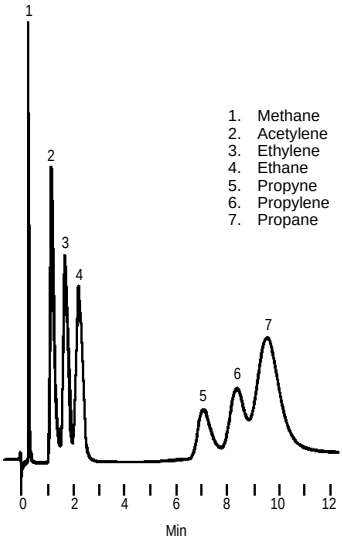


For more information,
request Bulletin 743 and Application Note 10.

795-0214

Figure 106. C1-C3 Hydrocarbons

Packing: **60/80 Carbosieve G**
Cat. No.: **10198** (packing)
Column: 5' x 1/8" stainless steel
Oven: 145°C to 195°C at 6°C/min
Carrier: nitrogen, 50mL/min
Det.: FID
Inj.: 1mL, appr. 15ppm each component in nitrogen



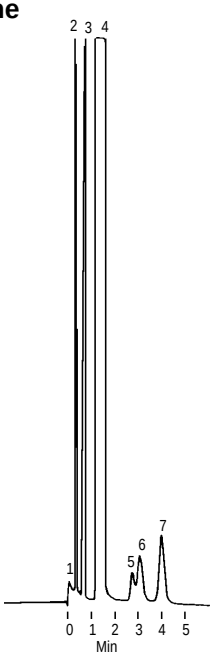
For more information,
request Bulletin 743 and Application Note 10.

795-0215

Figure 107. Methanol in Propylene/Propane

Packing: **100/120 HayeSep T**
Cat. No.: **10311** (packing)
Column: 5' x 1/8" stainless steel
Oven: 120°C
Carrier: helium, 30mL/min
Det.: P.E. 900 T.C., 225ma, 150°C
Inj.: 132°C

1. Air, Methane
2. Carbon dioxide
3. Ethane
4. Propylene, Propane
5. Butane
6. Butane
7. Methanol



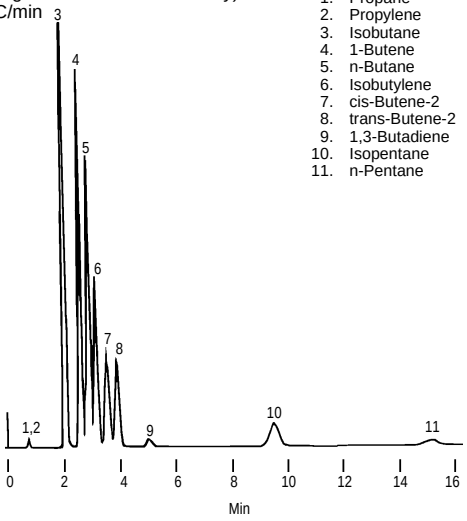
For more information, request Bulletin 743 and Application Note 10.

795-0216

Figure 108. C3-C5 Saturated and Unsaturated Hydrocarbons

Packing: **80/100 Carbopack C/0.19% picric acid**
Cat. No.: **11824** (packing)
Column: 2m x 1/8" stainless steel
Cat. No.: **13867** (general configuration stock column only)
Oven: 35°C to 70°C at 6°C/min
Carrier: nitrogen, 30mL/min
Det.: FID

1. Propane
2. Propylene
3. Isobutane
4. 1-Butene
5. n-Butane
6. Isobutylene
7. cis-Butene-2
8. trans-Butene-2
9. 1,3-Butadiene
10. Isopentane
11. n-Pentane

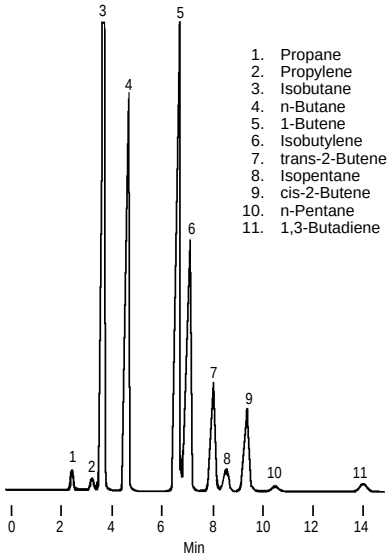


For more information, request Bulletin 743 and Application Note 142.

713-0757

Figure 109. C3-C5 Saturated and Unsaturated Hydrocarbons

Packing: **10% EDO-1 on 100/120 Chromosorb P AW**
Cat. No.: **11967** (packing)
Column: 20' x 1/8" stainless steel
Oven: 0°C
Carrier: nitrogen, 40mL/min
Det.: FID
Inj.: ASTM Hydrocarbon Mix Section L, Blend 6



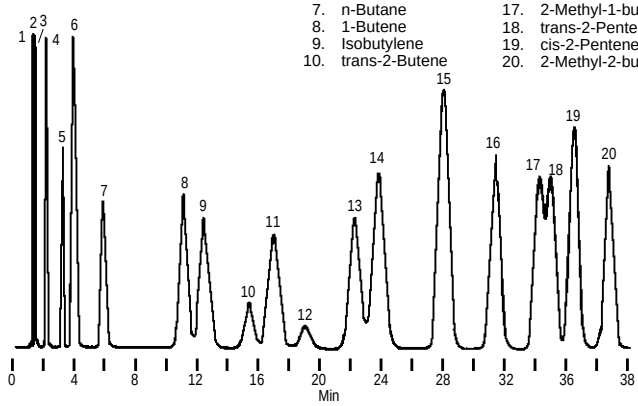
For more information, request Bulletin 743 and Application Note 142.

795-0217

Figure 110. C1-C5 Saturated and Unsaturated Hydrocarbons

Packing: **15% EDO-1 on 60/80 Chromosorb P AW**
Cat. No.: **custom**
Column: 20' x 3/16" stainless steel
Carrier: nitrogen, 40mL/min

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



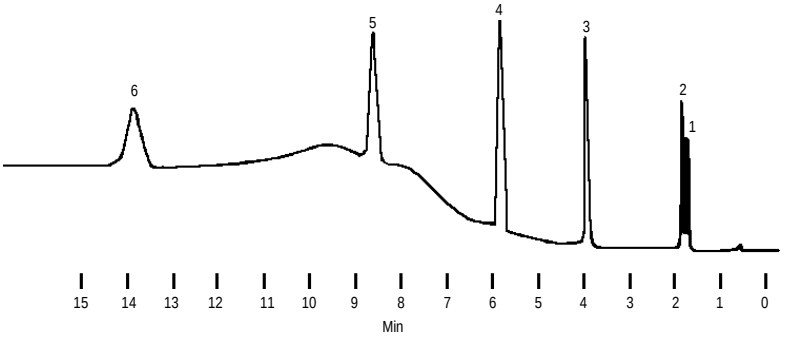
For more information, request Bulletin 743 and Application Note 10 and 142.

795-0218

Figure 111. Trace C2-C6 Hydrocarbons

Packing: **100/120 HayeSep D**
Cat. No.: **10293** (packing)
Column: 10' x 1/8" stainless steel
Oven: 120°C to 200°C at 24°C/min
Carrier: helium, 35mL/min
Det.: FID (3700 Varian)

1.	Acetylene	16ppm
2.	Ethylene	15ppm
3.	Propylene	14.3ppm
4.	1-Butene	15ppm
5.	1-Pentene	14.75ppm
6.	1-Hexane	16ppm



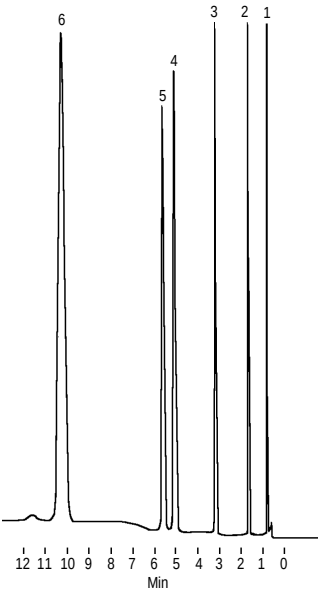
For more information, request Bulletin 743 and Application Note 10 and 142.

795-0219

Figure 112. C1-C5 Hydrocarbons

Packing: **100/120 HayeSep D**
Cat. No.: **10293** (packing)
Column: 10' x 1/8" stainless steel
Oven: 120°C to 200°C at 20°C/min
Carrier: helium, 35mL/min
Det.: FID (3700 Varian)

1.	Methane	0.1894%
2.	Ethane	0.0965%
3.	Propane	0.0989%
4.	Isobutane	0.1019%
5.	Butane	0.1019%
6.	n-Pentane	0.2002%



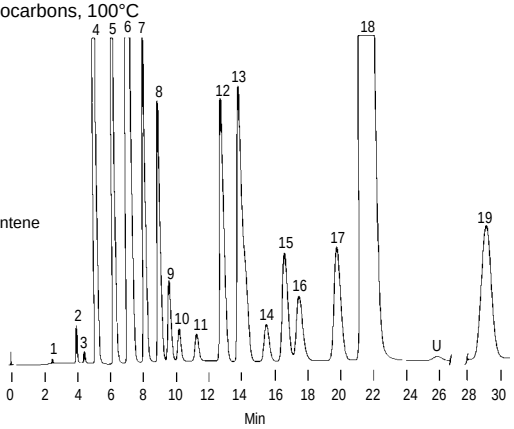
For more information, request Bulletin 743 and Application Note 10 and 142.

795-0220

Figure 113. C1-C6 Saturated and Unsaturated Hydrocarbons

Packing: **23% SP-1700 on 80/100 Chromosorb P AW**
Cat. No.: **11865** (packing)
Column: 30' x 1/8" stainless steel
Cat. No.: **12809-U** (general configuration stock column only)
Oven: 70°C
Carrier: helium, 25mL/min
Det.: FID, 150°C
Inj.: 0.6µL ASTM Section L, Blend 6, plus C5 hydrocarbons, 100°C

1. Ethane
2. Propane
3. Propylene
4. Isobutane
5. n-Butane
6. 1-Butene, Isobutylene
7. trans-2-Butene
8. cis-2-Butene
9. Isopentane
10. 1,3-Butadiene
11. Pentane
12. 1-Pentene
13. 2-Methyl-1-butene, trans-2-Pentene
14. cis-2-Pentene
15. 2-Methyl-2-butene
16. 2-Methyl-1-pentane
17. 3-Methyl-1-pentane
18. n-Hexane
U Unknown
19. 3-Methylhexane



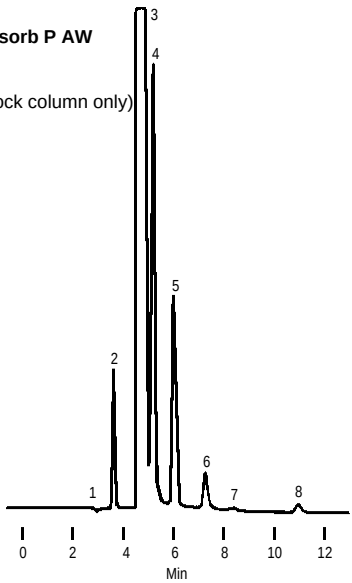
For more information, request Bulletin 743, and Application Note 142.

713-0758

Figure 114. Propane and Propylene at High Concentrations

Packing: **23% SP-1700 on 80/100 Chromosorb P AW**
Cat. No.: **11865** (packing)
Column: 30' x 1/8" stainless steel
Cat. No.: **12809-U** (general configuration stock column only)
Oven: 70°C
Carrier: helium, 25mL/min
Det.: FID, 150°C
Inj.: 0.5mL liquid propane gas, 100°C

1.	Pressure disturbance	
2.	Ethane	0.42%
3.	Propane	96.75%
4.	Propylene	1.72%
5.	Isobutane	0.93%
6.	n-Butane	0.17%
7.	1-Butene, Isobutylene	trace
8.	Isopentane	trace



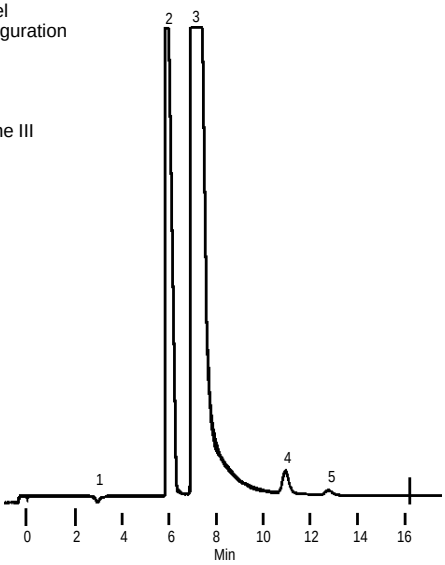
For more information, request Bulletin 743 and Application Note 142.

795-0221

Figure 115. Industrial Butane III

Packing: **23% SP-1700 on 80/100 Chromosorb P AW**
Cat. No.: **11865** (packing)
Column: 30' x 1/8" stainless steel
Cat. No.: **12809-U** (general configuration stock column only)
Oven: 70°C
Carrier: helium, 25mL/min
Det.: FID, 110°C
Inj.: 0.75mL industrial butane III

1. Pressure disturbance
2. Isobutane 2.02%
3. n-Butane 97.92%
4. Isopentane 0.05%
5. n-Pentane 0.01%

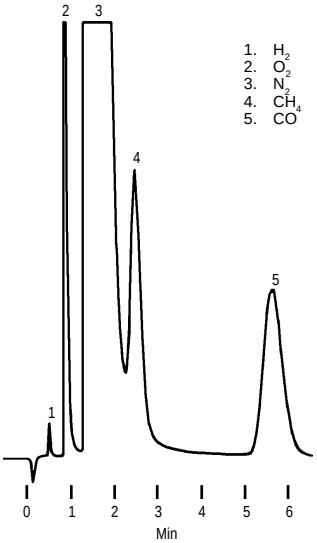


For more information, request Bulletin 743 and Application Note 142.

795-0222

Figure 116. Permanent Gases in Air

Packing: **60/80 Molecular Sieve 5A**
Cat. No.: **20302** (packing)
Column: 3' x 1/8" stainless steel
Oven: 60°C
Carrier: helium, 20mL/min
Det.: thermal conductivity, 150ma
Inj.: 0.25cc, 1% concentrations of H_2, O_2, CH_4, and CO in N_2

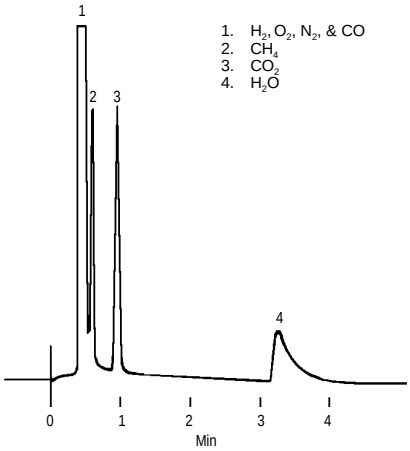


For more information, request Bulletin 743 and Application Note 142.

713-0739

Figure 117. Permanent Gases in Air

Packing: **60/80 Chromosorb 102**
Cat. No.: **20200-U** (packing)
Column: 6' x 1/8" stainless steel
Oven: 60°C
Carrier: helium, 20mL/min
Det.: thermal conductivity, 150ma
Inj.: 0.2cc, 1% concentrations of CH_4, and CO_2 from N_2

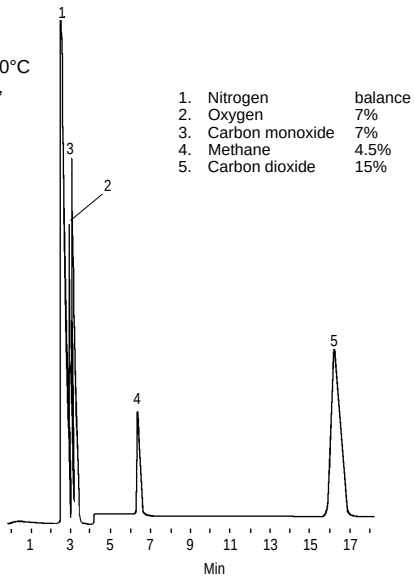


For more information, request Application Note 10.

795-0223

Figure 118. Scott Mix 237

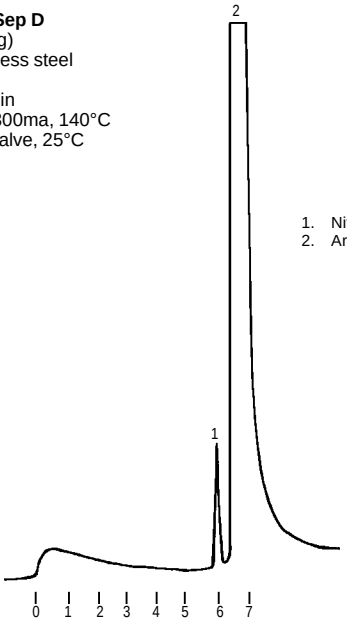
Packing: **100/120 HayeSep D**
Cat. No.: **10293** (packing)
Column: 20' x 1/8" Ni
Oven: 25°C
Carrier: helium, 30cc/min
Det.: P.E. 900 T.C, 225ma, 140°C
Inj.: 50mL vapor, Valco valve, ambient



795-0224

Figure 119. Nitrogen in Argon

Packing: **100/120 HayeSep D**
Cat. No.: **10293** (packing)
Column: 30' x 1/8" stainless steel
Oven: 25°C
Carrier: helium, 30cc/min
Det.: P.E. 900 T.C, 300ma, 140°C
Inj.: 250mL Valco valve, 25°C



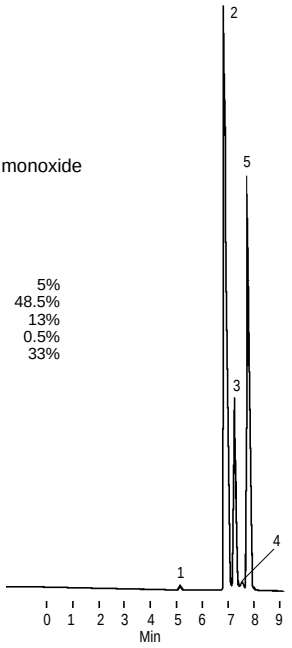
1. Nitrogen 373ppm
2. Argon balance

795-0225

Figure 120. Permanent Gases

Packing: **80/100 HayeSep A**
Cat. No.: **10283** (packing)
Column: 36' x 1/8"
Oven: 25°C
Carrier: helium, 23cc/min
Det.: P.E. 900 T.C, 225ma
Inj.: 25mL air plus hydrogen and carbon monoxide

1. Hydrogen 5%
2. Nitrogen 48.5%
3. Oxygen 13%
4. Argon 0.5%
5. Carbon monoxide 33%

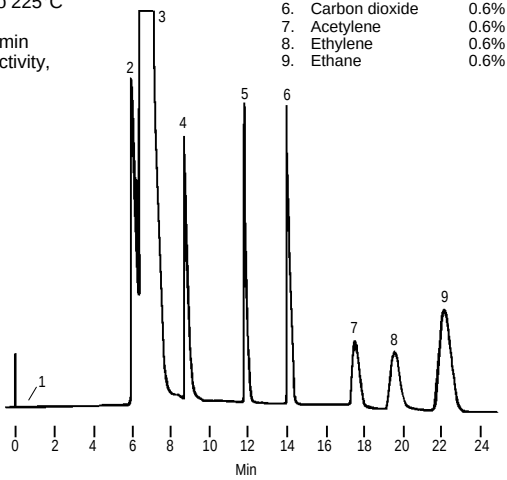


795-0226

Figure 121. Permanent Gases, Methane, and C2 Hydrocarbons

Packing: **100/120 Carbosieve S-II**
Column: **10' x 1/8" stainless steel**
Cat. No.: **13821** (general configuration stock column; other stock columns available)
Oven: 35°C (7 min) to 225°C at 32°C/min
Carrier: helium, 30mL/min
Det.: thermal conductivity, 150ma
Inj.: 0.6mL

1.	Hydrogen	2.5%
2.	Oxygen	2.5%
3.	Nitrogen	91.4%
4.	Carbon monoxide	0.6%
5.	Methane	0.6%
6.	Carbon dioxide	0.6%
7.	Acetylene	0.6%
8.	Ethylene	0.6%
9.	Ethane	0.6%



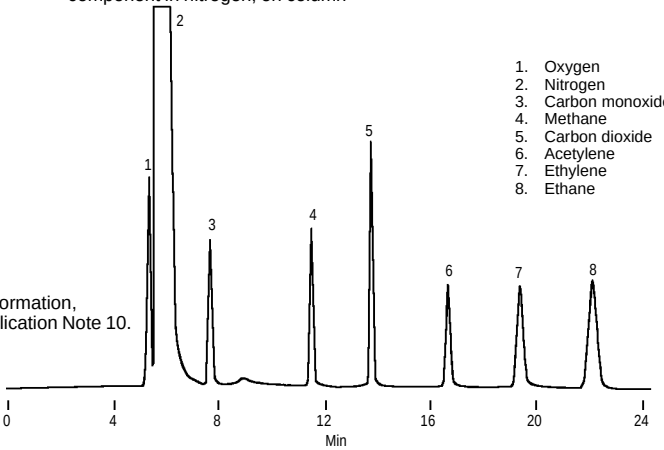
For more information, request Application Note 10.

795-0227

Figure 122. Permanent Gases and C1-C2 Hydrocarbons

Packing: **60/80 Carboxen-1000**
Column: **15' x 1/8" stainless steel**
Cat. No.: **12390-U** (general configuration stock column; other stock columns available)
Oven: 35°C (5 min) to 225°C at 20°C/min
Carrier: helium, 30mL/min
Det.: TCD
Inj.: 0.6mL Scott Gas Mix (Cat. No. 23437) with oxygen added, 1% each component in nitrogen, on column

1. Oxygen
2. Nitrogen
3. Carbon monoxide
4. Methane
5. Carbon dioxide
6. Acetylene
7. Ethylene
8. Ethane

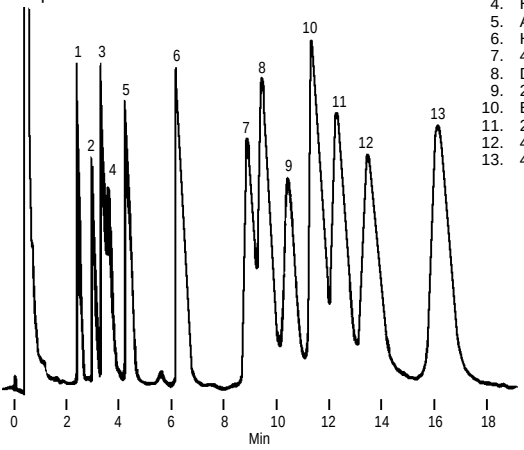


For more information, request Application Note 10.

795-0228

Figure 123. Pesticides

Packing: **GP 1.5% SP-2250/1.95% SP-2401 on 100/120 SUPELCOPORT**
Cat. No.: **11947** (packing)
Column: 6' x 4mm ID glass
(stock column available)
Oven: 200°C
Carrier: argon:methane (95:5), 70mL/min
Det.: EC NI63
Inj.: 5µL CP Mix



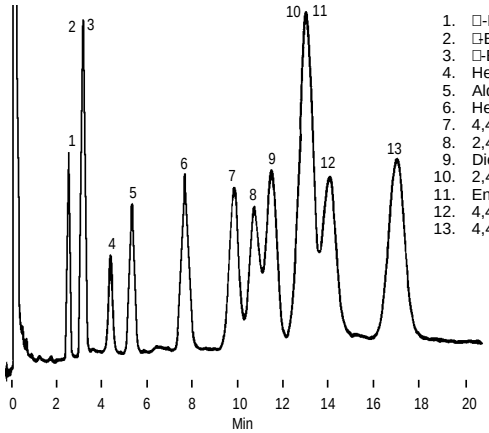
1. □-BHC
2. □BHC (Lindane)
3. □-BHC
4. Heptachlor
5. Aldrin
6. Heptachlor epoxide
7. 4,4'-DDE
8. Dieldrin
9. 2,4-DDD (TDE)
10. Endrin
11. 2,4'-DDT
12. 4,4'-DDD (TDE)
13. 4,4'-DDT

For more information, request Bulletins 758 and 775.

795-0229

Figure 124. Pesticides

Packing: **GP 4% SE-30/6% SP-2401 on 100/120 SUPELCOPORT**
Cat. No.: **11948** (packing)
Column: 6' x 4mm ID glass
Oven: 200°C
Carrier: argon:methane (95:5), 70mL/min
Det.: EC NI63
Inj.: 5µL CP Mix



1. □-BHC
2. □BHC (Lindane)
3. □-BHC
4. Heptachlor
5. Aldrin
6. Heptachlor epoxide
7. 4,4'-DDE
8. 2,4-DDD (TDE)
9. Dieldrin
10. 2,4'-DDT
11. Endrin
12. 4,4'-DDD (TDE)
13. 4,4'-DDT

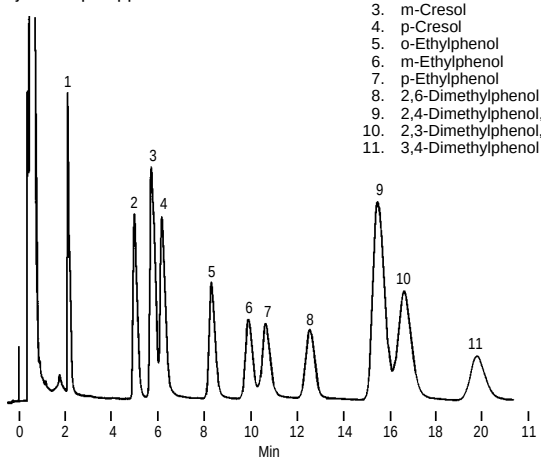
For more information, request Bulletins 758 and 775.

795-0230

Figure 125. Phenols

Packing: **0.1% SP-1000 on 80/100 Carbopack C**
Cat. No.: **11820** (packing)
Column: 6' x 2mm ID glass (stock column available)
Oven: 225°C
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.5µL approx. 0.1% each in MEK

1. Phenol
2. o-Cresol
3. m-Cresol
4. p-Cresol
5. o-Ethylphenol
6. m-Ethylphenol
7. p-Ethylphenol
8. 2,6-Dimethylphenol
9. 2,4-Dimethylphenol, 2,5-Dimethylphenol
10. 2,3-Dimethylphenol, 3,5-Dimethylphenol
11. 3,4-Dimethylphenol



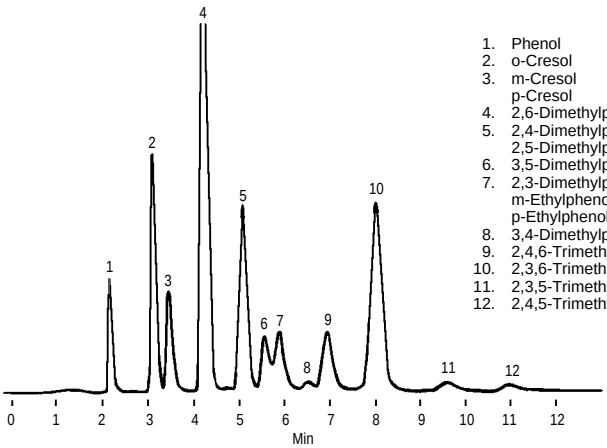
For more information, request Bulletin 775.

795-0231

Figure 126. Mixed Phenols

Packing: **3% SP-1000 on 100/120 SUPELCOPORT**
Cat. No.: **11738** (packing)
Column: 6' x 2mm ID glass
Oven: 130°C
Carrier: nitrogen, 20mL/min
Det.: FID, 175°C
Inj.: 0.05µL

1. Phenol
2. o-Cresol
3. m-Cresol
   p-Cresol
4. 2,6-Dimethylphenol
5. 2,4-Dimethylphenol
   2,5-Dimethylphenol
6. 3,5-Dimethylphenol
7. 2,3-Dimethylphenol
   m-Ethylphenol
   p-Ethylphenol
8. 3,4-Dimethylphenol
9. 2,4,6-Trimethylphenol
10. 2,3,6-Trimethylphenol
11. 2,3,5-Trimethylphenol
12. 2,4,5-Trimethylphenol



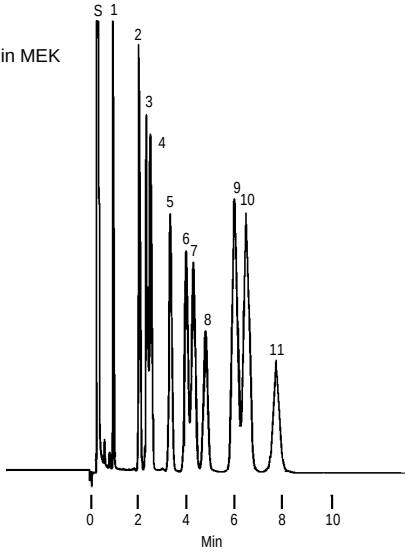
For more information, request Bulletin 775.

795-0232

Figure 127. Phenols

Packing: **60/80 Carbopack F-TA**
Column: 2m x 2mm ID glass
Oven: 220°C
Carrier: nitrogen, 15mL/min
Det.: FID
Inj.: 0.2µL approx. 0.1% each in MEK

S Solvent
1. Phenol
2. o-Cresol
3. m-Cresol
4. p-Cresol
5. o-Ethylphenol
6. p-Ethylphenol
7. p-Ethylphenol
8. 2,6-Dimethylphenol
9. 2,4-Dimethylphenol
   2,5-Dimethylphenol
10. 2,3-Dimethylphenol
    3,5-Dimethylphenol
11. 3,4-Dimethylphenol



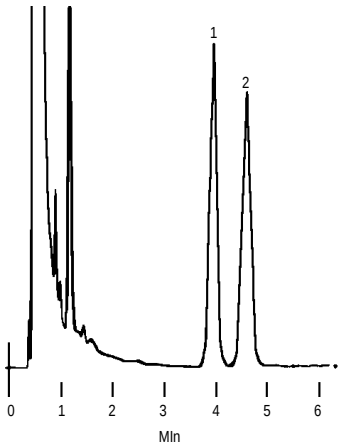
For more information, request Bulletin 775.

794-0139

Figure 128. Butyl Phenols

Packing: **10% SP-1000 on 80/100 SUPELCOPORT**
Cat. No.: **11872** (packing)
Column: 6' x 1/8" stainless steel
Oven: 180°C
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.5µL with 0.1% of each component in chloroform

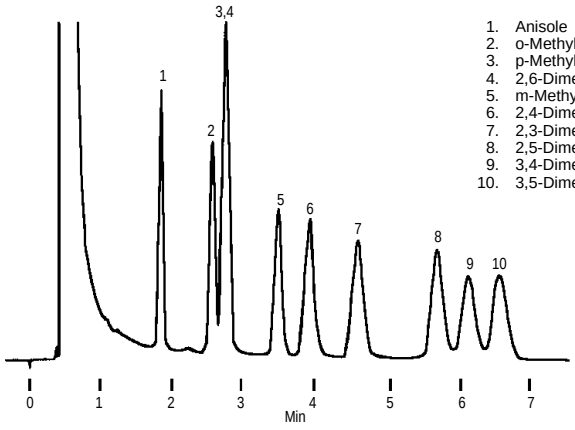
1. 2,6-Di-tert-butylphenol
2. 2,6-Di-tert-butyl-p-cresol



795-0233

Figure 129. Phenols (Anisoles)

Packing: **5% SP-1200/1.75% Bentone 34**
Cat. No.: **12134** (packing)
Column: 6' x 1/8" stainless steel
Cat. No.: **12721** (general configuration stock column; other stock columns available)
Oven: 150°C
Carrier: nitrogen, 20mL/min

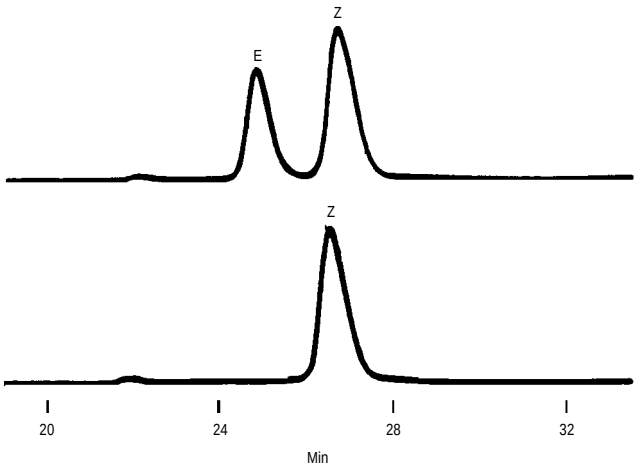


1. Anisole
2. o-Methylanisole
3. p-Methylanisole
4. 2,6-Dimethylanisole
5. m-Methylanisole
6. 2,4-Dimethylanisole
7. 2,3-Dimethylanisole
8. 2,5-Dimethylanisole
9. 3,4-Dimethylanisole
10. 3,5-Dimethylanisole

795-0234

Figure 130. Pheromones

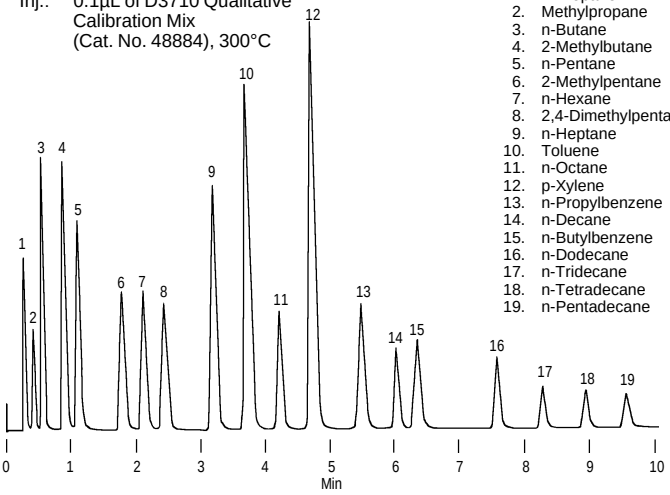
Packing: **15% SP-2340/ on 100/120 Chromosorb P AW-DMCS**
Cat. No.: **custom**
Column: 20' x 1/8" stainless steel
Oven: 225°C
Carrier: nitrogen, 10mL/min at 50psi
Inj.: E and Z-9-tetradecenyl acetate



795-0238

Figure 131. SIMDIS Calibration Blend (ASTM D3710)

Column: **Petrocol™ A, 20" x 1/8" stainless steel**
Cat. No.: **12445** (general configuration stock column only)
Oven: -20°C to 200°C at 20°C/min
Carrier: helium, 25mL/min
Det.: FID, 300°C
Inj.: 0.1µL of D3710 Qualitative Calibration Mix (Cat. No. 48884), 300°C



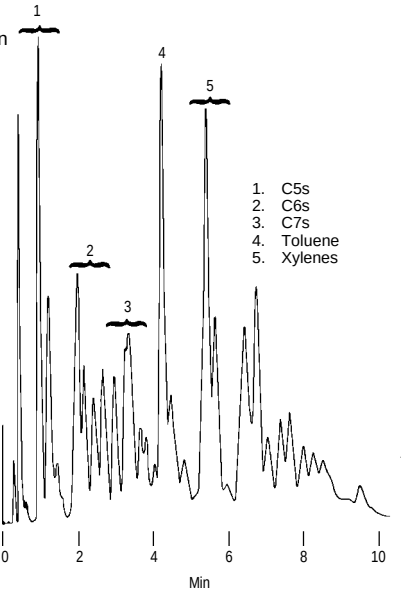
1. n-Propane
2. Methylpropane
3. n-Butane
4. 2-Methylbutane
5. n-Pentane
6. 2-Methylpentane
7. n-Hexane
8. 2,4-Dimethylpentane
9. n-Heptane
10. Toluene
11. n-Octane
12. p-Xylene
13. n-Propylbenzene
14. n-Decane
15. n-Butylbenzene
16. n-Dodecane
17. n-Tridecane
18. n-Tetradecane
19. n-Pentadecane

For more information, request Bulletin 864.

713-0772

Figure 132. Gasoline by ASTM D3710

Column: **Petrocol A, 20" x 1/8" stainless steel**
Cat. No.: **12445** (general configuration stock column only)
Oven: -20°C to 250°C at 15°C/min
Carrier: helium, 25mL/min
Det.: FID, 300°C
Inj.: 0.1µL gasoline, 300°C



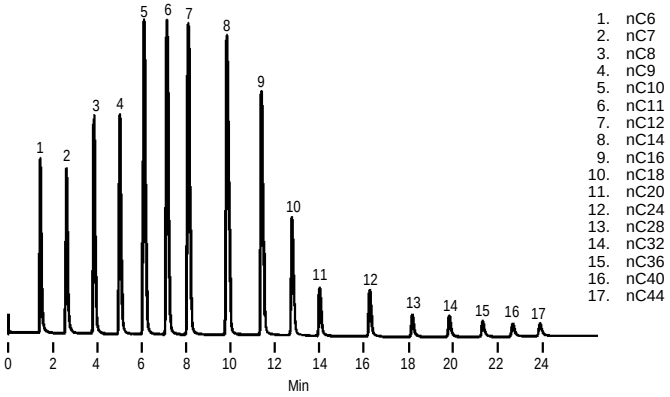
1. C5s
2. C6s
3. C7s
4. Toluene
5. Xylenes

For more information, request Bulletin 864.

713-0771

Figure 133. SIMDIS Calibration Blend (ASTM D2887)

Column: **Petrocol B, 20" x 1/8" stainless steel**
Cat. No.: **12449** (general configuration stock column only)
Oven: -25°C to 350°C at 15°C/min
Carrier: helium, 30mL/min
Det.: FID
Inj.: 0.1µL Quantitative Calibration Mix (Cat. No. 48882)

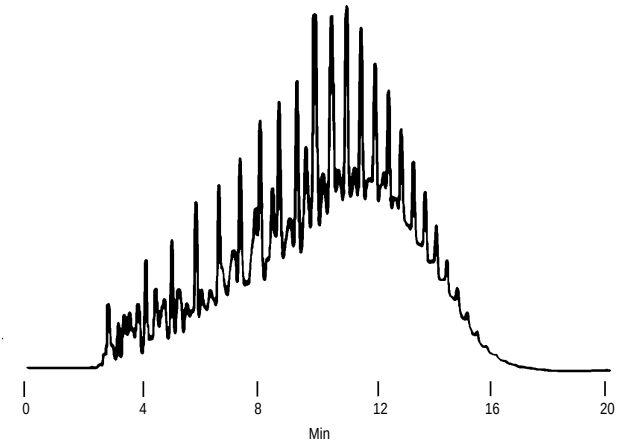


For more information, request Bulletin 864.

712-0427

Figure 134. Reference Gas Oil Sample (ASTM D2887)

Column: **Petrocol B, 20" x 1/8" stainless steel**
Cat. No.: **12449** (general configuration stock column only)
Oven: -25°C to 350°C at 15°C/min
Carrier: helium, 30mL/min
Det.: FID
Inj.: 0.1µL Reference Gas Oil Sample (Cat. No. 48873).

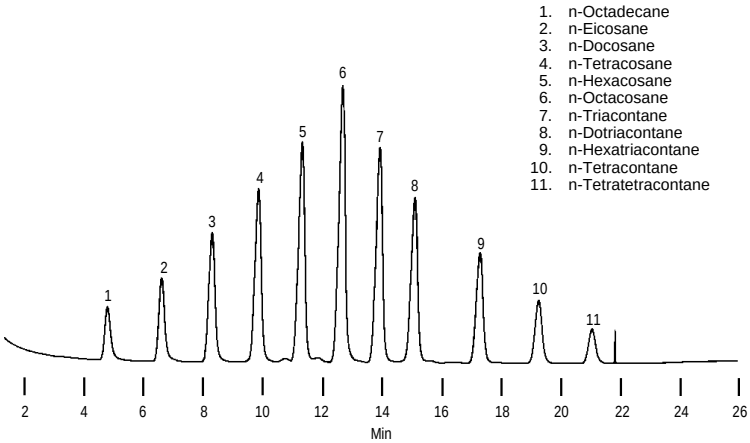


For more information, request Bulletin 864.

713-0769

Figure 135. PS-18-44D Wax Standard Mix (ASTM D2887)

Column: **Petrocol B, 20" x 1/8" stainless steel**
Cat. No.: **12449** (general configuration stock column only)
Oven: 80°C to 350°C at 10°C/min
Carrier: nitrogen, 30mL/min
Det.: FID, 380°C
Inj.: 1µL PS-18-44D Mix (Cat. No. 48928), 350°C

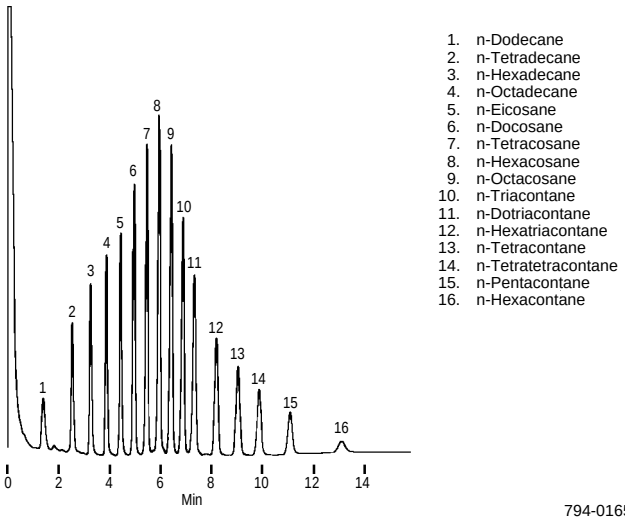


For more information, request Bulletin 864.

794-0408

Figure 136. PS-18-60D Wax Standard Mix (ASTM D2887)

Column: **Petrocol B, 20" x 1/8" stainless steel**
Cat. No.: **12449** (general configuration stock column only)
Oven: 50°C (1 min) to 350°C at 35°C/min
Carrier: nitrogen, 60mL/min
Det.: FID, 380°C
Inj.: 0.5µL PS-12-60D Mix (Cat. No. 48932), 350°C



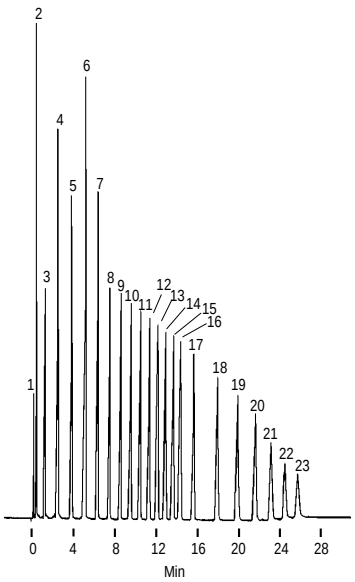
794-0165

Figure 137. Crude Oil Qualitative Calibration Standard

Column: **Petrocol C, 20" x 1/8" stainless steel**
Cat. No.: **12455** (general configuration stock column only)
Oven: -25°C to 350°C at 15°C/min
Carrier: helium, 30mL/min
Det.: FID, 360°C
Inj.: 1µL Crude Oil Qualitative Calibration Standard, 360°C

1. Porpane (nC3), 1.0%
2. n-Butane (nC4)
3. n-Pentane (nC5), 3.4%
4. n-Hexane (nC6), 5.2%
5. n-Heptane (nC7)
6. n-Octane (nC8), 6.2%
7. n-Nonane (nC9), 4.7%
8. n-Decane (nC10)
9. n-Undecane (nC11)
10. n-Dodecane (nC12)
11. n-Tridecane (nC13)
12. n-Tetradecane (nC14)
13. n-Pentadecane (nC15)
14. n-Hexadecane (nC16)
15. n-Heptadecane (nC17)
16. n-Octadecane (nC18)
17. n-Eicosane (nC20)
18. n-Tetracosane (nC24)
19. n-Octacosane (nC28)
20. n-Dotriacontane (nC32)
21. n-Hexatriacontane (nC36)
22. n-Tetracontane (nC40)
23. n-Tetratetracontane (nC44)

4.4% each by weight, except as noted.



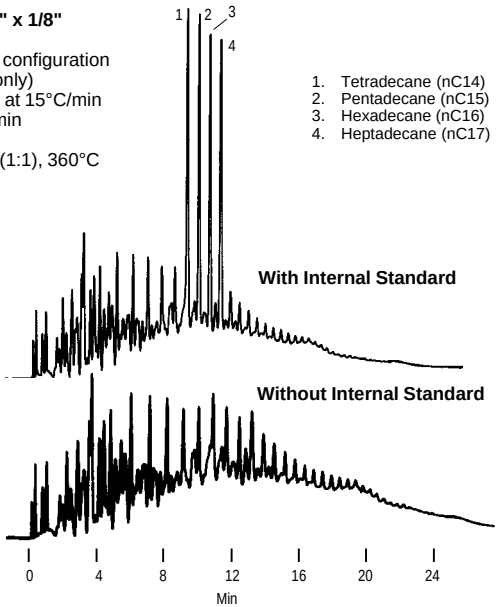
For more information, request Bulletin 864.

711-0072

Figure 138. Crude Oil — North Sea, Oseberg

Column: **Petrocol C, 20" x 1/8" stainless steel**
Cat. No.: **12445** (general configuration stock column only)
Oven: -25°C to 350°C at 15°C/min
Carrier: helium, 30mL/min
Det.: FID, 360°C
Inj.: 1µL oil:CS mix (1:1), 360°C

1. Tetradecane (nC14)
2. Pentadecane (nC15)
3. Hexadecane (nC16)
4. Heptadecane (nC17)

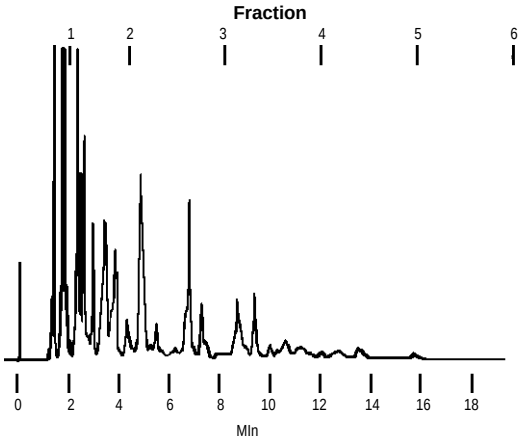


For more information, request Bulletin 864.

711-0076,0077

Figure 139. SIMDIS, Regular Gasoline

Packing: **10% SP-2100 on 100/120 SUPELCOPORT**
Cat. No.: **12140** (packing)
Column: 10' x 1/8" stainless steel
Cat. No. **13766** (general configuration stock column; other stock columns available)
Oven: 75°C to 200°C at 8°C/min
Carrier: 20mL/min
Det.: FID
Inj.: 0.1µL

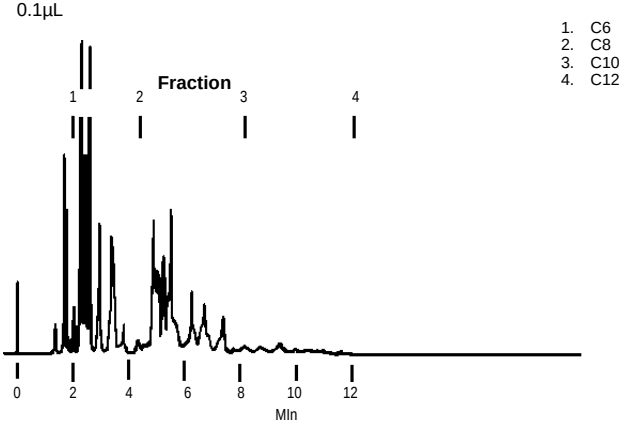


For more information, request Bulletin 864.

711-0088

Figure 140. Naphtha

Packing: **10% SP-2100 on 100/120 SUPELCOPORT**
Cat. No.: **12140**
Column: 10' x 1/8" stainless steel
Cat. No.: **13766** (general configuration stock column; other stock columns available)
Oven: 75°C to 200°C at 8°C/min
Carrier: 20mL/min
Det.: FID
Inj.: 0.1µL



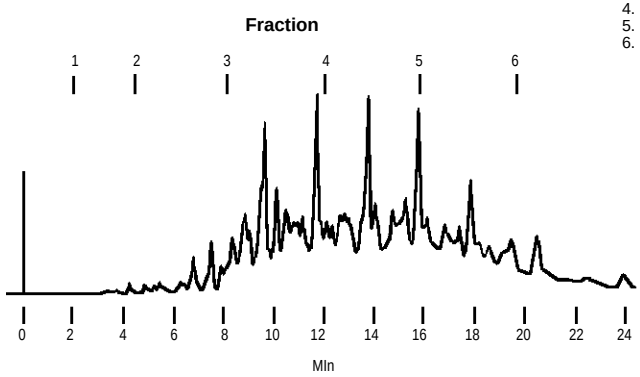
For more information, request Bulletin 864.

711-0087

Figure 141. Kerosene (Jet A)

Packing:	**10% SP-2100 on 100/120 SUPELCOPORT**
Cat. No.:	**12140** (packing)
Cat. No.:	**13766** (general configuration stock column; other stock columns available)
Column:	10' x 1/8" stainless steel (stock column available)
Oven:	75°C to 200°C at 8°C/min
Carrier:	20mL/min
Det.:	FID
Inj.:	0.1µL

1. C6
2. C8
3. C10
4. C12
5. C14
6. C16

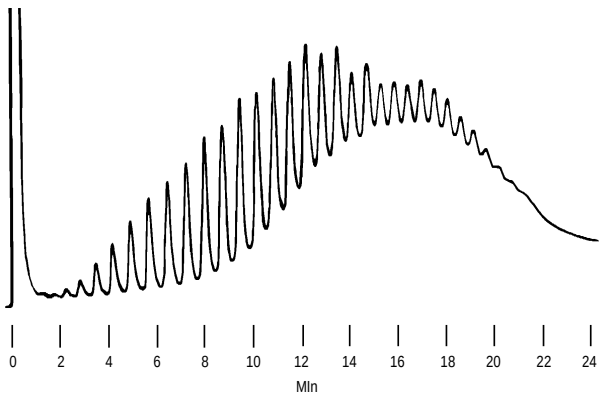


For more information, request Bulletin 864.

711-0089

Figure 142. Microcrystalline Wax

Packing:	**1% Dexsil® 300 on 100/120 SUPELCOPORT**
Cat. No.:	**11972** (packing, 20g/bottle)
Column:	18' x 1/8" stainless steel
Oven:	175°C to 350°C at 8°C/min
Carrier:	nitrogen, 20mL/min
Det.:	350°C
Inj.:	1µL chloroform containing 30µg wax (325°C)



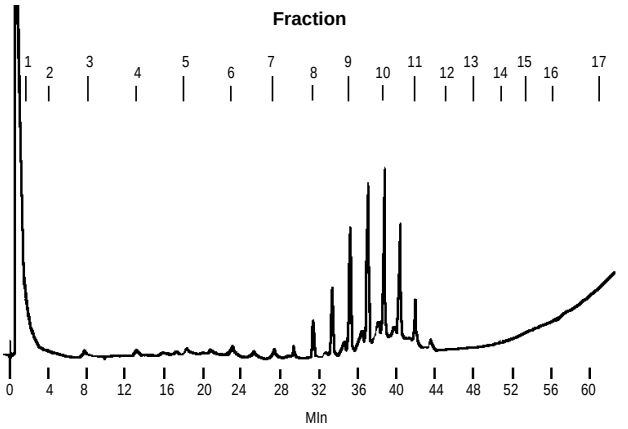
For more information, request Bulletin 864.

713-0750

Figure 143. Wax

Packing: **3% Dexsil® 300 on 100/120 SUPELCOPORT**
Cat. No.: **11973** (packing)
Column: 6' x 1/8" stainless steel
Oven: 100°C to 360°C at 4°C/min
Carrier: nitrogen, 20mL/min

1. C10
2. C12
3. C14
4. C16
5. C18
6. C20
7. C22
8. C24
9. C26
10. C28
11. C30
12. C32
13. C34
14. C36
15. C38
16. C40
17. C44



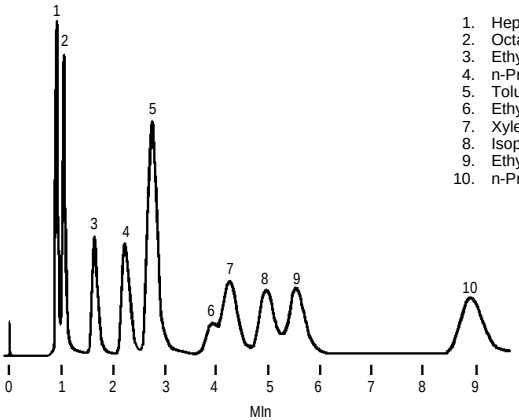
For more information, request Bulletin 864.

795-0242

Figure 144. Solvents — Alcohol Retarder Column

Packing: **15% THEED on 100/120 Chromosorb W AW**
Cat. No.: **11823** (packing)
Column: 10' x 1/8" stainless steel
Oven: 80°C
Carrier: nitro
Det.: FID
Inj.: 0.5µLgen, 20mL/min

1. Heptane
2. Octane
3. Ethyl acetate
4. n-Propyl acetate
5. Toluene
6. Ethyl benzene
7. Xylene
8. Isopropyl alcohol
9. Ethyl alcohol
10. n-Propyl alcohol

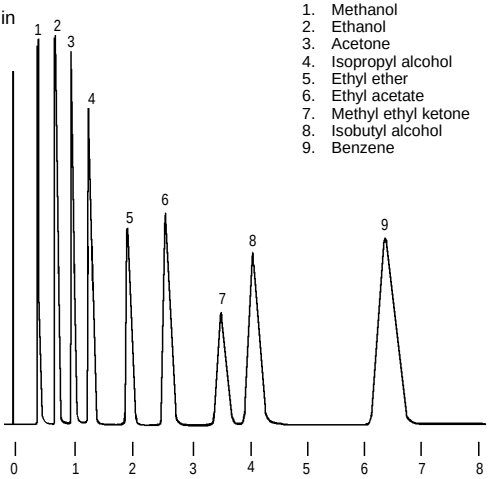


For more information, request Bulletins 816 and 824.

795-0243

Figure 145. Solvents

Packing: **60/80 Carbowax C/0.2% Carbowax 1500**
Cat. No.: **11826** (packing)
Column: 6' x 1/8" stainless steel
Cat. No.: **13860-U** (general configuration stock column, other stock columns available)
Oven: 100°C
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 1.0µL



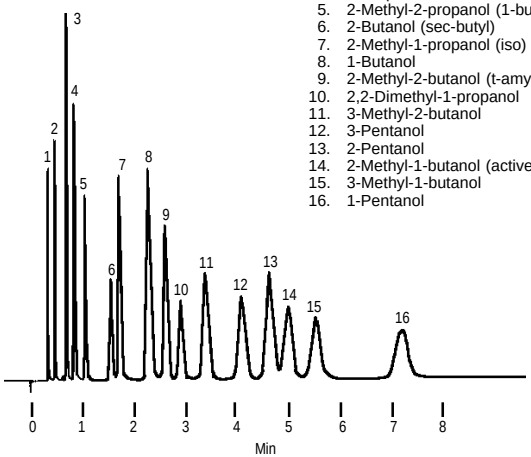
1. Methanol
2. Ethanol
3. Acetone
4. Isopropyl alcohol
5. Ethyl ether
6. Ethyl acetate
7. Methyl ethyl ketone
8. Isobutyl alcohol
9. Benzene

For more information, request Bulletins 816 and 824.

795-0244

Figure 146. Solvents (Methanol through Pentanol)

Packing: **GP 80/100 Carbopack C/0.2% Carbowax 1500**
Cat. No.: **11826** (packing)
Column: 6' x 2mm stainless steel
Cat. No.: **13860-U** (general configuration stock column; other stock columns available)
Oven: 125°C
Carrier: nitrogen, 20mL/min, 31psi
Det.: FID
Inj.: 0.02µL



1. Methanol
2. Ethanol
3. 2-Propanol
4. 1-Propanol
5. 2-Methyl-2-propanol (1-butyl)
6. 2-Butanol (sec-butyl)
7. 2-Methyl-1-propanol (iso)
8. 1-Butanol
9. 2-Methyl-2-butanol (t-amyl)
10. 2,2-Dimethyl-1-propanol
11. 3-Methyl-2-butanol
12. 3-Pentanol
13. 2-Pentanol
14. 2-Methyl-1-butanol (active)
15. 3-Methyl-1-butanol
16. 1-Pentanol

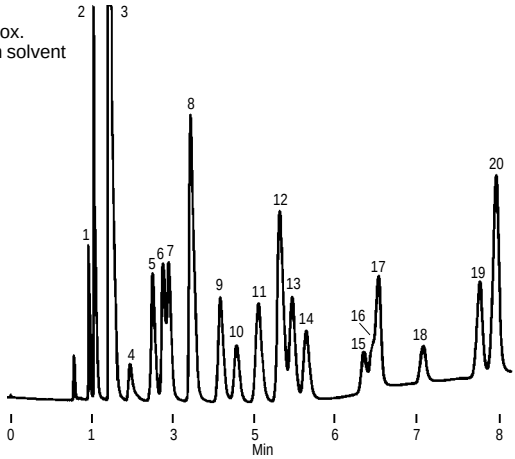
For more information, request Bulletins 816 and 824.

795-0239

Figure 147. Solvents (Ethyl Ether Through Styrene)

Packing: **10% SP-1000 on 80/100 SUPELCOPORT**
Cat. No.: **11872** (packing)
Column: 20' x 1/8" stainless steel
Cat. No.: **12719** (general configuration stock column; other stock columns available)
Oven: 100°C (6 min) to 140°C at 20°C/min
Carrier: nitrogen, 30mL/min
Det.: FID
Inj.: 5µL CS_2 approx. 100ppm each solvent

1. Ethyl ether
2. Isooctane
3. Carbon disulfide
4. Acetone
5. Carbon tetrachloride, Methylchloroform
6. Methyl ethyl ketone
7. Methylene chloride
8. Benzene
9. Trichloroethylene
10. Chloroform
11. Tetrachloroethylene
12. Toluene
13. Ethylene dichloride
14. Dioxane
15. Ethylbenzene
16. p-Xylene
17. m-Xylene
18. o-Xylene
19. 1,1,2-Trichloroethane
20. Styrene



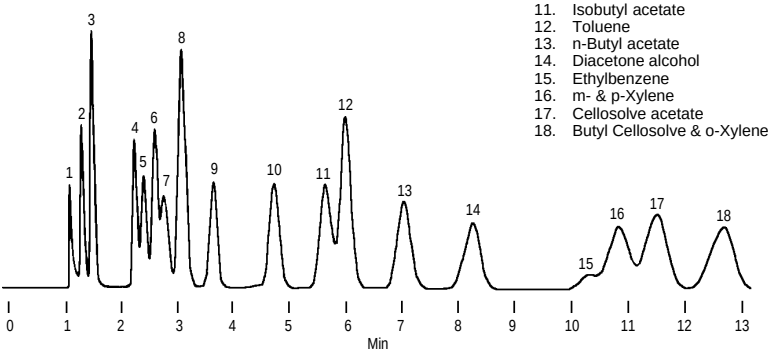
For more information, request Bulletins 816 and 824.

795-0240

Figure 148. Solvents (Methanol Through Xylenes)

Packing: **20% SP-2100/0.1% Carbowax 1500 on 100/120 SUPELCOPORT**
Cat. No.: **11821** (packing)
Column: 10' x 1/8" stainless steel
Cat. No.: **12718** (general configuration stock column; other stock columns available)
Oven: 100°C
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.5µL, approx. equal proportions of neat compounds

1. Methanol
2. Ethanol
3. Acetone
4. Methyl ethyl ketone
5. Ethyl acetate
6. Isobutyl alcohol
7. Methyl Cellosolve
8. Isopropyl acetate
9. 2-Nitropropane
10. MIBK
11. Isobutyl acetate
12. Toluene
13. n-Butyl acetate
14. Diacetone alcohol
15. Ethylbenzene
16. m- & p-Xylene
17. Cellosolve acetate
18. Butyl Cellosolve & o-Xylene

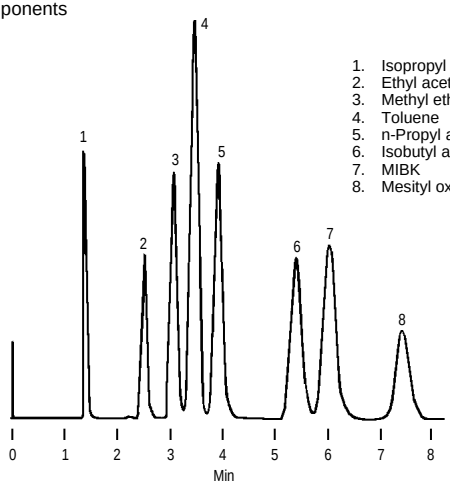


For more information, request Bulletins 816 and 824.

795-0241

Figure 149. Solvents — Ketone-Retarding Column

Packing: **20% SP-2401/0.1% Carbowax 1500 on 100/120 SUPELCOPORT**
Cat. No.: **11822** (packing)
Column: 10' x 1/8" stainless steel
Oven: 100°C
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.1µL, approx. equal proportions of neat components



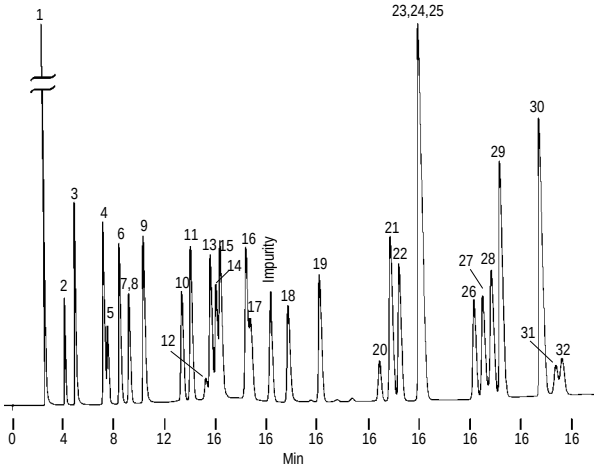
1. Isopropyl alcohol
2. Ethyl acetate
3. Methyl ethyl ketone
4. Toluene
5. n-Propyl acetate
6. Isobutyl acetate
7. MIBK
8. Mesityl oxide

For more information, request Bulletins 816 and 824.

795-0245

Figure 150. Industrial Solvents

Packing: **80/120 Carbopack B/3% SP-1500**
Cat. No.: **11813-U** (packing)
Column: 10' x 1/8" stainless steel
Cat. No.: **12592** (general configuration stock column; other stock columns available)
Oven: 70°C to 225°C at 4°C/min



1. Methanol
2. Methyl formate
3. Ethanol
4. Acetone
5. Methylene chloride
6. Isopropyl alcohol
7. Ethyl formate
8. Methyl acetate
9. n-Propyl alcohol
10. Tetrahydrofuran (THF)
11. Methyl ethyl ketone (MEK)
12. Methyl Cellosolve
13. sec-Butyl alcohol
14. Ethyl acetate
15. Isobutyl alcohol
16. 2-Nitropropane
17. n-Butyl alcohol
18. Ethyl Cellosolve
19. n-Propyl acetate
20. sec-Butyl acetate
21. Cyclohexanone
22. Isobutyl acetate
23. n-Butyl acetate
24. Toluene
25. Mesityl oxide
26. Cellosolve acetate
27. Butyl Cellosolve
28. Isoamyl acetate
29. Ethylbenzene
30. m-Xylene
31. p-Xylene
32. o-Xylene

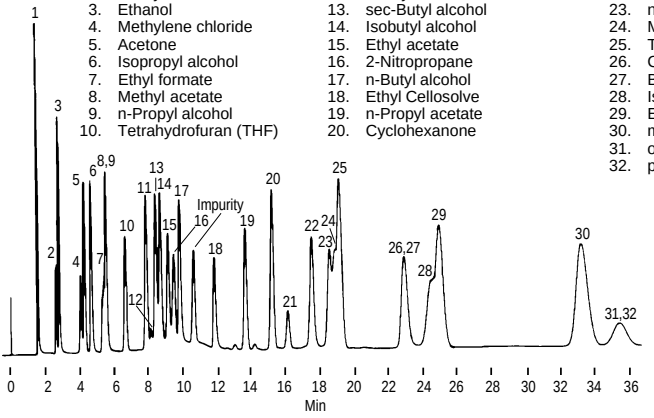
For more information, request Bulletin 824.

713-0787

Figure 151. Industrial Solvents

Packing: **60/80 Carbopack B/1% SP-1510**
Cat. No.: **11809** (packing)
Column: 10' x 1/8" stainless steel
Oven: 100°C to 225°C at 8°C/min
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.3µL, approx. equal proportions of neat components

1. Methanol
2. Methyl formate
3. Ethanol
4. Methylene chloride
5. Acetone
6. Isopropyl alcohol
7. Ethyl formate
8. Methyl acetate
9. n-Propyl alcohol
10. Tetrahydrofuran (THF)
11. Methyl ethyl ketone (MEK)
12. Methyl Cellosolve
13. sec-Butyl alcohol
14. Isobutyl alcohol
15. Ethyl acetate
16. 2-Nitropropane
17. n-Butyl alcohol
18. Ethyl Cellosolve
19. n-Propyl acetate
20. Cyclohexanone
21. sec-Butyl acetate
22. Isobutyl acetate
23. n-Butyl acetate
24. Mesityl oxide
25. Toluene
26. Cellosolve acetate
27. Butyl Cellosolve
28. Isoamyl acetate
29. Ethylbenzene
30. m-Xylene
31. o-Xylene
32. p-Xylene



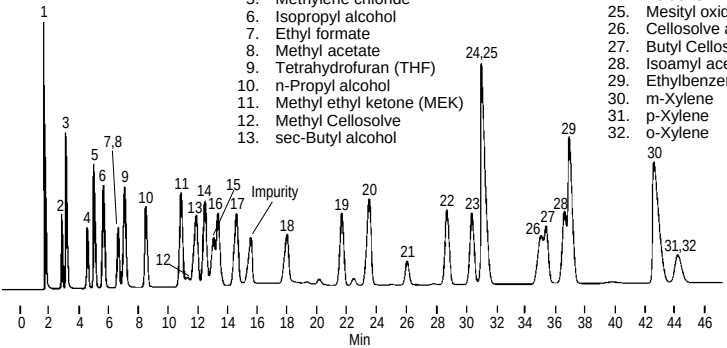
For more information, request Bulletin 824.

713-0788

Figure 152. Industrial Solvents

Packing: **80/100 Carbopack C/0.1% SP-1000**
Cat. No.: **11820** (packing)
Column: 10' x 1/8" stainless steel
Oven: 70°C to 225°C at 4°C/min
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.3µL, 3% each component by volume (approx. 12µg each)

1. Methanol
2. Methyl formate
3. Ethanol
4. Acetone
5. Methylene chloride
6. Isopropyl alcohol
7. Ethyl formate
8. Methyl acetate
9. Tetrahydrofuran (THF)
10. n-Propyl alcohol
11. Methyl ethyl ketone (MEK)
12. Methyl Cellosolve
13. sec-Butyl alcohol
14. Isobutyl alcohol
15. Ethyl acetate
16. 2-Nitropropane
17. n-Butyl alcohol
18. Ethyl Cellosolve
19. n-Propyl acetate
20. Cyclohexanone
21. sec-Butyl acetate
22. Isobutyl acetate
23. n-Butyl acetate
24. Toluene
25. Mesityl oxide
26. Cellosolve acetate
27. Butyl Cellosolve
28. Isoamyl acetate
29. Ethylbenzene
30. m-Xylene
31. p-Xylene
32. o-Xylene



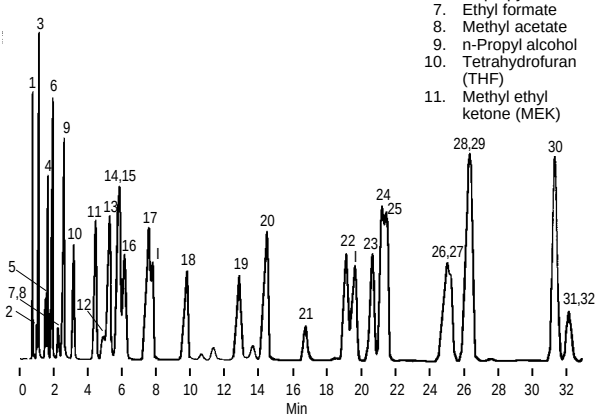
For more information, request Bulletin 824.

713-0789

Figure 153. Industrial Solvents

Packing: **60/80 Carbopack F-TA**
Column: 2m x 2mm ID glass
Oven: 75°C (2 min) to 225°C at 4°C/min
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 0.05µL solvents mix, 3% each solvent

1. Methanol
2. Methyl formate
3. Ethanol
4. Acetone
5. Methylene chloride
6. Isopropyl alcohol
7. Ethyl formate
8. Methyl acetate
9. n-Propyl alcohol
10. Tetrahydrofuran (THF)
11. Methyl ethyl ketone (MEK)
12. Methyl Cellosolve
13. sec-Butyl alcohol
14. Ethyl acetate
15. Isobutyl alcohol
16. 2-Nitropropane
17. n-Butyl alcohol
I Impurity
18. Ethyl Cellosolve
19. n-Propyl acetate
20. Cyclohexanone
21. sec-Butyl acetate
22. Isobutyl acetate
23. n-Butyl acetate
24. Toluene
25. Mesityl oxide
26. Cellosolve acetate
27. Butyl Cellosolve
28. Isoamyl acetate
29. Ethylbenzene
30. m-Xylene
31. p-Xylene
32. o-Xylene



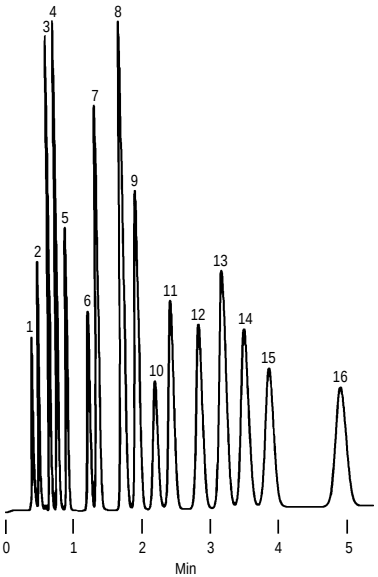
For more information, request Bulletin 824.

795-0248

Figure 154. Alcohols, C1-C5

Packing: **80/100 Carbopack F-SL**
Column: 2m x 2mm ID TightSpec glass
Oven: 130°C
Carrier: nitrogen, 15mL/min

1. Methanol
2. Ethanol
3. i-Propanol
4. n-Propanol
5. t-Butanol
6. i-Butanol
7. 2-Methyl-1-propanol
8. n-Butanol
9. 2-Methyl-2-butanol
10. 2,2-Dimethyl-1-propanol
11. 3-Methyl-2-butanol
12. 3-Pentanol
13. 2-Pentanol
14. 2-Methyl-1-butanol
15. 3-Methyl-1-butanol
16. n-Pentanol



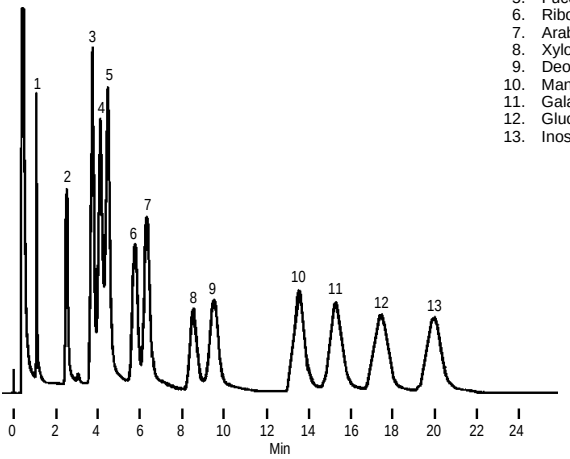
For more information, request Bulletin 824.

713-1069

Figure 155. Sugars

Packing: **3% SP-2330 on 100/120 SUPELCOPORT**
Cat. No.: **11802** (packing)
Column: 6' x 2mm ID glass
Oven: 225°C
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 5µL

1. Glyceraldehyde
2. Erythrose
3. Deoxyribose
4. Rhamnose
5. Fucose
6. Ribose
7. Arabinose
8. Xylose
9. Deoxyglucose
10. Mannose
11. Galactose
12. Glucose
13. Inositol

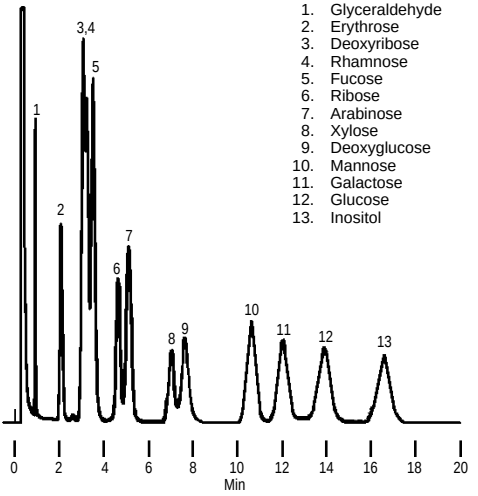


795-0249

Figure 156. Sugars

Packing: **3% SP-2340 on 100/120 SUPELCOPORT**
Cat. No.: **11863** (packing)
Column: 6' x 2mm ID glass
Oven: 225°C
Carrier: nitrogen, 20mL/min
Det.: FID
Inj.: 4µL

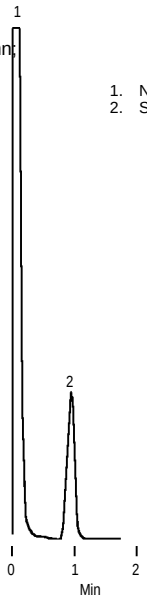
1. Glyceraldehyde
2. Erythrose
3. Deoxyribose
4. Rhamnose
5. Fucose
6. Ribose
7. Arabinose
8. Xylose
9. Deoxyglucose
10. Mannose
11. Galactose
12. Glucose
13. Inositol



795-0247

Figure 157. Sulfur Dioxide in Nitrogen

Packing: **45/60 Carboxen-1000**
Column: **2' x 1/8" stainless steel**
Cat. No.: **12370-U** (general configuration stock column; other stock columns available)
Oven: 190°C
Carrier: helium, 30mL/min
Det.: TCD
Inj.: 1µL of 1000ppm SO_2 in N_2, approx. 1µg SO_2 on column



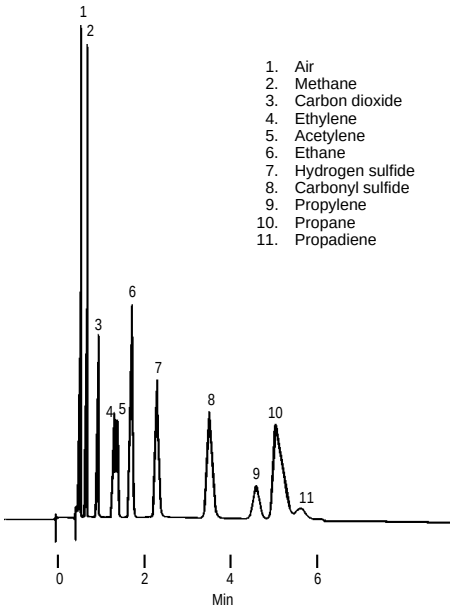
1. Nitrogen
2. Sulfur dioxide

For more information, request Bulletin 722.

795-0250

Figure 158. Sulfur Gases and Hydrocarbons

Packing: **HayeSep Q**
Cat. No.: **10301-U** (packing)
Column: 8' x 1/8"
Oven: 90°C
Carrier: helium, 30cc/min



1. Air
2. Methane
3. Carbon dioxide
4. Ethylene
5. Acetylene
6. Ethane
7. Hydrogen sulfide
8. Carbonyl sulfide
9. Propylene
10. Propane
11. Propadiene

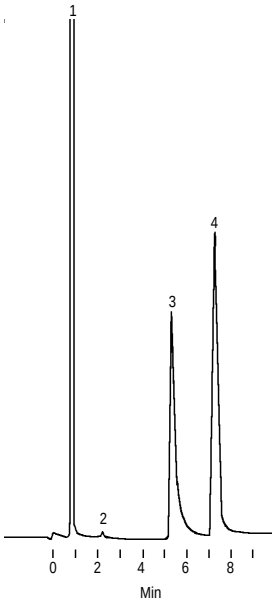
For more information, request Bulletin 722.

795-0251

Figure 159. Hydrogen Sulfide, Carbon Dioxide, and Water

Packing: **100/120 HayeSep D**
Cat. No.: **10293** (packing)
Column: 10' x 1/8" Ni
Oven: 60°C
Carrier: helium, 30cc/min
Det.: P.E. 900 T.C., 225ma, 140°C
Inj.: Valco valve, 50 microliters vapor (ambient), 100°C

1. Air (balance)
2. Carbon dioxide (approx. 0.1%)
3. Water (approx. 2.5%)
4. Hydrogen sulfide (approx. 2.5%)



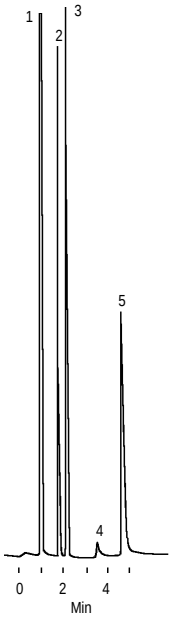
For more information, request Bulletin 722.

795-0252

Figure 160. Hydrogen Sulfide, Nitrogen, Carbon Dioxide, Nitrous Oxide and Water

Packing: **100/120 HayeSep D**
Cat. No.: **10293** (packing)
Column: 10' x 1/8" stainless steel
Oven: 80°C
Carrier: helium, 30cc/min
Det.: P.E. 900 T.C., 225ma
Inj.: Valco valve, 100 microliters, 140°C

1. Nitrogen (balance)
2. Carbon dioxide (2%)
3. Nitrous oxide (3%)
4. Water (0.5%)
5. Hydrogen sulfide (3%)

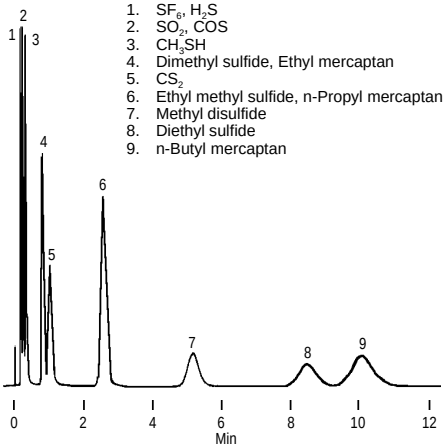


For more information, request Bulletin 722.

795-0253

Figure 161. Light Sulfur Gases, Alkyl Sulfides, and Mercaptans

Packing: **40/60Carbopack B HT 100**
Cat. No.: **20272** (packing)
Column: **1.4m x 1/8" OD Teflon® (FEP)**
Cat. No.: **11502-U** (general configuration stock column only)
Oven: 100°C
Carrier: nitrogen, 70mL/min
Det.: flame photometric
Inj.: 0.5mL of synthetic mix



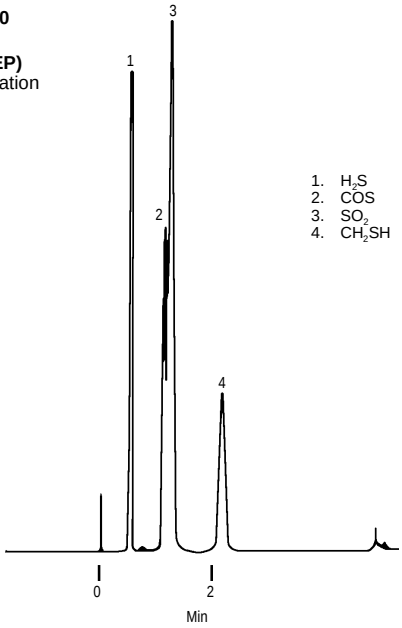
1. SF_6, H_2S
2. SO_2, COS
3. CH_3SH
4. Dimethyl sulfide, Ethyl mercaptan
5. CS_2
6. Ethyl methyl sulfide, n-Propyl mercaptan
7. Methyl disulfide
8. Diethyl sulfide
9. n-Butyl mercaptan

For more information, request Bulletin 722.

795-0254

Figure 162. Trace Sulfur Gases

Packing: **40/60 Carbopack B HT 100**
Cat. No.: **20272** (packing)
Column: **1.4m x 1/8" OD Teflon (FEP)**
Cat. No.: **11502-U** (general configuration stock column only)
Oven: 35°C
Carrier: nitrogen, 20mL/min
Det.: flame photometric
Inj.: 0.3mL



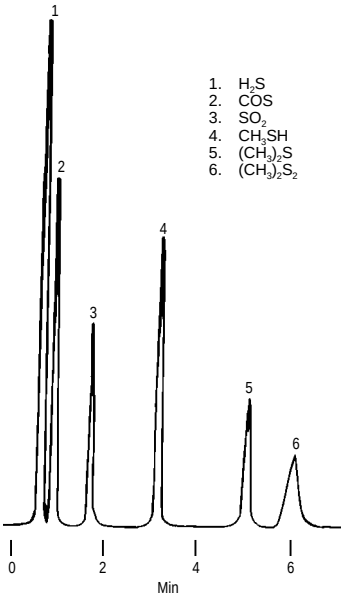
1. H_2S
2. COS
3. SO_2
4. CH_2SH

For more information, request Bulletin 722.

713-0806

Figure 163. Kraft Pulp Mill Stack Gases

Packing:	**Supelpak™-S**
Column:	**30" (18" packed) x 1/8" OD Teflon® (FEP)**
Cat. No.:	**12255-U** (general configuration stock column only)
Oven:	30°C (1 min) to 210°C at 40°C/min
Carrier:	helium, 30mL/min
Det.:	flame photometric
Inj.:	2mL

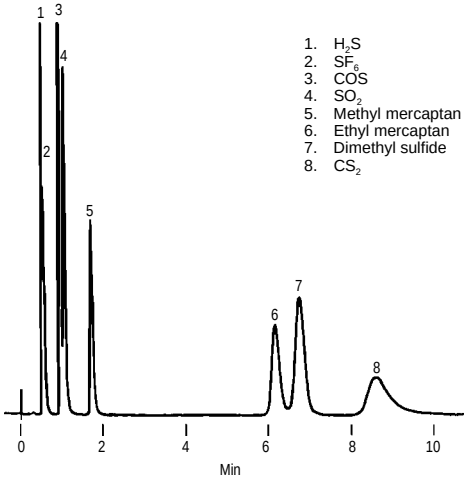


For more information, request Bulletin 722.

713-0805

Figure 164. Trace Sulfur Gases with C_2 Isomeric Sulfur Compounds

Packing:	**GP 60/80 Carbopack B/1.5% XE-60/1.0% H_3PO_4**
Cat. No.:	**11828** (packing)
Column:	6' x 2mm ID glass
Oven:	50°C
Carrier:	nitrogen, 35mL/min
Det.:	flame photometric
Inj.:	0.25mL

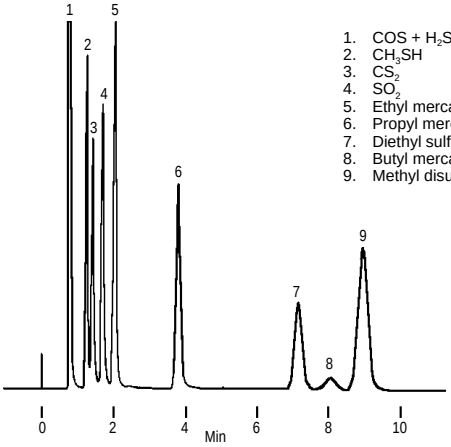


For more information, request Bulletin 722.

713-0807

Figure 165. Alkyl Sulfides and Mercaptans

Packing: **Chromosil 330**
Column: **8' (6' packed) x 1/8" OD Teflon (FEP)**
Cat. No.: **11496** (general configuration stock column only)
Oven: 65°C
Carrier: nitrogen, 20mL/min
Det.: flame photometric
Inj.: 0.5cc of synthetic mix



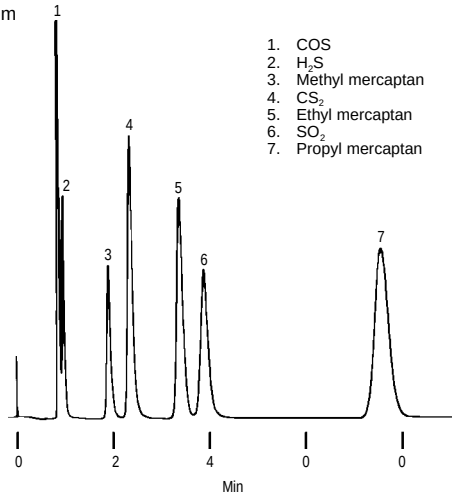
1. $COS + H_2S$
2. CH_3SH
3. CS_2
4. SO_2
5. Ethyl mercaptan, Dimethyl sulfide
6. Propyl mercaptan, Ethyl methyl sulfide
7. Diethyl sulfide
8. Butyl mercaptan
9. Methyl disulfide

For more information, request Bulletin 722.

795-0255

Figure 166. Trace Light Sulfur Gases and C1-C3 Mercaptans

Packing: **Chromosil 330**
Column: **8' (6' packed) x 1/8" OD Teflon (FEP)**
Cat. No.: **11496** (general configuration stock column only)
Oven: 40°C
Carrier: nitrogen, 20mL/min
Det.: flame photometric
Inj.: 0.2mL, approx. 1ppm each component in nitrogen



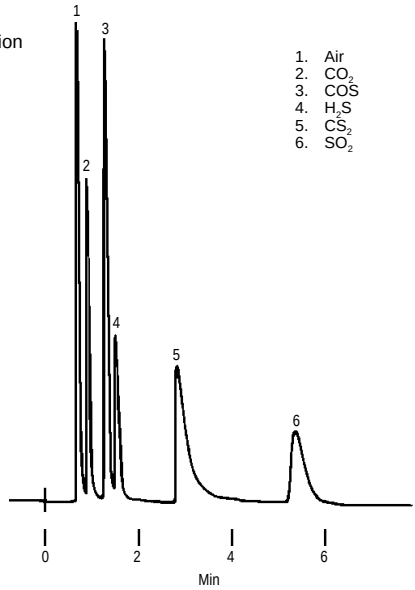
1. COS
2. H_2S
3. Methyl mercaptan
4. CS_2
5. Ethyl mercaptan
6. SO_2
7. Propyl mercaptan

For more information, request Bulletin 722.

713-0804

Figure 167. Light Sulfur Gases at Percent Concentrations

Packing: **Chromosil 310**
Column: **6' x 4mm ID glass**
Cat. No.: **11501** (general configuration stock column only)
Oven: 40°C
Carrier: helium, 50mL/min
Det.: thermal conductivity
Inj.: 0.3mL of synthetic mix

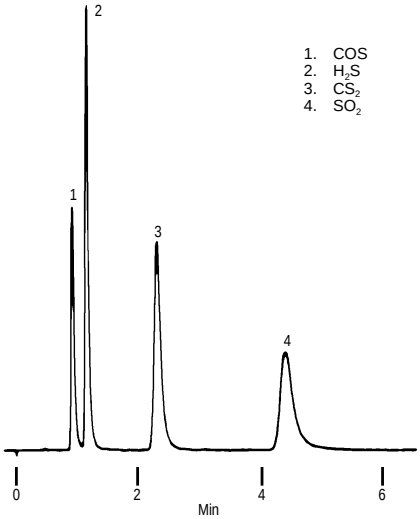


For more information, request Bulletin 722.

794-0844

Figure 168. Trace Light Sulfur Gases

Packing: **Chromosil 310**
Column: **8' (6' packed) x 1/8" OD Teflon (FEP)**
Cat. No.: **11501** (general configuration stock column only)
Oven: 50°C
Carrier: nitrogen, 20mL/min
Det.: flame photometric
Inj.: 0.5mL approx. 1ppm each component in nitrogen

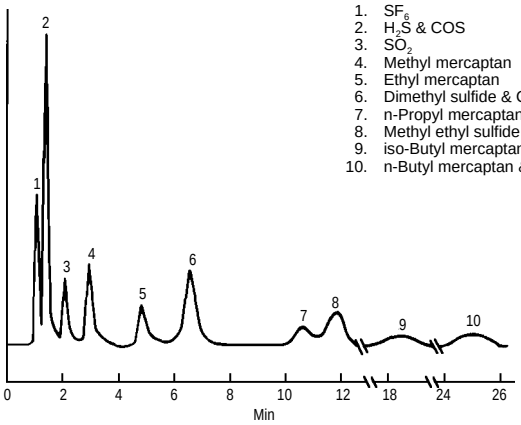


For more information, request Bulletin 722.

713-0803

Figure 169. Mercaptans, Sulfides, and Disulfides

Packing: **12% polyphenyl ether/0.5% H_3PO_4 on 40/60 Chromosorb T**
Column: **36' x 0.085" ID Teflon**
Cat. No.: **11500** (general configuration stock column only)
Oven: 50°C
Carrier: nitrogen, 80mL/min
Det.: FPD
Inj.: 0.5cc synthetic mix



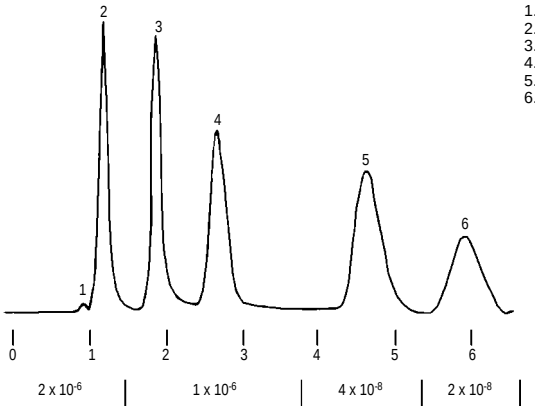
1. SF_6
2. H_2S & COS
3. SO_2
4. Methyl mercaptan
5. Ethyl mercaptan
6. Dimethyl sulfide & CS_2
7. n-Propyl mercaptan
8. Methyl ethyl sulfide
9. iso-Butyl mercaptan
10. n-Butyl mercaptan & Diethyl sulfide

For more information, request Bulletin 722.

794-0850

Figure 170. Sulfur Gases

Packing: **12% polyphenyl ether/0.5% H_3PO_4 on 40/60 Chromosorb T**
Column: **36' x 0.085" ID Teflon**
Cat. No.: **11500** (general configuration stock column only)
Oven: 50°C
Carrier: nitrogen, 100mL/min
Det.: flame photometric (sens. settings on figure)
Inj.: 0.2mL nitrogen approx. 1ppm each analyte



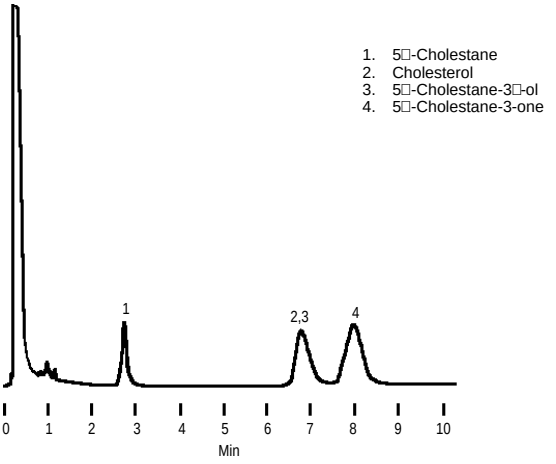
1. Air
2. H_2S
3. SO_2
4. CH_3SH
5. C_2H_5SH
6. $(CH_3)_2S$

For more information, request Bulletin 722.

713-0808

Figure 171. Cholesterol (Steroids)

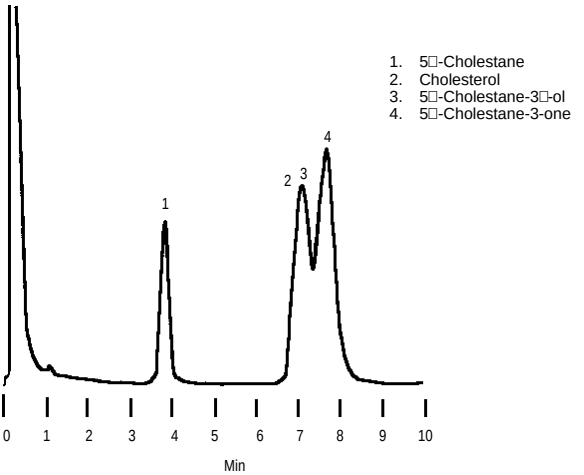
Packing: **3% SP-2250 on 100/120 SUPELCOPORT**
Cat. No.: **11878** (packing)
Column: 3' x 2mm ID glass
(stock column available)
Oven: 250°C
Carrier: nitrogen, 20mL/min



795-0235

Figure 172. Cholesterol (Steroids)

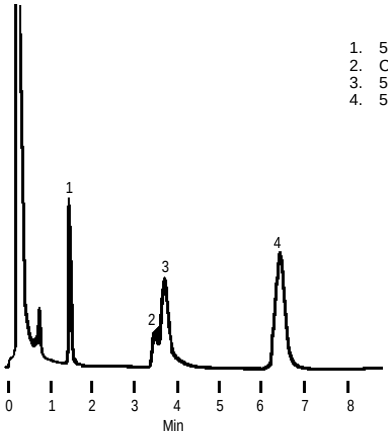
Packing: **3% SP-2100 on 80/100 SUPELCOPORT**
Cat. No.: **11987** (packing)
Column: 3' x 2mm ID glass
Oven: 250°C
Carrier: nitrogen, 20mL/min



795-0236

Figure 173. Cholesterol (Steroids)

Packing: **3% SP-2401 on 100/120 SUPELCOPORT**
Cat. No.: **11978** (packing)
Column: 3' x 2mm ID glass
Oven: 250°C
Carrier: nitrogen, 20mL/min

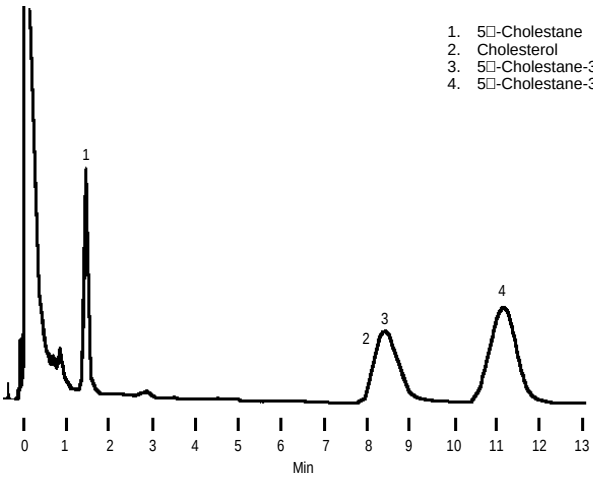


1. 5□-Cholestane
2. Cholesterol
3. 5□-Cholestane-3□-ol
4. 5□-Cholestane-3-one

795-0237

Figure 174. Cholesterol (Steroids)

Packing: **3% SP-2300 on 100/120 SUPELCOPORT**
Cat. No.: **11888** (packing)
Column: 3' x 2mm ID glass
(stock column available)
Oven: 250°C
Carrier: nitrogen, 20mL/min

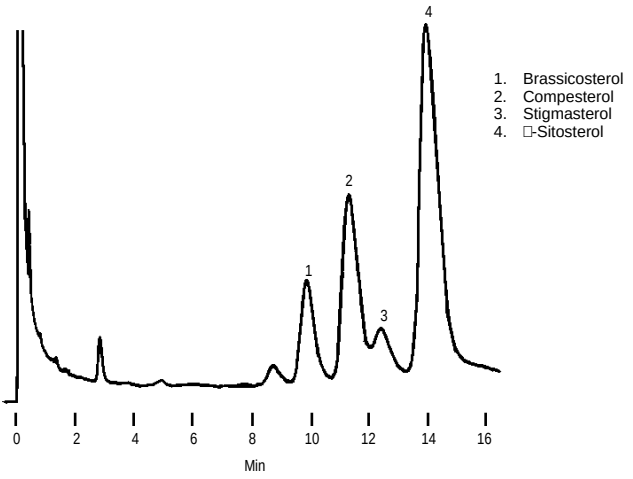


1. 5□-Cholestane
2. Cholesterol
3. 5□-Cholestane-3□-ol
4. 5□-Cholestane-3-one

795-0283

Figure 175. Plant Sterols

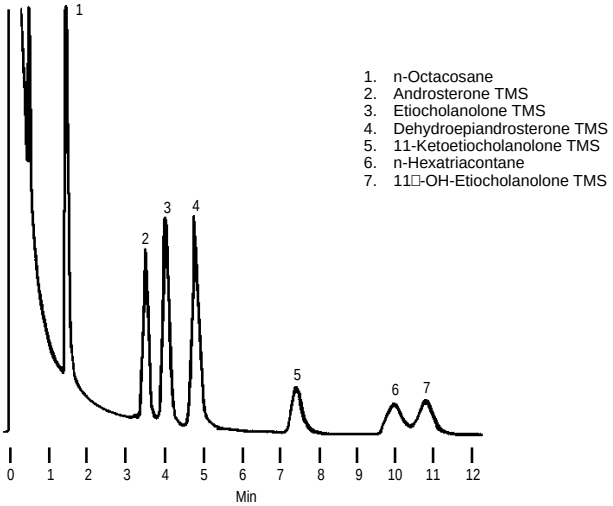
Packing: **3% SP-2250 on 100/120 SUPELCOPORT**
Cat. No.: **11878** (packing)
Column: 3' x 2mm ID glass
Oven: 260°C
Carrier: nitrogen, 20mL/min



795-0257

Figure 176. Ketosteroids

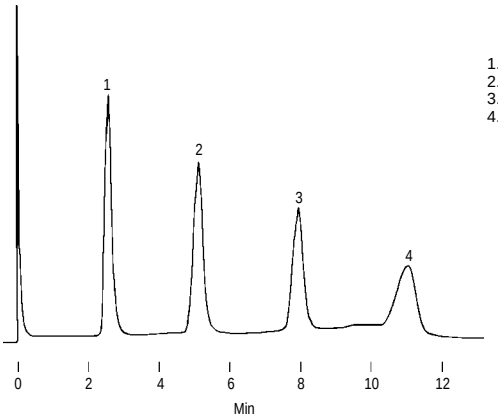
Packing: **3% OV-225 on 80/100 SUPELCOPORT**
Cat. No.: **11957-U** (packing)
Column: 6' x 4mm ID glass
Oven: 250°C
Carrier: nitrogen, 20mL/min



795-0258

Figure 177. Triglycerides

Packing: **1% Dexsil 300 on 100/120 SUPELCOPORT**
Cat. No.: **11972** (packing, 20g/bottle)
Column: 18" x 1/8" stainless steel
Oven: 275°C to 350°C at 8°C/min
Carrier: nitrogen, 20mL/min
Det.: FID, 350°C
Inj.: 1µL chloroform containing 1µg each triglyceride, 325°C

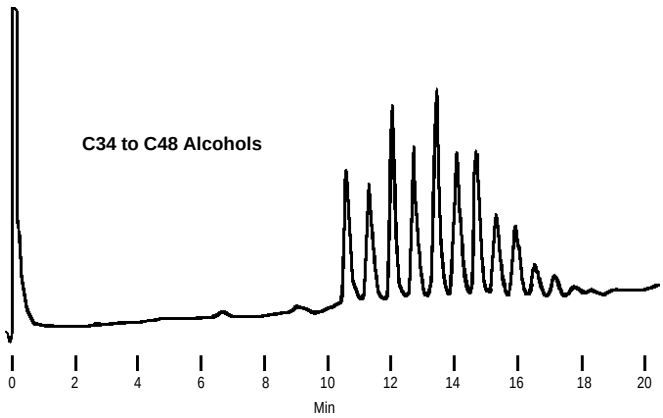


1. Trilaurin
2. Trimyristin
3. Tripalmitin
4. Tristearin

713-0944

Figure 178 Pentaerithritol Esters

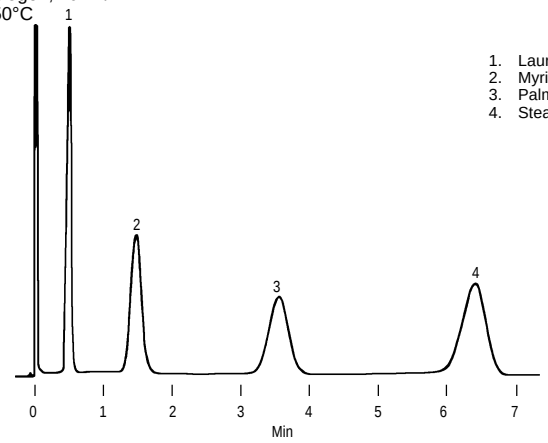
Packing: **1% Dexsil 300 on 100/120 SUPELCOPORT**
Cat. No.: **11972** (packing)
Column: 18" x 1/8" stainless steel
Oven: 125°C to 300°C at 8°C/min
Carrier: nitrogen, 20mL/min
Det.: 350°C



795-0259

Figure 179. Cholesteryl Esters

Packing: **1% Dexsil 300 on 100/120 SUPELCOPORT**
Cat. No.: **11972** (packing)
Column: 18" x 2mm ID glass
Oven: 300°C to 350°C at 6°C/min
Carrier: nitrogen, 40mL/min
Det.: 350°C



1. Laurate
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3. Palmitate
4. Stearate

713-0943

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