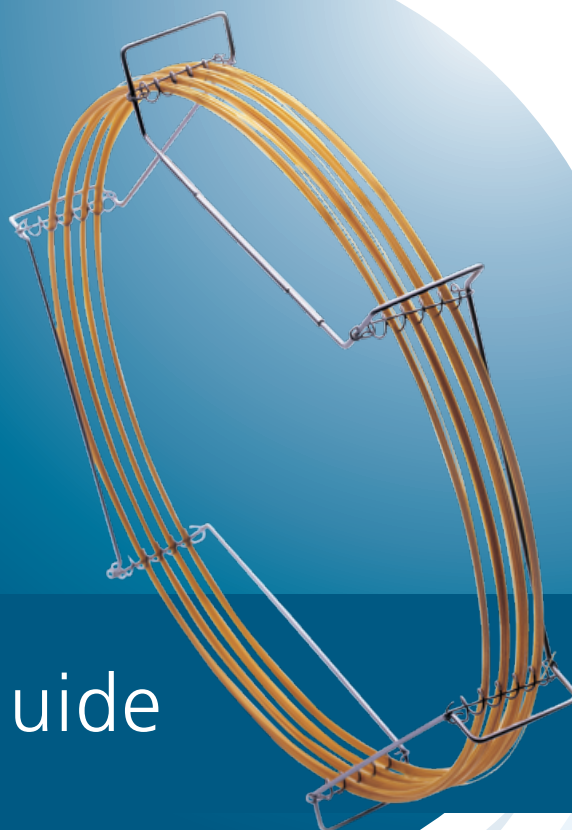




Applications Guide



Environmental



Chemical



Food, Flavors and
Fragrances



Fuels and
Petrochemical

SGE Capillary Columns

SGE Analytical Science

Few companies can claim to be able to provide a total solution for analytical science; SGE is one of those few. From sample preparation, to injection, the separation and throughout the chromatographic process in either LC or GC there is a SGE product that has been designed to provide you with the results you need time and again.

This brochure highlights some of SGE's capabilities in capillary gas chromatography, specifically in the technically demanding area of capillary columns. SGE columns are engineered for consistent separation performance and can be found in many laboratories being tasked to perform everything from routine analyses to the latest R&D challenges.

forte™ GC Capillary Columns

With over 30 year's experience, GC capillary columns truly are SGE's strength, its forte.

SGE is the only independent manufacturer of GC capillary columns that has the skill and technology to control all critical processes from producing the fused silica capillary tubing, through the phase synthesis, to the validation of the performance of each column.

SGE offers a comprehensive range of **forte** GC capillary columns for almost any chromatographic application providing the best possible combination of, Performance, Robustness, Reproducibility, Low Bleed and Inertness.

With this brochure we bring to you a small taste of the applications you might consider running on an SGE GC capillary column. If the application is not in this guide, please visit our website www.sge.com

forte™; Now with added capabilities

SilGuard™ is a new option for the **forte™** line of GC capillary columns, which further enhances column robustness and endurance whilst adding additional analytical capabilities to the standard GC column. It is a unique integrated guard column system, developed using SGE's renowned SilTite™ ferrule technology.

SilGuard™ technology stands to benefit chromatographers by reducing the amount of non volatiles entering the analytical column and as a result, **forte™** columns can now offer enhanced endurance with no loss of sensitivity.

For more information on SilGuard contact you local SGE office, distributor or visit www.sge.com



Silguard equipped GC Capillary Column

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Food, Flavours and Fragrances	12-17
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Fuels and Petrochemical	18-21
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Chemical	22-26
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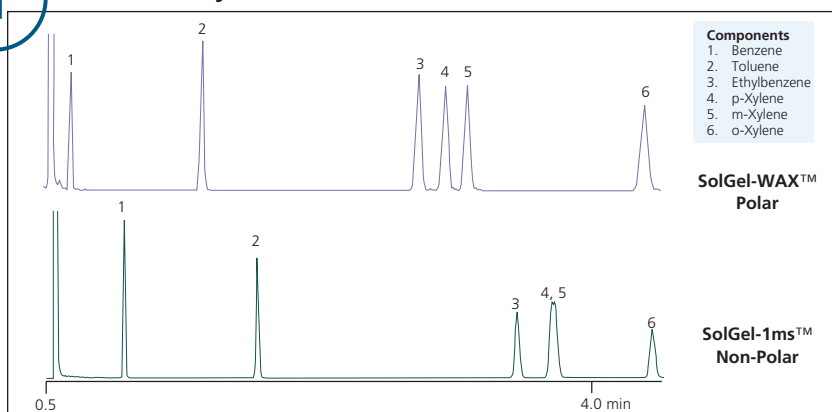
SGE Capillary Column Part Number Listing	27-29
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GC Column Replacement Guide	29
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GC Troubleshooting and Maintenance	30
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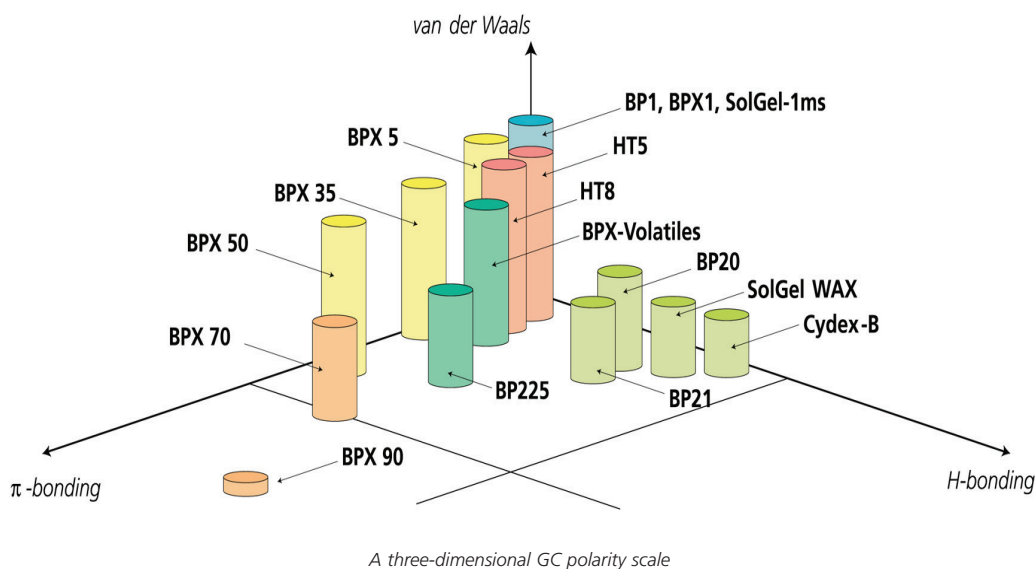
Guidelines for Choosing Columns

1 Stationary Phase

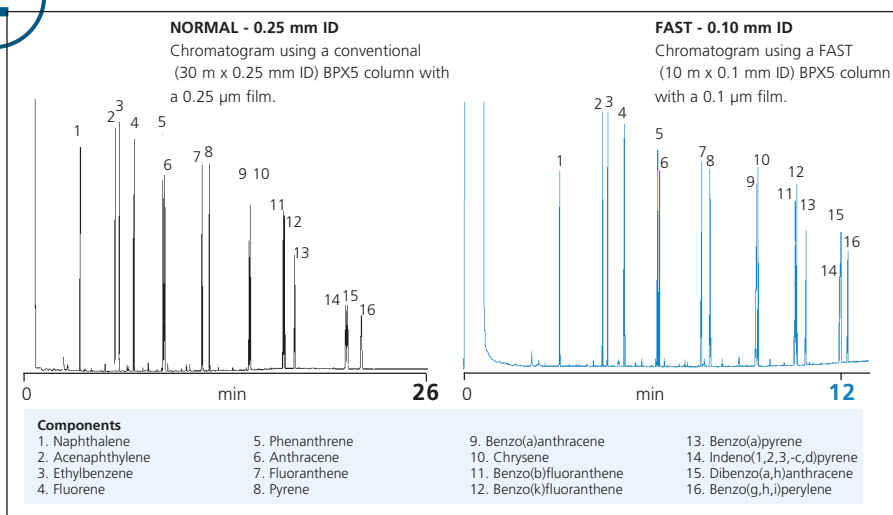


Effect of Stationary Phase. BTEX analysis on a polar (SolGel-WAX™) column and a 100% dimethyl polysiloxane (SolGel-1ms™), both 30 m x 0.25 mm ID x 0.25 µm film.

- Select the least polar phase that will perform the separation you require
- Non-polar stationary phases separate analytes predominantly by order of boiling point.
- Increase the amount of phenyl and/or cyanopropyl content in the phase, and the separation is then influenced more by differences in dipole moments or charge distributions (BP10 (1701), BPX35, BPX50, BP225 & BPX70)
- To separate compounds that differ more in their hydrogen bonding capacities (for example aldehydes and alcohols), polyethylene glycol type phases are best suited - SolGel-WAX™, BP20 (WAX) & BP21 (FFAP)



2 Internal Diameter

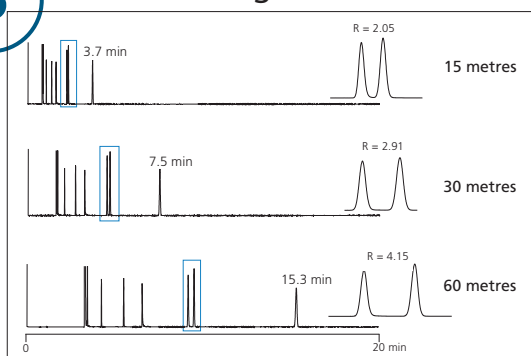


Effect of Internal Diameter. Polynuclear Aromatic Hydrocarbon (PAH) analysis.

- The smaller the diameter the greater the efficiency, hence better resolution. Fast columns (0.1 mm ID) are used for faster analysis because the same resolution can be achieved in a shorter time.

3

Column Length

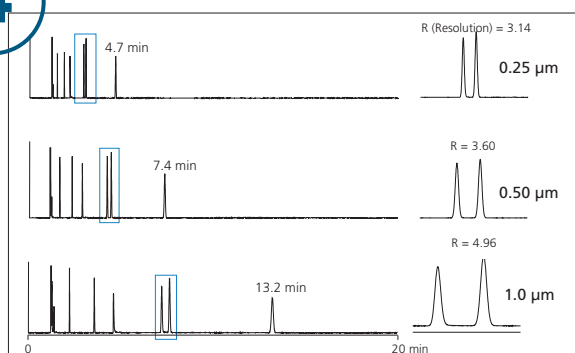


Effect of Length

- Always try to select the shortest column that will provide the required resolution for the application. If the maximum column length available is being used, and resolution of the sample mixture is still inadequate then try changing the stationary phase or internal diameter.
- Resolution is proportional to the square root of the column efficiency. Therefore, doubling the column length will only increase the resolving power of the column by approximately 40%.

4

Film thickness



Effect of Film Thickness.

- For samples with a variation in solute concentration, a thicker film column is recommended. This will reduce the possibility of broad overloaded peaks co-eluting with other compounds of interest. If the separation of two solutes is sufficient and co-elution is still unlikely, even with large differences in concentration, then a thinner film can be used.
- The greater the film thickness the greater the retention of solutes, therefore the higher the elution temperature.

As a rule, doubling the film thickness results in an increase in elution temperature of approximately 15-20 ° under isothermal conditions. Using a temperature program, the increase in elution temperature is slightly less.

$$\beta = \frac{id}{4d_f}$$

where

β = ratio

id = column internal diameter (μm)

d_f = film thickness (μm)

Formula to calculate Phase Ratio

- From the phase ratio value β , a column can be categorized for the type of application it would best suit. The smaller the β value, the greater the ratio of phase to the column inner diameter, making it better suited for analyzing volatile compounds. Columns which have thin films are generally better suited for high molecular weight compounds and are characterized by large β values

PHASE RATIO

Film thickness (μm)	Column ID (mm)					
	0.1	0.15	0.22	0.25	0.32	0.53
0.10	250	-	550	625	800	1325
0.15	-	250	-	-	-	883
0.25	-	150	220	250	320	530
0.50	-	75	110	125	160	265
1.00	-	-	55	63	80	132
3.00	-	-	-	-	27	44
5.00	-	-	-	-	16	26

Above shows the phase ratio (β) available for the SGE range of capillary columns. Keeping a similar phase ratio when changing column internal diameters will ensure that your chromatographic parameters will not need substantial changes.

Recommended Column by Application

Application	PHASE													
	SolGel-1ms BP1	BPX1 BP1-PONA	BPX5 BP5	HT5	HT8	BPX35	BPX-Volatiles BP624	BP10	BPX50	SolGel-WAX™ BP20	BP21	BPX70	CYDEX-B	BPX90
Acidic/Neutral Drugs			●			●								
Acids			●							●	●			
Alcohols			●				●			●	●			●
Amines Aliphatic			●				●			●				
Amines Aromatic			●			●	●			●				
Antidepressants			●			●								
Aromatic -PAH	●		●		●	●			●					●
Aroclors					●									●
Beverages -Alcohols							●			●				
Butter-Fat			●	●										
Chiral - Compounds													●	
Chlorinated Aromatics	●		●			●		●						
Cigarette Lighter Fuel			●				●							
Dioxins			●						●					
Essential Oils			●							●			●	●
Food - FAME			●							●		●		●
Glucose - Methylated												●		
Herbicides	●		●			●			●					
Industrial Solvents							●			●				
Ketones						●	●	●	●	●				
Monomers			●							●				
Nitroaromatics	●		●		●	●		●	●					
Organochlorine Pesticides	●		●		●	●		●	●					●
Organophosphorous Pesticides	●		●			●			●					●
Paraffins	●	●	●	●										
PCB's			●		●									●
Petroleum	●	●	●	●										
Phenols			●			●				●	●			
Phthalates	●		●											●
Plant Sterols			●			●			●					
Polymers	●			●										
Polywax	●		●	●										
Pyrethroids	●		●					●	●					
Racehorse Doping Mixture			●			●								
Sedatives			●			●								
Semivolatiles	●		●			●								●
Silicon Oil				●										
Solvents							●			●				●
Sugars-Alditol Acetates			●							●	●			
Triglycerides			●	●										
TRPH	●		●	●										
Volatiles			●				●			●				
Xylenes	●	●	●	●						●				●

● Indicates recommended phases to be used for the application

● Indicates alternative phases that can be used for the application



Environmental

The widespread use of GC-MS for Environmental analyses requires both low bleed and inertness. The broad range of compounds of interest means that medium polarity phases become more useful. BPX5, BPX35, and BPX50 provide a range of polarities, all with low bleed, high temperature limits, and robustness. Use of the optional SilGuard™ integrated guard column technology with *forte*™ BPX5 capillary GC columns provides additional protection by reducing the amount of non volatiles entering the analytical column.

For specialised applications such as PCBs, SGE's HT8 delivers unique separation capabilities.

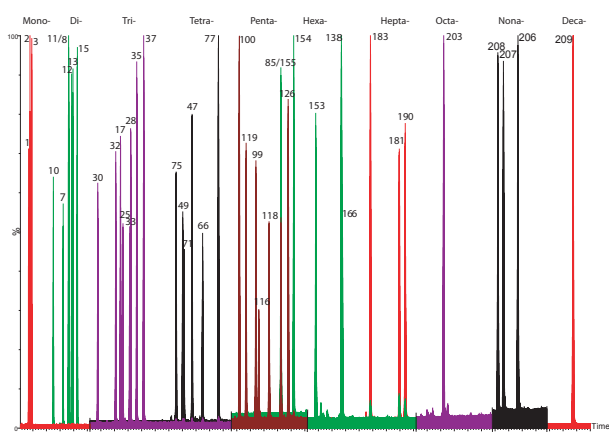
Applications

- [Analysis of PBDE'S, PCDT'S, and other complex mixtures using BPX5 and SolGel-1ms](#)
- [HT8: The perfect PCB Column](#)
- [Fast Pesticide Screening using a BPX5 GC Capillary Column](#)
- [Analysis of Polychlorinated Dibenzodioxins & Furans on BPX5](#)
- [Analysis of Polynuclear Aromatic Hydrocarbons on BPX35](#)
- [Analysis of Polynuclear Aromatic Hydrocarbons on BPX5](#)
- [Analysis of Volatile Organic Pollutants on BPX-Volatiles](#)
- [Applications using BPX90](#)
- [Analysis of Volatiles in Drinking Water on 25 m BP624 Column](#)
- [Polychlorinated Biphenyls PCB Analysis](#)



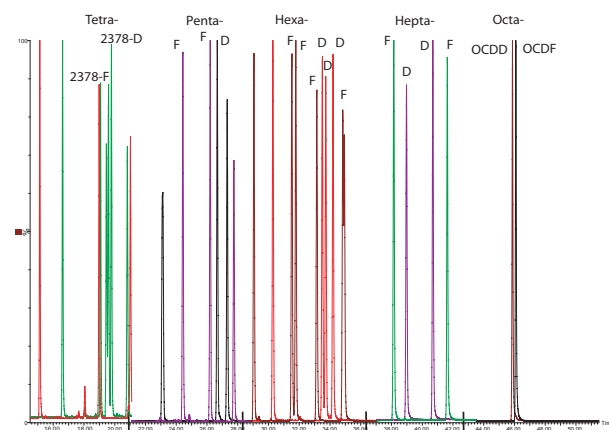


ANALYSIS OF PBDE'S, PCDT'S, AND OTHER COMPLEX MIXTURES USING BPX5 AND SOLGEL-1ms



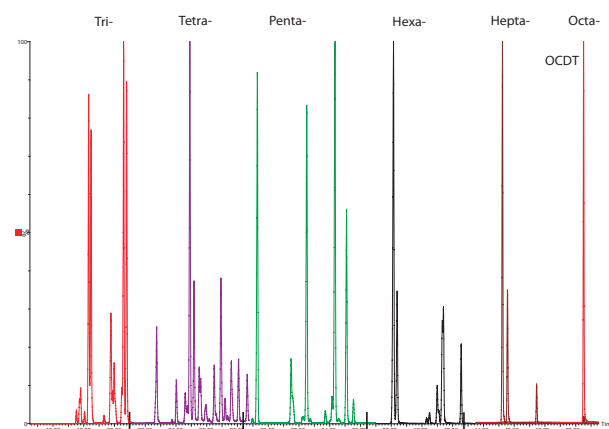
SIM 7-Group Analysis of 44 mono- to deca-PBDE's via cool-on-column (3- μ L). Deca-PBDE 209 at 310 °C, PBDEs 33/28 and 138/166 partially resolved, PBDE 85 coeluted with 155.

- 44 Mono-Deca-PBDEs
- 6890 GC/Autospec HRMS
- Cool-on-column inlet
- (No liner but 0.53 mm retention gap)
- 12.5 m BPX5 0.15 mm ID 0.1 μ m
- 0.25 m 0.53 mm ID plus
- 2 m 0.25 mm retention gaps
- He programmed 245-415 kPa
- 150 °C-315 °C @ 3 °C/min



SIM 2-Group Analysis for non-o-PCBs. Tetra-PCB's 77 and 81 (A) are resolved from residual o-PCB's (97, 87, 110, and 136). Penta-126 (B), and hexa-169 (C) also detected in eluate 2-basic alumina of DX-3 QC sediment extract (5 of 500 μ L) Ion chromatograms (not smoothed). PBDE's are in same eluate (Peterman et al., 2006). Tetra-PBDE 47 from (M-2 Br)+ incidentally detected (B); 0.3 ng/g near lab background.

- Dioxin-like non-ortho PCBs
- HP 5890A GC/VG 70S HRMS
- Heated (275 °C) Direct inlet
- 4 mm Siltek Cyclo-Uniliner
- 30 m SolGel-1ms 0.15 mm ID 0.1 μ m
- 2.5 m x 0.25 mm ID retention gap
- He constant at 415 kPa
- 155 °C (1 min) - 205 °C @ 1.8 °C/min then to 310 °C @ 3.6 °C/min



ACKNOWLEDGEMENT

Paul H. Peterman, US Geological Survey, Columbia Environmental Research Center. For additional information see SGE application note AN-0030-C.

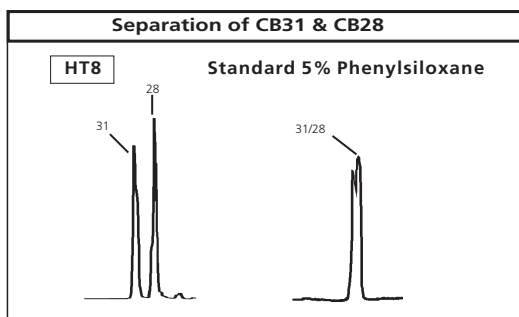
EXPERT TIP

SGE liners undergo a high temperature de-activation process making them ideal for using with active compounds



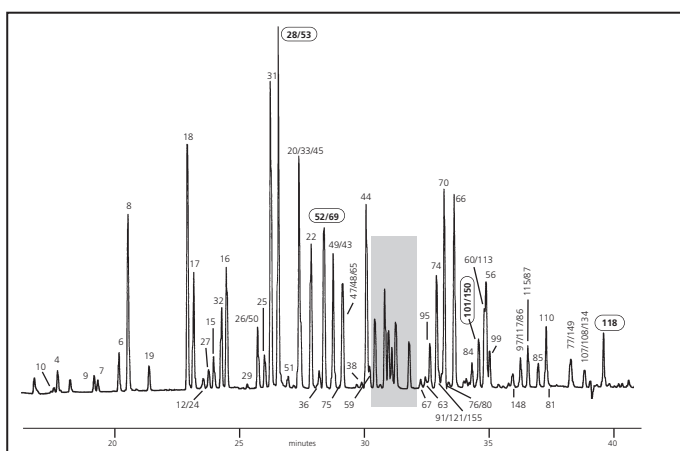


HT8: THE PERFECT PCB COLUMN



Chromatogram on the left demonstrates clearly the significant difference in selectivity of the HT8 column. By GC/MS, quantitation of CB28 using a standard 5% phenylpolysiloxane column is impossible as coelution with CB31 (with the same number of chlorines) occurs.

HT8 separates the two congeners by a full minute allowing quantitation to be performed with ease.



AROCLO 1242

Phase:

Column:

Initial Temp:

Rate 1:

Temp 2:

Rate 2:

Final Temp:

Carrier Gas:

Detector:

HT8, 0.25 µm film

50 m x 0.22 mm ID

80 °C, 2 min

30 °C/min

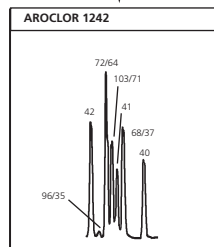
170 °C

3 °C/min

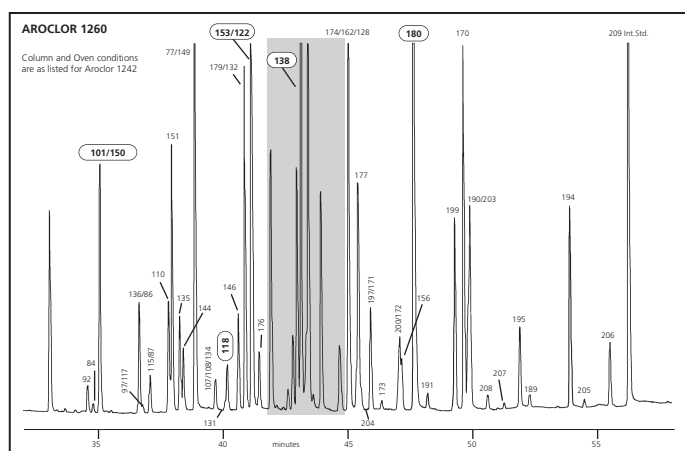
Split, 300 °C

He, 40 psi

ECD, 330 °C

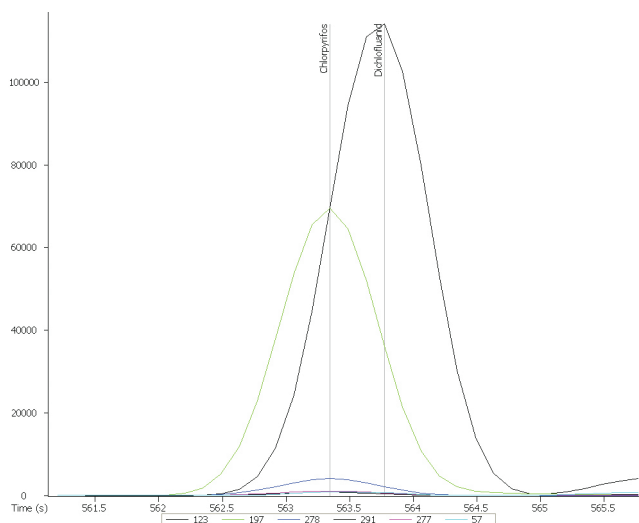
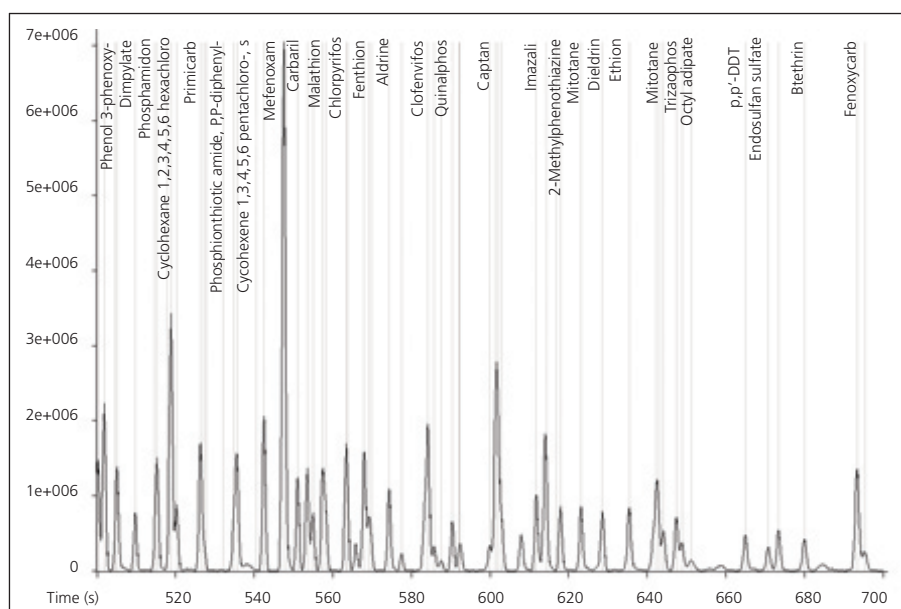
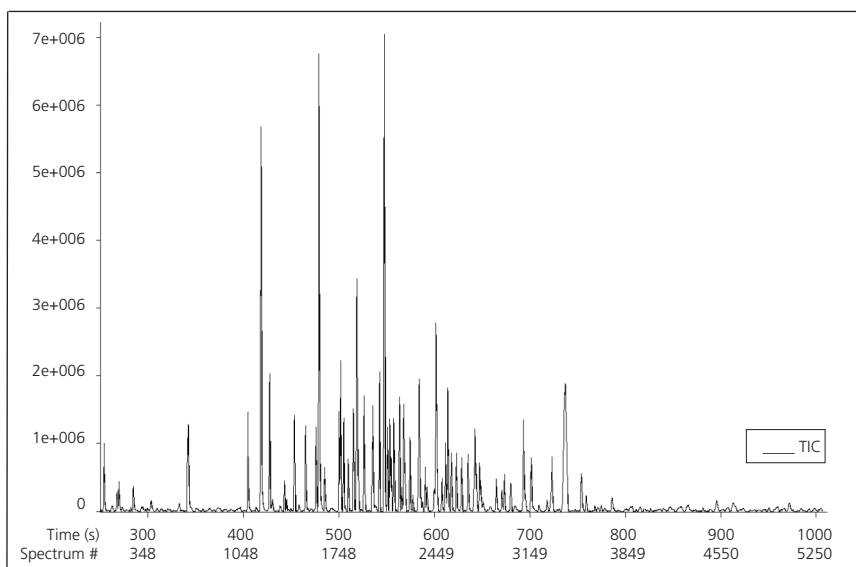


Congener #	Cl Position	Cl #	Identification by GC/MS
42	23-24	4	✓
96	236-26	5	✓
35	34-3	3	✓
64	235-4	4	✗
72	25-35	4	✗
103	246-25	5	✓
71	26-34	4	✓
41	234-2	4	✓
68	24-35	4	✓
37	34-4	3	✓
100	246-24	5	✓





FAST PESTICIDE SCREENING USING A BPX5 GC CAPILLARY COLUMN



ACKNOWLEDGEMENT

SGE would like to thank Prof. Jana Hajšlová and Jakub Schurek from VSCHT (Prague, CZ) for providing these chromatograms.

Phase:

Column:

Initial Temp:

Rate 1:

Final Temp:

Detector Type:

Carrier Gas:

Carrier Gas Flow:

Average Linear Velocity:

Injection Mode:

Injection Temperature:

Total run time:

Detector voltage:

Data acquisition speed:

Part No.:

SGE *forte* BPX5DX

40 m x 0.18 mm ID x 0.18 µm

80 °C, 1 min

25 °C/min to 300 °C

300 °C, 7 min

LECO™ TOF Mass spectrometer

He

constant flow mode at 1 mL/min

~75 cm/sec

splitless

270 °C

16.8 min

1700 V

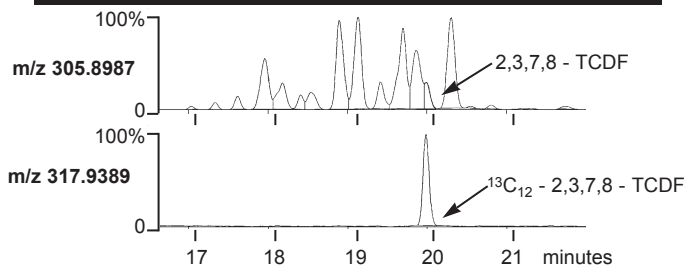
10 Hz

054229

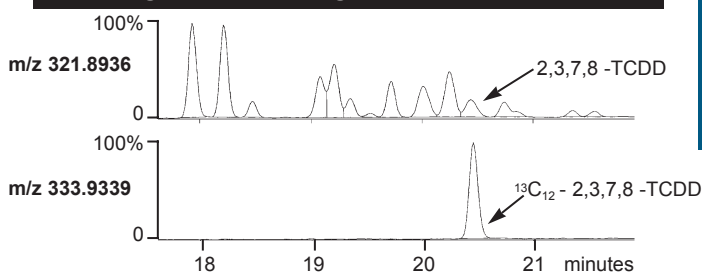


ANALYSIS OF POLYCHLORINATED DIBENZODIOXINS & FURANS ON BPX5

Single Ion Chromatograms of TCDF Isomers



Single Ion Chromatograms of TCDD Isomers



Phase:

Column:

Initial Temp:

Rate 1:

Temp1:

Rate 2:

Temp 2 :

Rate 3:

Final Temp:

Detector:

Part No.:

BPX5, 0.25 μ m

50 m x 0.22 mm ID

80 °C

10 °C/min

240 °C

2 °C/min

280 °C

10 °C/min

320 °C

Mass Spectrometer

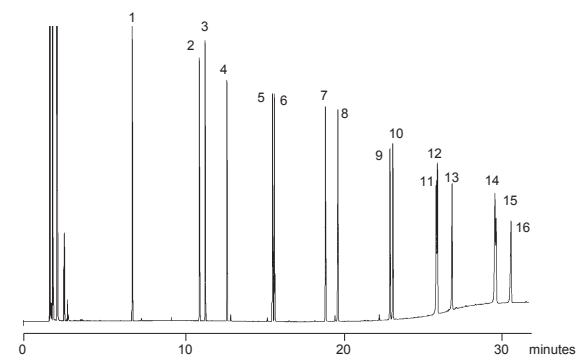
054114

EXPERT TIP

Remember : the lower the temperature, the longer your column will last.

SGE wishes to acknowledge Dr P.Ambridge, Dr A.Fernandes and C.Brook at AEA Technology, Harwell, U.K.

ANALYSIS OF POLYNUCLEAR AROMATIC HYDROCARBONS ON BPX35



Components

1. Naphthalene
2. Acenaphthylene
3. Acenaphthene
4. Fluorene
5. Phenanthrene
6. Anthracene
7. Pyrene
8. Fluoranthene
9. Benzo (a) anthracene

10. Chrysene
11. Benzo (b) fluoranthene
12. Benzo (k) fluoranthene
13. Benzo (a) pyrene
14. Indeno (1,2,3 -c,d)pyrene
15. Dibenzo (a,h) anthracene
16. Benzo (g,h,i) perylene

Phase:

Column:

Initial Temp:

Rate:

Final Temp:

Carrier Gas:

Detector:

Part No.:

BPX35, 0.25 μ m

30 m x 0.22 mm ID

100 °C, 1 min

10 °C/min

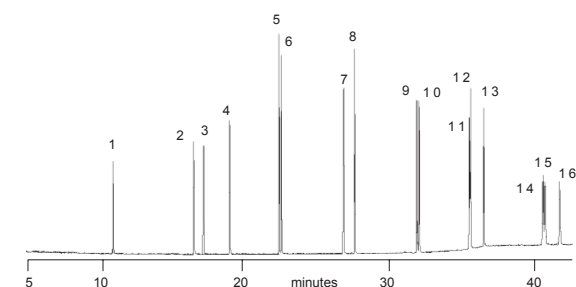
360 °C, 10 min

He, 25 psi

FID 380 °C

054714

ANALYSIS OF POLYNUCLEAR AROMATIC HYDROCARBONS ON BPX5



Components

(0.5ng each component)

1. Naphtalene
2. Acenaphthylene
3. Acentaphthene
4. Fluorene
5. Phenanthrene
6. Anthracene
7. Pyrene
8. Fluoranthene

9. Chrysene
10. Benzo (a) anthracene
11. Benzo (b) fluoranthene
12. Benzo (k) fluoranthene
13. Benzo (a) pyrene
14. Indeno (1,2,3 -c,d)pyrene
15. Dibenzo (a,h) anthracene
16. Benzo (g,h,i) perylene

Polynuclear Aromatic Hydrocarbons (EPA 625 PAHs)

Phase:

Column:

Initial Temp:

Rate:

Final Temp:

Carrier Gas:

Detector:

Carrier Gas:

Part No.:

BPX5, 0.25 μ m film

25 m x 0.22 mm ID

50 °C, 2 min

8 °C/min

290 °C, 10 min

HP5971 MSD

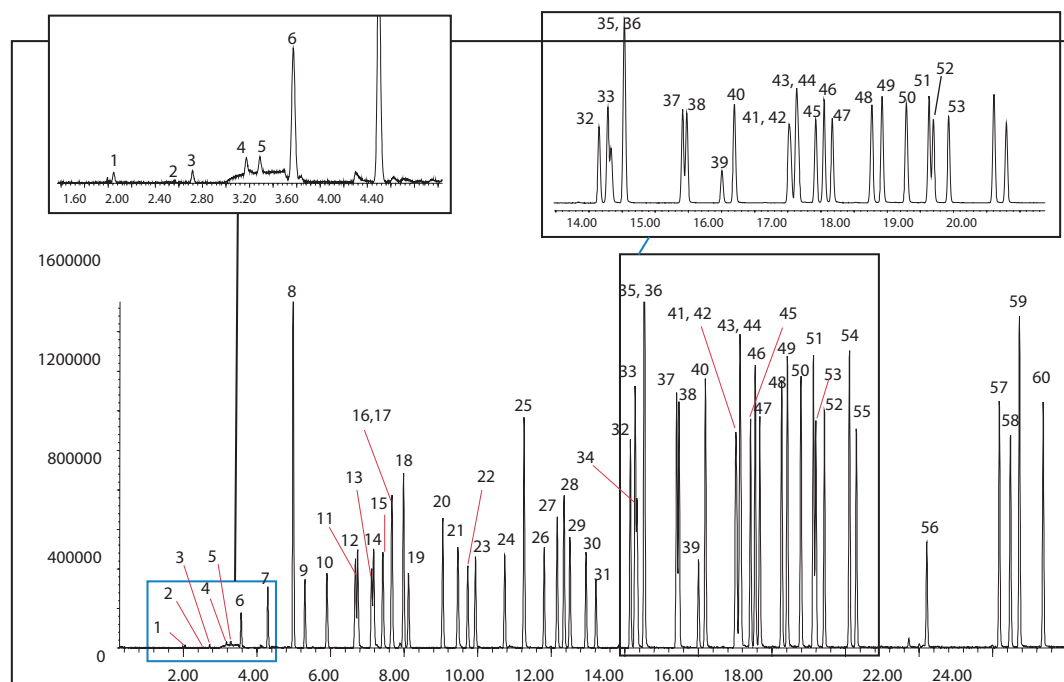
Split 40:1

He, 15 psi

054113



ANALYSIS OF VOLATILE ORGANIC POLLUTANTS ON BPX-VOLATILES



Chromatogram showing analysis of commonly screened volatile organic pollutants

Components

1. Dichlorodifluoromethane	31. 1,2-Dibromomethane
2. Chloromethane	32. Chlorobenzene
3. Vinyl chloride	33. Ethylbenzene
4. Bromomethane	34. 1,1,2-Dibromochloromethane
5. Chloromethane	35. p-Xylene
6. Trichlorofluoromethane	36. m-Xylene
7. 1,1-Dichloroethene	37. o-Xylene
8. Dichloromethane	38. Styrene
9. trans-1,2-Dichloroethene	39. Bromoform
10. 1,1-Dichloroethane	40. Isopropylbenzene
11. 2,2-Dichloropropane	41. Bromobenzene
12. cis-1,2-Dichloroethene	42. 1,1,2,2-Tetrachloroethane
13. Bromochloromethane	43. 1,2,3-Trichloropropane
14. Chloroform	44. n-Propyl benzene
15. 1,1,1-Trichloroethane	45. 2-Chlorotoluene
16. 1,1-Dichloropropene	46. 1,3,5-Trimethylbenzene
17. Carbon tetrachloride	47. 4-Chlorotoluene
18. Benzene	48. tert-Butylbenzene
19. 1,2-Dichloroethane	49. 1,2,4-Trimethylbenzene
20. Trichloroethene	50. sec-Butylbenzene
21. 1,2-Dichloropropane	51. 1,3-Dichlorobenzene
22. Dibromomethane	52. p-Isopropyltoluene
23. Bromodichloromethane	53. 1,2-Dichlorobenzene
24. cis-1,3-Dichloropropene	54. n-Butylbenzene
25. Toluene	55. 1,4-Dichlorobenzene
26. trans-1,3-Dichloropropene	56. 1,2-Dibromo-3-chloropropane
27. 1,1,2-Trichloroethane	57. 1,2,4-Trichlorobenzene
28. Tetrachloroethene	58. Hexachlorobutadiene
29. 1,3-Dichloropropane	59. Naphthalene
30. Dibromochloromethane	60. 1,2,3-Trichlorobenzene

Phase:

502.2 mix:

Column:

Initial Temp:

Rate 1:

Rate 2:

Final Temp:

Detector Type:

Carrier Gas:

Carrier Gas Flow :

Constant Flow:

Average Linear Velocity:

Injection Mode:

Split Ratio:

Injection Volume:

Injection Temperature:

Autosampler:

Liner Type :

Liner Part Number:

Column Part Number:

ms-NoVent™Part No:

HP5973 restrictor:

Full scan:

BPX-Volatiles 1 µm film

200 ppm in Methanol

40 m x 0.18 mm ID

40 °C , 0 min

6 °C to 210 °C

15 °C to 240 °C

240 °C, 5 min

Mass Spectrometer

He, 40.3 psi

1.2 mL/min

On

35 cm/sec at 40 °C

Split

50:1

1 µL

250 °C

No

4 mm ID Single Taper Liner

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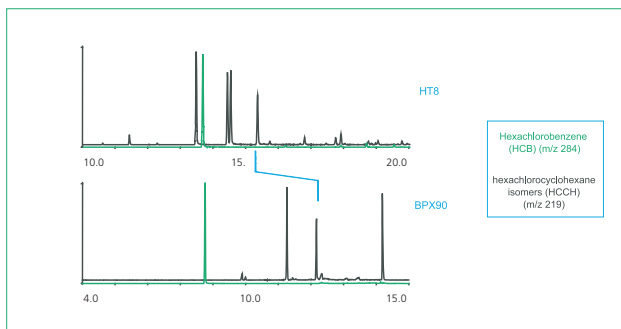
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113409

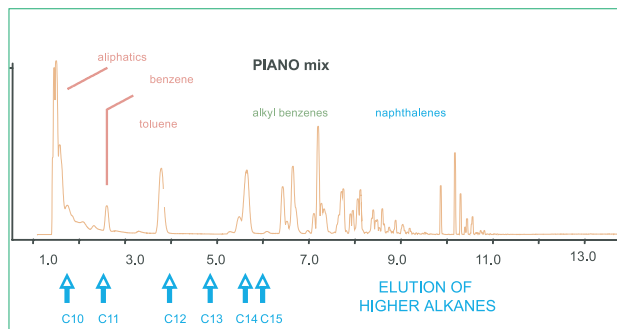
45-450 m/z



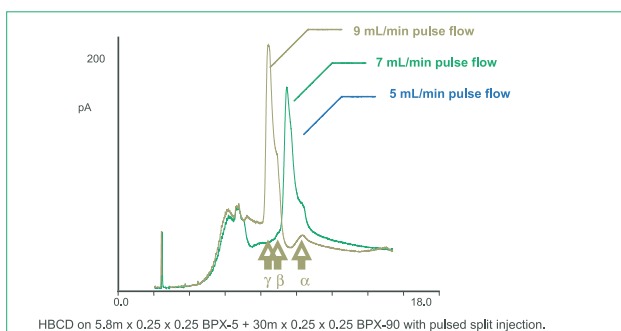
APPLICATIONS USING BPX90



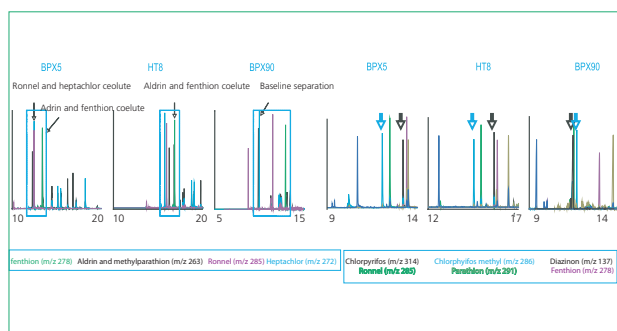
HCCH isomers and HCB



Separation of aromatics

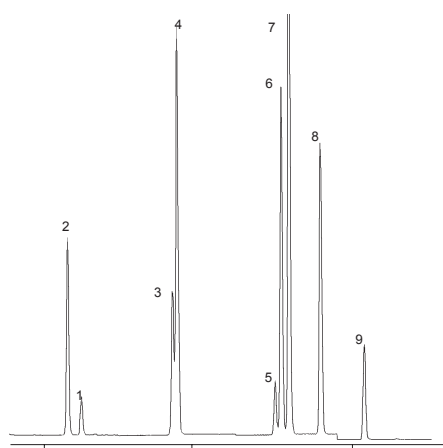


Separation of hexabromocyclododecanes



Selectivity for pesticides & thiophosphate esters

ANALYSIS OF VOLATILES IN DRINKING WATER ON 25 M BP624 COLUMN



Components

1. Difluorobenzene
2. Benzene
3. Toluene - (d8)
4. Toluene
5. Chlorobenzene - (d5)
6. Ethyl benzene
7. p- & m-Xylene
8. o-Xylene
9. Bromofluorobenzene



VOLATILES IN DRINKING WATER

Phase:	BP624, 1.2 μ m
Column:	25 m x 0.22 mm ID
Initial Temp:	50 $^{\circ}$ C, 2 min
Rate:	15 $^{\circ}$ C/min
Final Temp:	170 $^{\circ}$ C
Detector:	HP5970 MSD
Injection Mode:	Hexadecane extract
Carrier Gas:	He, 15 psi
Part No.:	054826

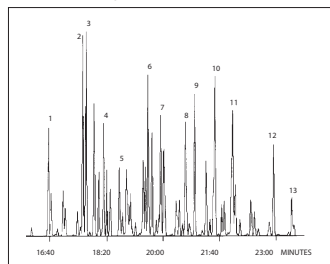
EXPERT TIP

Condition column at either 20 $^{\circ}$ above the maximum method temperature or the recommended maximum column temperature (whichever is lower).



POLYCHLORINATED BIPHENYLS PCB ANALYSIS

GC/MS Analysis of PCB mixture



Components

1. PCB 18
2. PCB 31
3. PCB 28
4. PCB 52
5. PCB 44
6. PCB 70
7. PCB 101
8. PCB 110
9. PCB 149
10. PCB 153
11. PCB 138
12. PCB 180
13. PCB 170

Phase:

Column:

Initial Temp:

Rate:

Final Temp:

Detector:

Injection Mode:

Carrier Gas:

HT8, 0.25 μ m

25 m x 0.22 mm ID

60 °C, 2 min

12 °C/min

360 °C, 10 min

Ion Trap MS

PTV

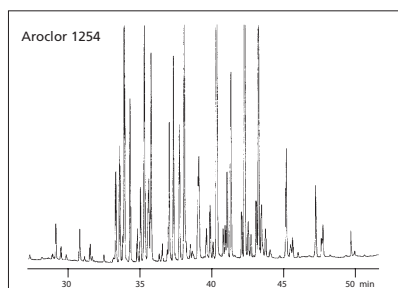
He, 15 psi

Performance Specifications

HT8 8% Phenyl (Equiv) Polycarborane - Siloxane

Minimum Operating Temp.: -20 °C

Maximum Cycling Temp.: 370 °C (Polyimide)



Phase:

Column:

Initial Temp:

Rate 1:

Temp 1:

Rate 2:

Temp 2:

Detector:

Carrier Gas:

HT8, 0.25 μ m

50 m x 0.22 mm ID

60 °C

40 °C/min

200 °C

3 °C/min

320 °C

ECD

He, 40 psi

PCB ANALYSIS

Phase:

Column:

Initial Temp:

Rate 1:

Temp 1:

Rate 2:

Temp 2:

Rate 3:

Temp 3:

Carrier Gas:

Detector:

HT8, 0.25 μ m film

50 m x 0.22 mm ID

90 °C, 1 min

20 °C/min

170 °C, 7.5 min

3.5 °C/min

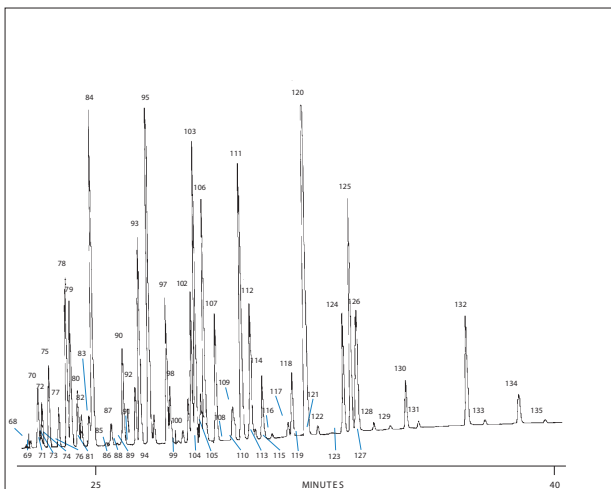
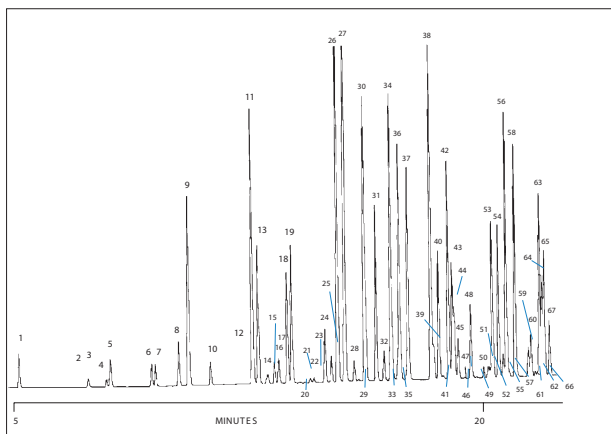
285 °C

20 °C/min

320 °C

H₂, 43 cm/sec

ECD



Components

- | | | | |
|-----------------|---------------|-----------------|--------------|
| 1. PCB1 | 41. PCB835 | 80. PCB144 | 119. PCB157 |
| 2. PCB2 | 42. PCB864 | 81. PCB147 | 120. PCB180 |
| 3. PCB3 | 43. PCB71/103 | 82. PCB135 | 121. PCB193 |
| 4. PCB10 | 44. PCB41 | 83. PCB77/82 | 122. PCB191 |
| 5. PCB4 | 45. PCB37 | 84. PCB149 | 123. PCB198 |
| 6. PCB9 | 46. PCB68 | 85. PCB124 | 124. PCB199 |
| 7. PCB7 | 47. PCB100 | 86. PCB143 | 125. PCB170 |
| 8. PCB6 | 48. PCB40 | 87. PCB134/ | 126. PCB190/ |
| 9. PCB 8/5 | 49. PCB57 | 107/131 | 196/203 |
| 10. PCB19 | 50. PCB67 | 88. PCB123 | 127. PCB169 |
| 11. PCB18 | 51. PCB63 | 89. PCB133 | 128. PCB208 |
| 12. PCB11 | 52. PCB102 | 90. PCB118 | 129. PCB207 |
| 13. PCB17 | 53. PCB95 | 91. PCB165 | 130. PCB195 |
| 14. PCB13 | 54. PCB74 | 92. PCB143/114 | 131. PCB189 |
| 15. PCB24 | 55. PCB121/ | 93. PCB132/179 | 132. PCB194 |
| 16. PCB27 | 155/91 | 94. PCB122 | 133. PCB205 |
| 17. PCB15 | 56. PCB70 | 95. PCB153 | 134. PCB206 |
| 18. PCB32 | 57. PCB80 | 96. PCB176 | 135. PCB209 |
| 19. PCB16 | 58. PCB66 | 97. PCB141 | |
| 20. PCB54 | 59. PCB96/55 | 98. PCB105 | |
| 21. PCB23 | 60. PCB84/92 | 99. PCB137 | |
| 22. PCB34 | 61. PCB125 | 100. PCB130 | |
| 23. PCB29 | 62. PCB90 | 101. PCB178 | |
| 24. PCB26 | 63. PCB101 | 102. PCB163 | |
| 25. PCB25 | 64. PCB60 | 103. PCB138 | |
| 26. PCB31 | 65. PCB56 | 104. PCB160 | |
| 27. PCB8/53 | 66. PCB152 | 105. PCB158/175 | |
| 28. PCB51 | 67. PCB99 | 106. PCB187/182 | |
| 29. PCB21 | 68. PCB119 | 107. PCB183/129 | |
| 30. PCB33/45/20 | 69. PCB83 | 108. PCB126 | |
| 31. PCB22 | 70. PCB136 | 109. PCB185 | |
| 32. PCB46 | 71. PCB86 | 110. PCB159/202 | |
| 33. PCB36 | 72. PCB97 | 111. PCB174/128 | |
| 34. PCB52/69 | 73. PCB89 | 112. PCB177/201 | |
| 35. PCB43 | 74. PCB115 | 113. PCB167 | |
| 36. PCB49 | 75. PCB87 | 114. PCB171 | |
| 37. PCB47/48/75 | 76. PCB154 | 115. PCB197 | |
| 38. PCB44 | 77. PCB85 | 116. PCB173 | |
| 39. PCB59 | 78. PCB10/81 | 117. PCB200 | |
| 40. PCB42 | 79. PCB151 | 118. PCB156/172 | |

Part Number:
054676



Food, Flavours and Fragrances

GC analysis in the Food, Flavours and Fragrances area covers a diverse range of compounds that vary in both polarity and boiling point. As a consequence a range of different columns are often required. Chromatograms are often complex, and any single column may not give enough separation of all of the compounds that may be present. Pairs of columns such as BPX5 and SolGel-WAX™ may be used to overcome this problem.

For specific classes of compounds such as fatty acids, specialised columns are often necessary. Short chain fatty acids may be analyzed as free acids on the Nitroterephthalic acid (TPA) modified Polyethylene Glycol BP21 phase. Longer chain fatty acids are usually analyzed as fatty acid methyl esters on wax phases such as BP20 and SolGel-WAX™, or for more demanding applications, BPX70 or BPX90.

Applications

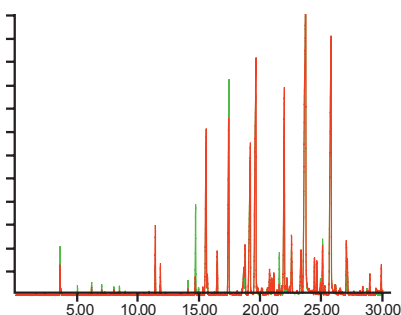
- Comparison of Geranium Oils on SolGel-WAX™
- Analysis of Eucalyptus Oil on SolGel-WAX™
- Analysis of Lavender Oil on Cydex-B
- Analysis of Lavender Oil on BPX-5
- Analysis of Tasmanian Lavender Oil on SolGel-WAX™
- Analysis of Wine on BP20
- Analysis of Scotch Whisky on BP20
- Analysis of Teatree oil on BPX5
- Analysis of Omega-3 Fatty Acids using BPX70
- BPX90 – a Highly Polar Phase for FAME Analysis
- Analysis of PUFA-1 Marine FAME on BPX70
- Analysis of PUFA-2 Animal FAME on BPX70
- Analysis of PUFA-1 Marine FAME on BPX70



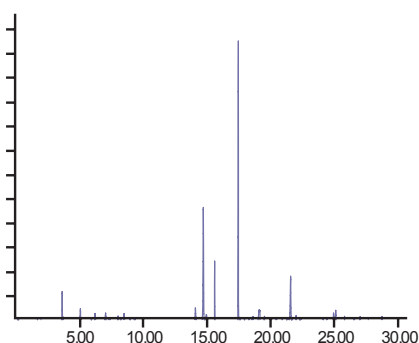


Food, Flavours and Fragrances

COMPARISON OF GERANIUM OILS ON SOLGEL-WAX™



Comparison of total ion chromatograms (TIC) for Geranium oils from Reunion Island (green trace) and South Africa (red trace).



Subtraction of the two TIC chromatograms shows the difference between the two essential oils.

EXPERIMENTAL CONDITIONS

Column:	SGE <i>forte</i> SolGel-WAX™, 30 m x 0.25 mm x 0.25 µm (SGE P/N 054796)
Temperature Program:	60 °C for 3 min, then 4 °C/min to 220 °C
Carrier Gas:	He
Flow:	0.6 mL/min
Injection Volume	0.3 µL split ratio 30:1
Injection temp:	250 °C
Liner:	SGE P/N 092019 single tapered with quartz wool

ACKNOWLEDGEMENT

We thank M. Bernet and M. Didtsch of the ISIPCA Group, Research and Studies Centre for Fragrance, Cosmetics and Food Flavours, France, for providing these chromatograms. For more information see SGE application note AN-0020-C.

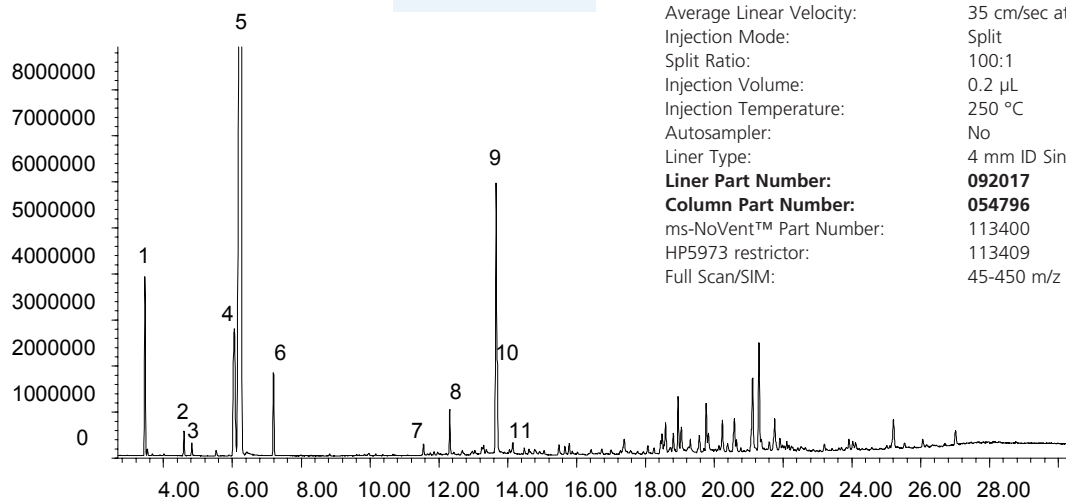
ANALYSIS OF EUCALYPTUS OIL ON SOLGEL-WAX™

ACKNOWLEDGEMENT

SGE would like to thank Masterfoods UK for supplying chromatographic conditions for this chromatogram. For more information see SGE technical poster TP-0100-C.

Components

1. α -Pinene
2. β -Pinene
3. Sabinene
4. Limonene
5. 1,8-Cineole
6. p-Cymene
7. Linalool L
8. Terpinen-4-ol
9. α -Terpineol
10. α -Terpinenyl acetate
11. d-Carvone



Phase:

Sample:

Column:

Initial Temp: 40 °C, 1 min

Rate 1:

Final Temp: 8 °C/min to 220 °C

Detector Type:

Carrier Gas: Mass Spectrometer

Carrier Gas Flow: He, 25.7 psi

Constant Flow: 1.8 mL/min

Average Linear Velocity:

Injection Mode: On

Split Ratio:

Injection Volume: 35 cm/sec at 40 °C

Injection Temperature:

Autosampler: Split

Liner Type: 100:1

Liner Part Number: 0.2 µL

Column Part Number: 250 °C

ms-NoVent™ Part Number:

HP5973 restrictor:

Full Scan/SIM:

SolGel-WAX™, 0.25 µm film

Neat

30 m x 0.25 mm ID

40 °C, 1 min

8 °C/min to 220 °C

220 °C, 5 min

Mass Spectrometer

He, 25.7 psi

1.8 mL/min

On

35 cm/sec at 40 °C

Split

100:1

0.2 µL

250 °C

No

4 mm ID Single Taper Liner

092017

054796

113400

113409

45-450 m/z



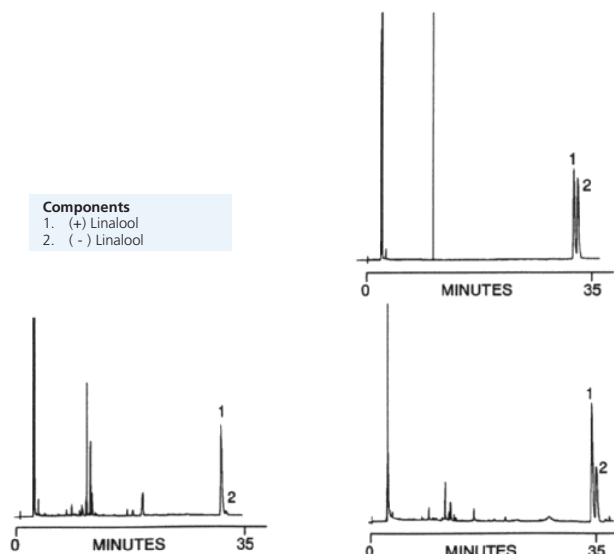
Montluçon - 211 bis avenue J.F.Kennedy
BP 1140 - 03103 Montluçon cedex
Tél. (33) (0)4 70 03 88 55 - Fax (33) (0)4 70 03 82 60
www.interchim.com - interchim@interchim.com



ANALYSIS OF LAVENDER OIL ON CYDEX-B

Components

1. (+) Linalool
2. (-) Linalool



EXPERT TIP

Better resolution is often obtained from chiral columns by using lower temperatures and higher carrier gas velocities than for conventional columns.

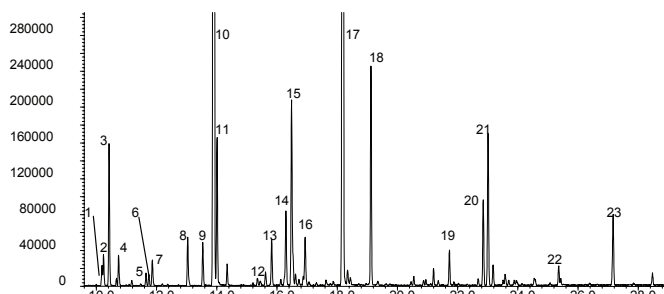
LAVENDER OIL

Phase: CYDEX-B, 0.25 μ m film
Column: 50 m x 0.22 mm ID
 Initial Temp: Isothermal at 90 °C
 Final Temp: FID
 Detector: 32 x 10⁻¹² AFS
 Injection Mode: Split
 Part No.: 054901

ANALYSIS OF LAVENDER OIL ON BPX5

Components

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



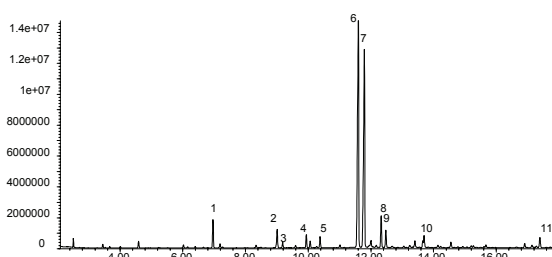
Phase: BPX5, 0.25 μ m film
Lavender Oil: Lavender Oil in ethanol
Column: 30 m x 0.25 mm ID
 Initial Temp: 40 °C, 1 min
 Rate 1: 5 °C/min to 260 °C
 Final Temp: 260 °C
 Detector Type: Mass Spectrometer
 Carrier Gas: He, 7.0 psi
 Carrier Gas Flow: 1.0 mL/min
 Constant Flow: On
 Average Linear Velocity: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

ANALYSIS OF TASMANIAN LAVENDER OIL SOLGEL-WAX™



Components

1. 3-Octanone
2. Octenyl acetate
3. Octanol
4. cis Linalool oxide
5. trans Linalool oxide
6. Linalool L
7. Linalyl acetate
8. Terpinen-4-ol
9. Lavandulyl acetate
10. Borneol L
11. Caryophyllene oxide

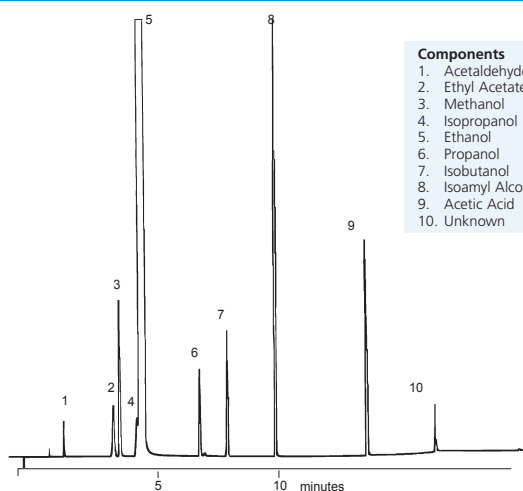


Phase: SolGel-WAX™, 0.25 μ m film
Sample: Neat
Column: 30 m x 0.25 mm ID
 Initial Temp: 40 °C, 1 min
 Rate 1: 8 °C/min to 220 °C
 Final Temp: 220 °C, 5 min
 Detector Type: Mass Spectrometer
 Carrier Gas: He, 25.7 psi
 Carrier Gas Flow: 1.8 mL/min
 Constant Flow: On
 Average Linear Velocity: 35 cm/sec at 40 °C
 Injection Mode: Split
 Split Ratio: 100:1
 Injection Volume: 0.2 μ L
 Injection Temperature: 250 °C
 Autosampler: No
 Liner Type: 4 mm ID Single Taper Liner
Liner Part Number: 092017
Column Part Number: 054796
 ms-NoVent™ Part Number: 113400
 HP5973 restrictor: 113409
 Full Scan/SIM: 45-450 m/z



Food, Flavours and Fragrances

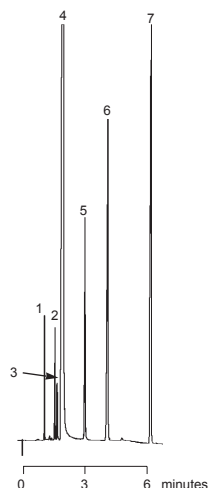
ANALYSIS OF WINE ON BP20



- Components**
1. Acetaldehyde
 2. Ethyl Acetate
 3. Methanol
 4. Isopropanol
 5. Ethanol
 6. Propanol
 7. Isobutanol
 8. Isoamyl Alcohol
 9. Acetic Acid
 10. Unknown

Phase: BP20, 1.0 μ m
Column: 25 m x 0.32 mm ID
 Initial Temp: 40 °C, 2 min
 Rate 1: 5 °C/min
 Temp 2: 50 °C
 Rate 2: 15 °C/min
 Final Temp: 190 °C
 Carrier Gas: H₂, 6 psi
 Injection Mode: 2 μ L
Part No.: 054442

ANALYSIS OF SCOTCH WHISKY ON BP20



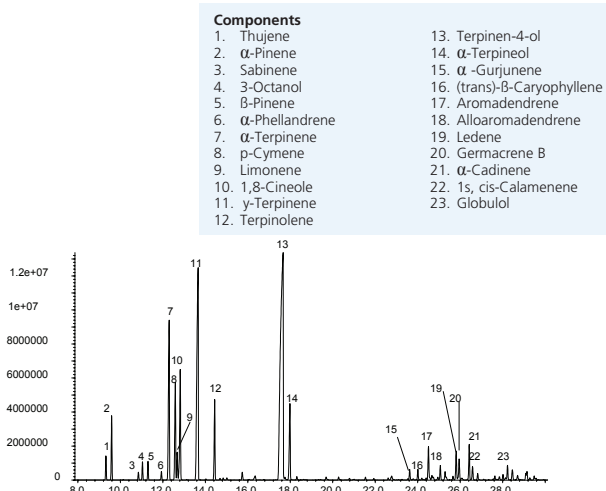
- Components**
1. Acetaldehyde
 2. Ethyl Acetate
 3. Methanol
 4. Ethanol
 5. Propan-1-ol
 6. 2-Methylpropan-1-ol
 7. 2-Methylbutan-1-ol+3-Methylbutan-1-ol

EXPERT TIP

For extended life of polar columns, always use an oxygen trap in the carrier gas line.

Phase: BP20, 1.0 μ m
Column: 12 m x 0.53 mm ID
 Initial Temp: 55 °C, 3 min
 Rate: 10 °C/min
 Final Temp: 120 °C, 0 min
 Detector: FID
 Sensitivity: 128 x 10⁻¹² AFS
 Injection Mode: Split
Part No.: 054447

ANALYSIS OF TEATREE OIL ON BPX5

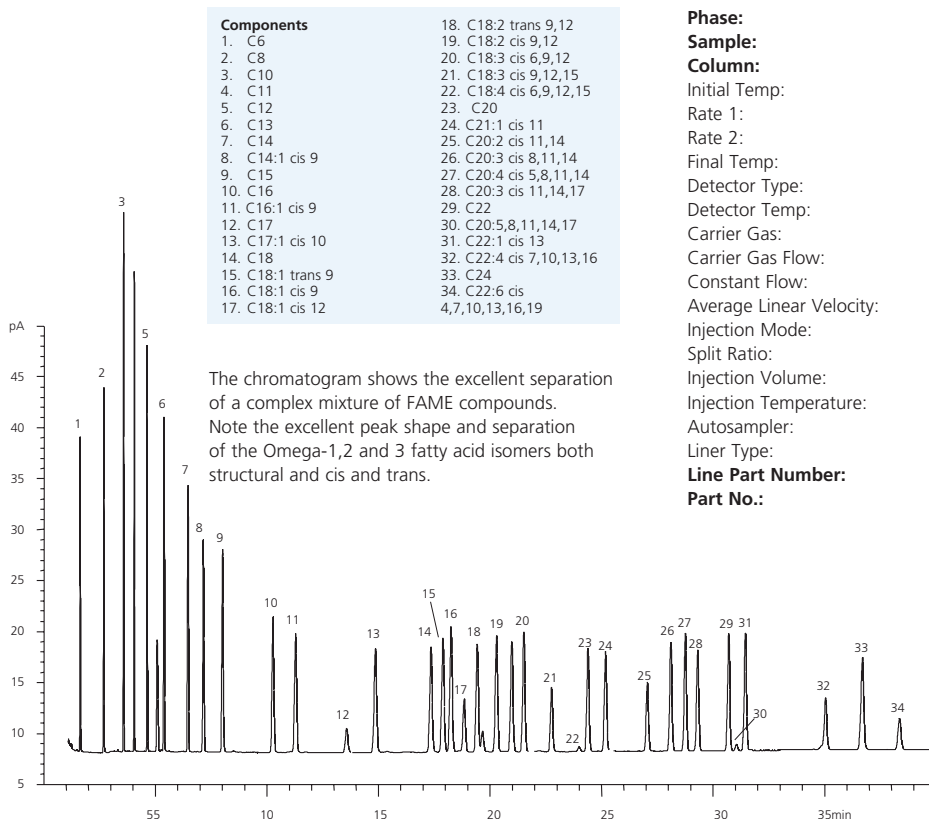


- Components**
1. Thujene
 2. α -Pinene
 3. Sabinene
 4. 3-Octanol
 5. β -Pinene
 6. α -Phellandrene
 7. α -Terpinene
 8. p-Cymene
 9. Limonene
 10. 1,8-Cineole
 11. γ -Terpinene
 12. Terpinolene
 13. Terpinen-4-ol
 14. α -Terpineol
 15. α -Gurjunene
 16. (trans)- β -Caryophyllene
 17. Aromadendrene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

Phase: BP20, 0.25 μ m film
Column: 30 m x 0.25 mm ID
 Initial Temp: 40 °C, 1 min
 Rate 1: 5 °C/min to 200 °C
 Final Temp: 200 °C
 Detector Type: Mass Spectrometer
 Carrier Gas: He, 7.0 psi
 Constant Flow: 1.0 mL/min.
 Average Linear Velocity: 36 cm/sec at 40 °C
 Injection Mode: Split
 Split Ratio: 200:1
 Purge on (Split) Vent Flow: 200 mL/min.
 Injection Volume: 0.2 μ L
 Injection Temperature: 250 °C
 Autosampler: No
 Liner Type: 4 mm ID Double Taper Liner
Line Part Number: 092018
Part No.: 054101



ANALYSIS OF OMEGA-3 FATTY ACIDS USING A BPX70



Phase:

Sample:

Column:

Initial Temp:

Rate 1:

Rate 2:

Final Temp:

Detector Type:

Detector Temp:

Carrier Gas:

Carrier Gas Flow:

Constant Flow:

Average Linear Velocity:

Injection Mode:

Split Ratio:

Injection Volume:

Injection Temperature:

Autosampler:

Liner Type:

Line Part Number:

Part No.:

BPX70, 0.25 µm film

10 ppm in methanol

25 m x 0.32 mm ID

80 °C, 2 min

50 °C/min to 130 °C, 10 min

2 °C/min to 172 °C

172 °C, 6 min

FID

300 °C

He, 10 psi

2.2 mL/min.

On

39 cm/sec at 80 °C

Split

58:1

1 µL

250 °C

No

4 mm ID Focus Liner™

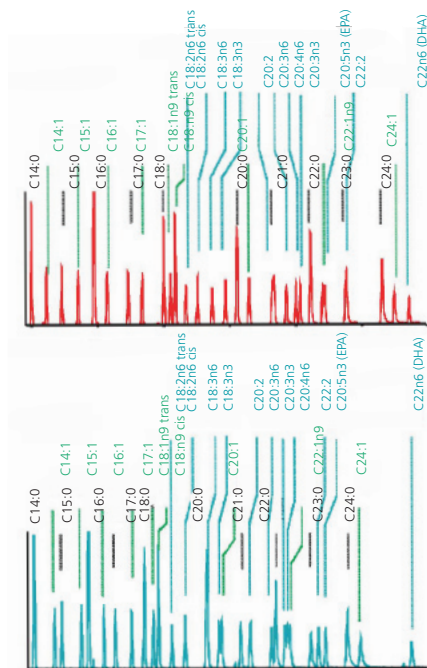
092002

054606

ACKNOWLEDGEMENT

SGE would like to thank Masterfoods UK for supplying the sample and chromatographic conditions for this chromatogram. For more information see SGE technical poster TP-0100-C

BPX90 – A HIGHLY POLAR PHASE FOR FAME ANALYSIS

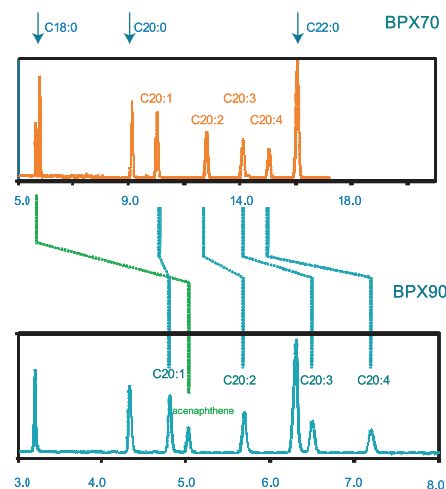


Supelco 37 FAME test mixture. Columns 15 m x 0.25 mm ID x 0.25 micron film. Temperature programmed 70°C (hold 1 min) to 150 °C (20 °C/min) to 250 °C (10 °C/min) then hold at 250 °C (5 min). Injector: 240 °C. Detection MS.

WHAT IS DIFFERENT ?

- BPX90 is a highly polar phase of the poly (biscyanopropylsiloxane) type.
- The phase has excellent thermal stability and a wide operating range (70 - 280 °C).
- The separation mechanisms gives short elution times relative to other polar phases. BPX90 shows low selectivity for non-polar analytes and saturated FAME.
- BPX90 shows enhanced selectivity for polyunsaturated FAME and the selectivity can be tuned with film thickness.
- BPX90 is effective for the separation of cis and trans isomers and positional isomers of FAME analytes.

FAME POLARITY TEST

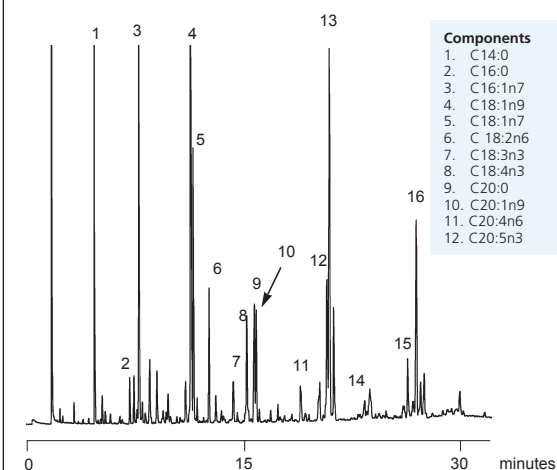


C18-C22 FAME test mixture. Columns 30 m x 0.25 mm ID x 0.25 micron film. Isothermal: 180°C. Injector: 240 °C. Detection FID at 280 °C.



Food, Flavours and Fragrances

ANALYSIS OF PUFA-1 MARINE FAME ON BPX70

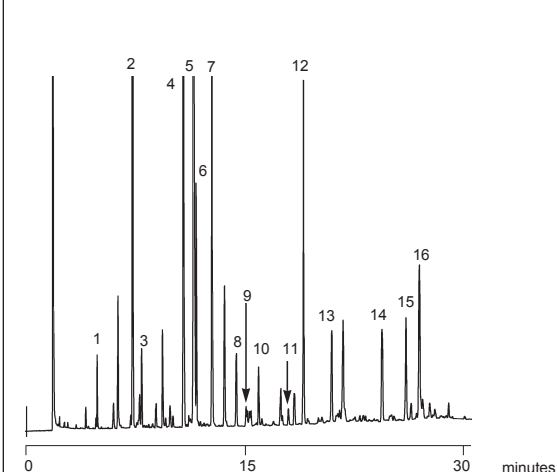


EXPERT TIP

To fully utilize the high thermal stability of BPX70 columns SGE recommend the use of Helium when operating above 220/230 °C for extended periods.

Phase: BPX70, 0.25 µm film
Column: 25 m x 0.22 mm ID
Initial Temp: 150 °C, 0 min
Program Rate: 2 °C/min
Final Temp: 210 °C, 5 min
Carrier Gas: He, 15 psi
Detector: FID, 280 °C
Sensitivity: 32 x 10⁻¹²AFS
Injection Mode: Split, 50:1
Part No.: 054602

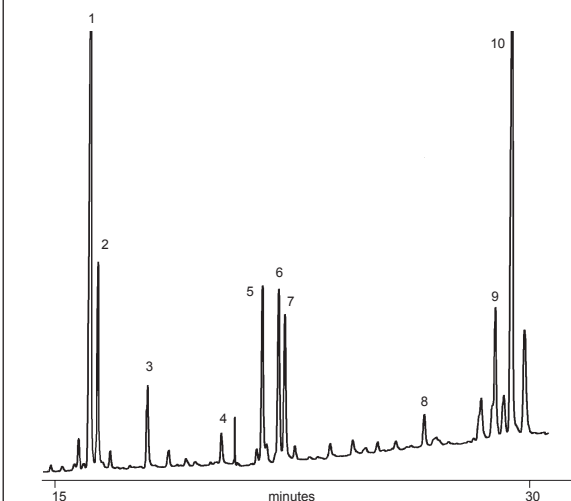
ANALYSIS OF PUFA-2 ANIMAL FAME ON BPX70



PUFA-2 ANIMAL FAME

Phase: BPX70, 0.25 µm film
Column: 25 m x 0.22 mm ID
Initial Temp: 150 °C, 0 min
Program Rate: 2 °C/min
Final Temp: 210 °C, 5 min
Carrier Gas: He, 15 psi
Detector: FID, 280 °C
Sensitivity: 32 x 10⁻¹²AFS
Injection Mode: Split, 50:1
Part No.: 054602

ANALYSIS OF PUFA-1 MARINE FAME ON BPX70



PUFA-2 ANIMAL FAME

Phase: BPX70, 0.25 µm
Column: 50 m x 0.22 mm ID
Initial Temp: 150 °C, 0 min
Program Rate: 2 °C/min
Final Temp: 210 °C, 5 min
Carrier Gas: He, 15 psi
Detector: FID, 280 °C
Sensitivity: 32 x 10⁻¹²AFS
Injection Mode: Split, 50:1
Part No.: 054603



Fuels and Petrochemical

For Fuels and Petrochemical analysis by GC, one of the main considerations is the thermal stability of the column, both physical & chemical. Phases must have high temperature limits to allow the analysis of high boiling point compounds and columns must be able to physically withstand repeated cycling to extreme temperatures. Columns such as SGE's BPX1 and HT5 have been created with these demands in mind.

Where higher polarity is required, such as the separation of aromatic compounds, SolGel-WAX™, and BPX90, provide enhanced selectivity without the unnecessary sacrifice of maximum temperature limits.

Applications

- [Total Recoverable Petroleum Hydrocarbons \(TRPH\) Analysis on Standard and Fast BPX5](#)
- [Analysis of Polywax 655 & Refinery Lubrication Oil on HT5](#)
- [The Separation of Aromatics from Olefins in Petroleum Samples using BPX90](#)
- [Unleaded Gasoline on BPX5](#)
- [Fast GC For TPH Analysis](#)
- [Simulated Distillation using BPX1-SimD](#)

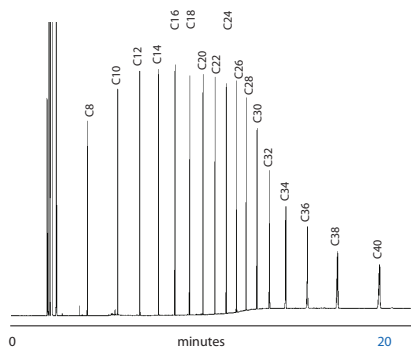


Fuels and Petrochemical

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (TRPH) ANALYSIS ON STANDARD AND FAST BPX5

NORMAL

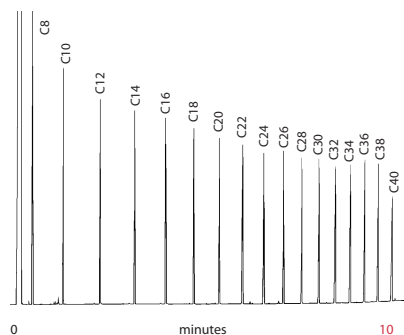
Chromatogram showing separation of Total Recoverable Petroleum Hydrocarbons using a conventional 30 m x 0.25 mm ID BPX5 column with a 0.25 micron film.



Phase: BPX5, 0.25 μ m film
TRPH (C8-C40): 5 ng/ μ L in dichloromethane
Column: 30 m x 0.25 mm ID
Initial Temp: 40 $^{\circ}$ C, 2 min
Rate 1: 30 $^{\circ}$ C/min to 330 $^{\circ}$ C
Rate 2: NA
Final Temp: 330 $^{\circ}$ C, 9 min
Detector Type: FID, 350 $^{\circ}$ C
Carrier Gas: He, 14.4 psi
Carrier Gas Flow : 1.29 mL/min
Constant Flow: On
Average Linear Velocity: 40 cm/sec at 40 $^{\circ}$ C
Injection Mode: Split, 120:1
Purge On Time: NA
Purge On (Split) Vent Flow: 160 mL/min
Injection Volume: 1 μ L
Injection Temperature: 250 $^{\circ}$ C
Autosampler: Yes
Liner Type : 4 mm ID FocusLiner™ with single taper
Liner Part Number: 092003
Part No.: 054101

FAST

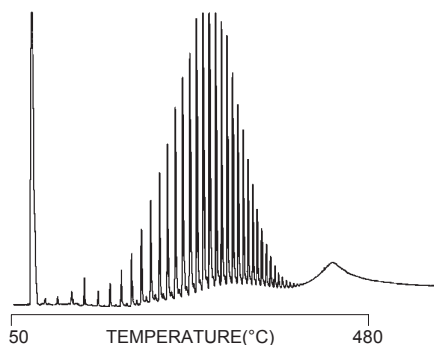
Chromatogram showing separation of Total Recoverable Petroleum Hydrocarbon using a FAST BPX5 column.



Phase: BPX5, 0.10 μ m film
TRPH (C8-C40) Standard: 5 ng/ μ L in dichloromethane
Column: 10 m x 0.10 mm ID
Initial Temp: 40 $^{\circ}$ C, 1 min
Rate 1: 30 $^{\circ}$ C/min to 330 $^{\circ}$ C
Rate 2: NA
Final Temp: 330 $^{\circ}$ C, 0 min
Detector Type: FID, 350 $^{\circ}$ C
Carrier Gas: He, 28 psi
Carrier Gas Flow : 0.52 mL/min
Constant Flow: On
Average Linear Velocity: 55 cm/sec at 40 $^{\circ}$ C
Injection Mode: Split, 120:1
Purge On Time: NA
Purge On (Split) Vent Flow: 62 mL/min
Injection Volume: 1 μ L
Injection Temperature: 250 $^{\circ}$ C
Autosampler: Yes
Liner Type : 2.3 mm ID FocusLiner™
Liner Part Number: 092005
Part No.: 054099

ANALYSIS OF POLYWAX 655 & REFINERY LUBRICATION OIL ON HT5

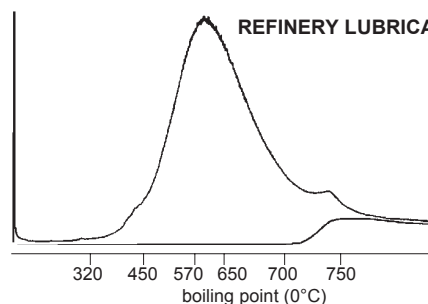
POLYWAX 655



POLYWAX 655 & REFINERY LUBRICATION OIL

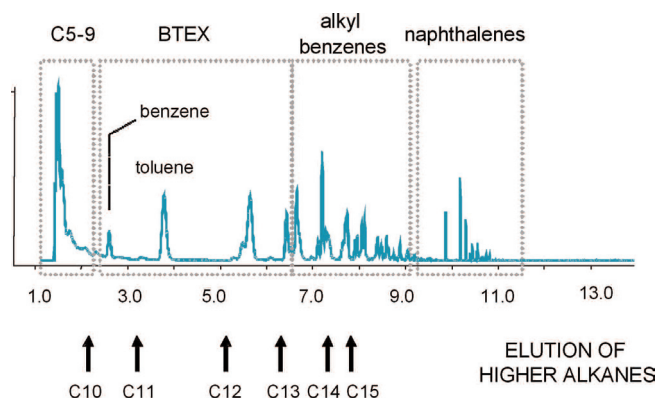
Phase: HT5, 0.1 μ m
Column: 6 m x 0.53 mm ID
Initial Temp: 50 $^{\circ}$ C
Rate: 10 $^{\circ}$ C/min
Final Temp: 480 $^{\circ}$ C, 15 min
Detector: FID
Sensitivity: 40 x 10⁻¹² AFS
Injection Mode: On-Column
Carrier Gas: H₂, 20 mL/min
Solvent: CS₂
Part No.: 054661

REFINERY LUBRICATION OIL





THE SEPARATION OF AROMATICS FROM OLEFINS IN PETROLEUM SAMPLES USING BPX90



The separation of a petroleum sample using a BPX90 column (30 m x 0.25 mm ID, 250 micron film) showing the resolution of aromatic families and the separation from more abundant alkanes.

UNLEADED GASOLINE ON BPX5

Phase: BPX5, 0.25 μ m film
Column: 30 m x 0.25 mm ID

Column Part No. 054101

Components

1. Benzene
2. Toluene
3. Ethylbenzene
4. m,p-Xylene
5. o-Xylene

Sample Introduction:

Injector Temp: 240 °C
Injection Volume: 0.1 μ L
Autosampler Syringe: 0.5 μ L Removable Needle
Part No. 000410

Septa: Auto-Sep TTM
Part No. 041882
Injection Type: Split
Purge On Time: NA
Purge On (Split) Vent: 200 mL/min
Split Ratio: 149 :1
Liner Type: FocusLinerTM
single taper
Part No.092003

Pressure/Flow Values:

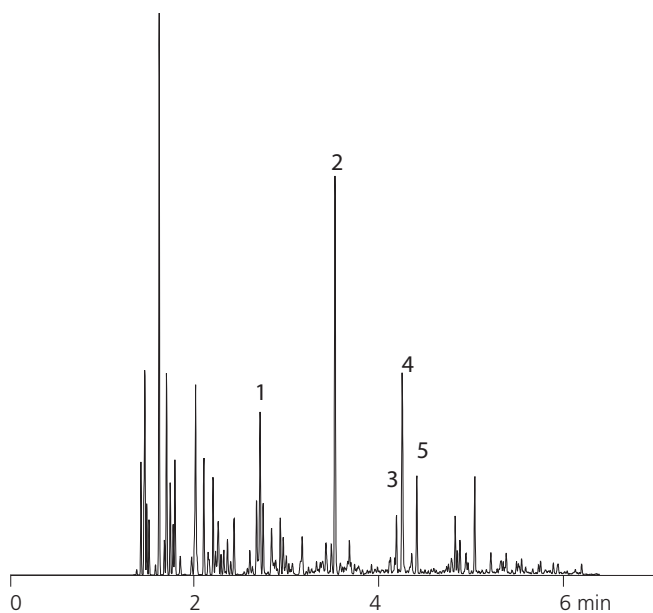
Carrier Gas: He
Constant Flow: On
Pressure: 13.6 psi
Column Flow: 1.34 mL/min
Linear Velocity: 30 cm/sec @ 25 °C

Oven Parameters:

Initial Temp: 25 °C
Initial Time: 1 min
Rate 1: 30 °C/min
Final Temp 1: 240 °C
Hold Time: 1 min
Run Time: 9.17 min

Detector Parameters:

Detector Type: FID @ 280 °C

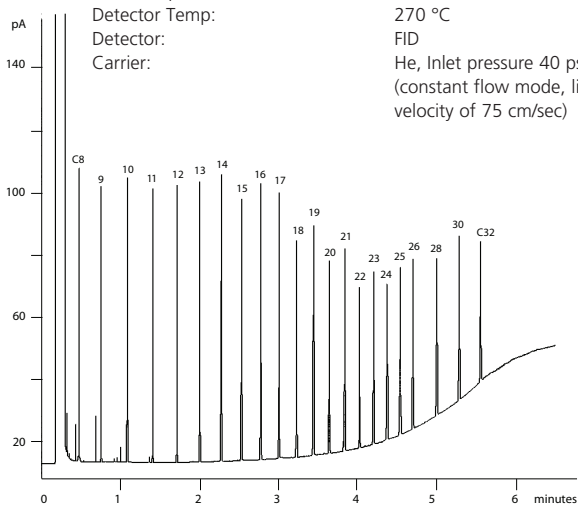




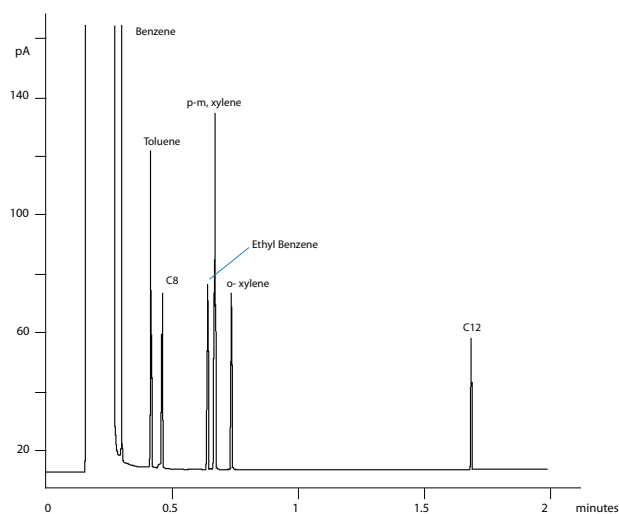
Fuels and Petrochemical

FAST GC FOR TPH ANALYSIS

Phase: BPX5, 0.1 μm
Column: 5 m x 0.1 mm ID
 Initial Temp: 50 $^{\circ}\text{C}$
 Rate 1: 45 $^{\circ}\text{C}/\text{min}$
 Final Temp: 300 $^{\circ}\text{C}$, 0 min
 Detector Temp: 270 $^{\circ}\text{C}$
 Detector: FID
 Carrier: He, Inlet pressure 40 psi
 (constant flow mode, linear
 velocity of 75 cm/sec)

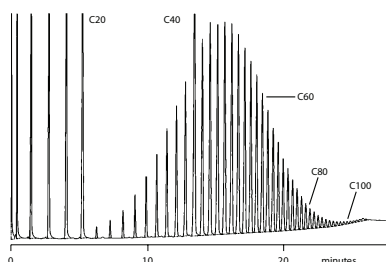


Chromatogram of TPH standards from C8 to C32

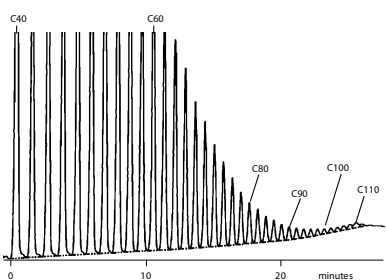


Chromatogram showing elution of BTEX in under one minute

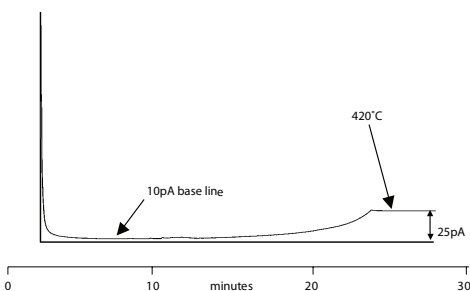
SIMULATED DISTILLATION USING BPX1-SIMD



Standard mix for HTSD using BPX1-SimD



Enlarged section of the chromatogram above



CS2 Blank

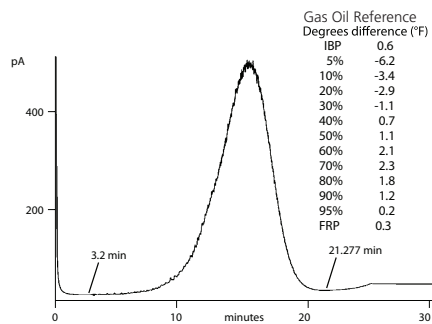
Phase: BPX1, 0.1 μm
Column: 5 m x 0.53 mm ID
 Initial Temp: 40 $^{\circ}\text{C}$
 Rate: 15 $^{\circ}\text{C}$
 Final Temp: 420 $^{\circ}\text{C}$, 5 min
 Detector Temp: 440 $^{\circ}\text{C}$
 Carrier Gas: He, 10 mL/min
 Instrument: HP 6890
Part No.: 054800

Separation Systems Injector

Initial Temp: 40 $^{\circ}\text{C}$
 Rate: 15 $^{\circ}\text{C}$
 Final Temp: 420 $^{\circ}\text{C}$, 5 min

A portion of the previous chromatogram from C40 to the end of the analysis (expanded vertically) shows excellent resolution and the ability to see beyond C110.

All of the data presented was produced by Dr. Lubkowitz and the staff at Separation Systems Inc. on a system using the Separation System programmed temperature vaporization injector (PTV) and the SIMDIS EXPERT® software



Reference Gas Oil MT-60



Chemical

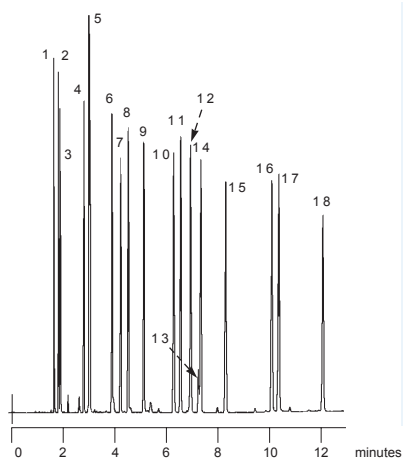
For general chemical analysis, a good rule of thumb is to use the lowest polarity column that provides sufficient separation. Particular classes of compounds, such as alcohols, amines, or organic acids, may require thicker film phases, or specific phases such as the BPX35 or BP21 to avoid undue peak tailing.

Applications

- Analysis of 18 Alcohols on BP20
- Analysis of Aliphatic Alcohols on BP1
- Analysis of 15 Organic Acids on BP20
- US EPA 625 Phenols Mix on BPX50
- Analysis of Organic Acids in Water on BP21
- Analysis of Amines on BP1
- Analysis of Aromatic Amines on BP5
- Analysis of Aromatic Amines from Diazo Dyes on BPX35
- Analysis of Ketones on thick film BPX5
- Analysis of Triethylamine and Triethanolamine on SolGel-1ms™



ANALYSIS OF 18 ALCOHOLS ON BP20



Components

1. Methanol
2. Propan-2-ol
3. Ethanol
4. sec-Butan-1-ol
5. n-Propanol + 2-Methyl-3-Buten-2-ol
6. d,l-3-Methyl-2-Butan-1-ol
7. Pentan-3-ol
8. d,l-2-Pentan-1-ol
9. n-Butanol
10. 2,4-Dimethyl Pentan-3-ol
11. Hexan-3-ol
12. 2-Methyl Prop-2-en-1-ol
13. Crotyl Alcohol (2-Buten-1-ol)
14. Hexan-2-ol
15. Pentan-1-ol
16. 2-Methyl Pentan-1-ol
17. 2-Ethyl Butan-1-ol
18. Hexan-1-ol

EXPERT TIP

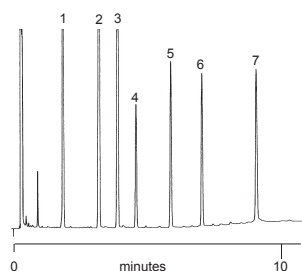
Purge the column with oxygen free carrier gas for at least 30 minutes before heating GC oven.

ALCOHOLS

Phase:
Column:
Initial Temp:
Rate:
Final Temp:
Detector:
Sensitivity:
Injection Mode:
Part No.:

BP20, 0.25 µm film
30 m x 0.25 mm ID
45 °C, 2 min
3 °C/min
80 °C, 0 min
FID
128 x 10⁻¹² AFS
Split
054427

ANALYSIS OF ALIPHATIC ALCOHOLS ON BP1



Components

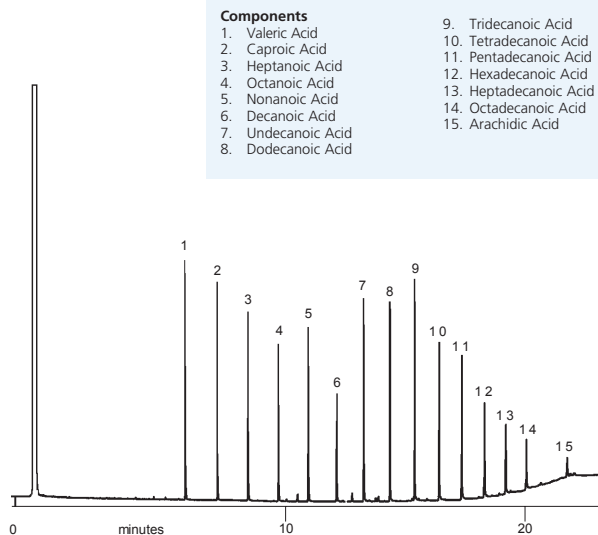
1. Octanol
2. Decanol
3. Undecanol
4. Dodecanol
5. Tetradecanol
6. Hexadecanol
7. Eicosanol

ALCOHOLS

Phase:
Column:
Initial Temp:
Rate:
Final Temp:
Carrier Gas:
Injection Volume:
Part No.:

BP1, 3.0 µm film
12 m x 0.53 mm ID
100 °C
10 °C/min
260 °C
N₂
0.1 µL
054097

ANALYSIS OF 15 ORGANIC ACIDS ON BP20



Components

1. Valeric Acid
2. Caproic Acid
3. Heptanoic Acid
4. Octanoic Acid
5. Nonanoic Acid
6. Decanoic Acid
7. Undecanoic Acid
8. Dodecanoic Acid
9. Tridecanoic Acid
10. Tetradecanoic Acid
11. Pentadecanoic Acid
12. Hexadecanoic Acid
13. Heptadecanoic Acid
14. Octadecanoic Acid
15. Arachidic Acid

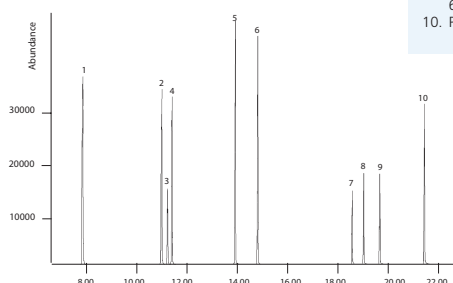
ORGANIC ACIDS

Phase:
Column:
Initial Temp:
Rate:
Final Temp:
Detector:
Injection Mode:
Carrier Gas:
Part No.:

BP20, 0.25 µm
30 m x 0.32 mm ID
70 °C
10 °C/min
260 °C, 5 min
FID
Split
H₂, 6 psi
054433



US EPA 625 PHENOLS MIX ON BPX50



Components

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

US EPA 625 PHENOLS MIX

Phase:

Column:

Injector Mode:

Initial Oven Temp:

Rate 1:

Final Temp:

Detector:

Part No.:

BPX50, 0.25 μ m

30 m x 0.25 mm ID

Split, 40:1

50°C, 1 min

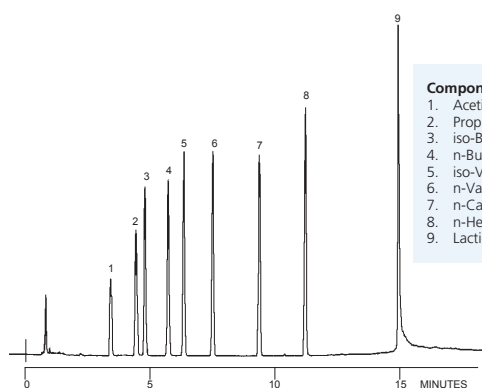
8 °C/min

300 °C, 10 min

HP 5973 MSD

054751

ANALYSIS OF ORGANIC ACIDS IN WATER ON BP21



Components

1. Acetic Acid
2. Propanoic Acid
3. iso-Butyric Acid
4. n-Butyric Acid
5. iso-Valeric Acid
6. n-Valeric Acid
7. n-Caproic Acid
8. n-Heptanoic Acid
9. Lactic Acid

EXPERT TIP

On-column injection and the addition of a 0.03 M Oxalic acid (2 %) to the injection solution increases the acidity of the column to allow lactic acid to be detected.

ORGANIC ACIDS IN WATER
(0.03M OXALIC ACID)

Phase:

Column:

Initial Temp:

Rate:

Final Temp:

Detector:

Sensitivity:

Injection Mode:

Part No.:

BP21, 0.5 μ m film

30 m x 0.53 mm ID

85 °C, 0 min

6 °C/min

180 °C, 5 min

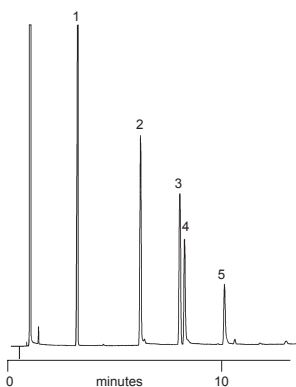
FID

64 x 10⁻¹² AFS

On-Column

054477

ANALYSIS OF AMINES ON BP1



Components

1. Aniline
2. Decylamine
3. Dicyclohexylamine
4. Dodecylamine
5. Tetradecylamine

ANALYSIS OF AMINES

Phase:

Column:

Initial Temp:

Rate:

Final Temp:

Carrier Gas:

Injection Volume:

Part No.:

BP1, 3.0 μ m film

12 m x 0.53 mm ID

70 °C

10 °C/min

250 °C

N₂0.1 μ L

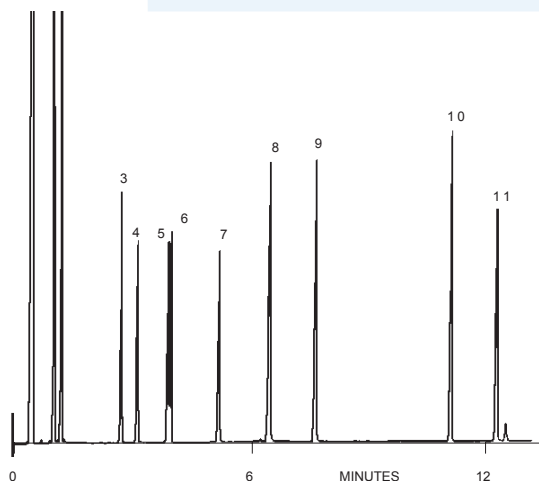
054097



ANALYSIS OF AROMATIC AMINES ON BP5

Components

- | | |
|----------------------|------------------------|
| 1. Pyridine | 7. 2,6-Dimethylaniline |
| 2. 2-Methyl Pyridine | 8. 1,4-Phenyldiamine |
| 3. gamma - BHC | 9. Nicotine |
| 4. Aniline | 10. Biphenylamine |
| 5. o-Toluidine | 11. Bibenzylamine |
| 6. m-Toluidine | |



EXPERT TIP

Using a thicker film helps prevent amines from tailing.

Phase:

Column:

Initial Temp:

Rate:

Final Temp:

Detector:

Sensitivity:

Injection Mode:

Part No.:

BP5, 1.0 µm film

12 m x 0.53 mm ID

60 °C, 0 min

10 °C/min

190 °C, 0 min

FID

128 x 10⁻¹²AFS

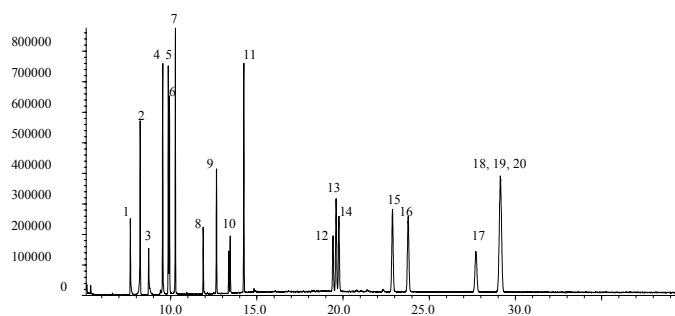
Split

054197

ANALYSIS OF AROMATIC AMINES FROM DIAZO DYES ON BPX35

Components

- | | |
|---------------------------|---|
| 1. Indolin | 13. 4,4'-Diaminodiphenylmethane |
| 2. o-Toluidine | 14. Benzidine |
| 3. 2,4-Diaminoanisole | 15. 3,3'-Dimethyl-4,4'-diaminodiphenylmethane |
| 4. p-Chloroaniline | 16. 3,3'-dimethylbenzidine |
| 5. p-a residue | 17. 4,4'-Thiodianiline |
| 6. 2,4,6-Trimethylaniline | 18. 3,3'-Dichlorobenzidine |
| 7. 4-Chlorotoluidine | 19. 4,4'-Methylene-bis(2chloraniline) |
| 8. Unknown | 20. 3,3'-Dimethoxybenzidine |
| 9. 2-Naphthylamine | |
| 10. Unknown | |
| 11. 4-Aminodiphenyl | |
| 12. 4,4'-Oxydianiline | |



Phase:

Azo Dyes Standard:

Column:

Initial Temp:

Rate 1:

Rate 2:

Final Temp:

Detector Type:

Carrier Gas:

Carrier Gas Flow :

Constant Flow:

Average Linear Velocity:

Injection Mode:

Purge On Time:

Purge On (Split) Vent Flow:

Injection Volume:

Injection Temperature:

Autosampler:

Liner Type :

Part No.:

Column Part Number:

BPX35 0.25 µm film

10 ppm solution in DCM

30 m x 0.25 mm ID

50 °C, 2 min

15 °C/min to 240 °C

10 °C/min to 280 °C

280 °C, 25 min

MSD

He, 7.1 psi

1.0 mL/min

On

36 cm/sec at 50 °C

Splitless

1.0 min

60 mL/min

1 µL

250 °C

No

4 mm ID Double Taper

092018

054701

EXPERT TIP

SilTite ferrules eliminate the need for re-tightening following temperature cycling and reduce oxygen levels with in the system improving performance

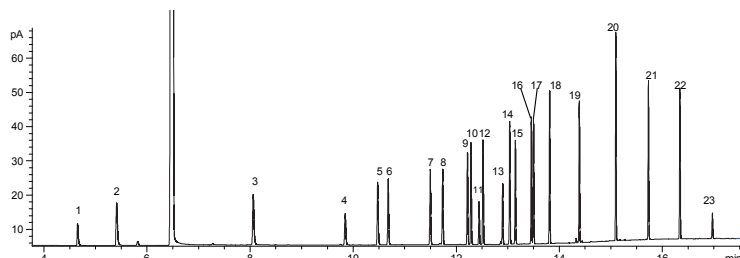




ANALYSIS OF KETONES ON THICK FILM BPX5

Components

- | | |
|-------------------------|-------------------------|
| 1. Ethanol | 13. 2-Methyl-3-hexanone |
| 2. Acetone | 14. 4-Methyl-2-hexanone |
| 3. 2-Butanone | 15. 5-Methyl-2-hexanone |
| 4. 3-Methyl-2-butanone | 16. 3-Heptanone |
| 5. 2-Pentanone | 17. 2-Heptanone |
| 6. 3-pentanone | 18. Cyclohexanone |
| 7. 4-Methyl-2-pentanone | 19. 2-Octanone |
| 8. 3-Methyl-2-pentanone | 20. 2-Nonanone |
| 9. 3-Hexanone | 21. 2-Decanone |
| 10. 2-Hexanone | 22. 2-Undecanone |
| 11. Mesityl oxide | 23. 2-Dodecanone |
| 12. Cyclopentanone | |



Phase:

Sample:

Column:

Initial Temp:

Rate 1:

Rate 2:

Final Temp:

Detector Type:

Detector Temp:

Carrier Gas:

Carrier Gas Flow :

Constant Flow:

Average Linear Velocity:

Injection Mode:

Split Ratio:

Injection Volume:

Injection Temperature:

Autosampler:

Liner Type :

Liner Part Number:

Column Part Number:

BPX5, 1.0 μ m film

300 ppm in dichloromethane

60 m x 0.25 mm ID

40 °C , 5 min

10 °C/min to 80 °C

30 °C/min to 260 °C

260 °C, 4 min

FID

360 °C

He, 27.6 psi

1.9 mL/min

On

35 cm/sec at 40 °C

Split

100:1

0.4 μ L

250 °C

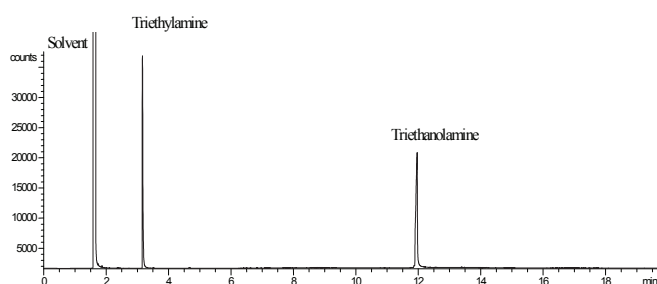
No

4 mm ID Single Taper Liner

092017

054123

ANALYSIS OF TRIETHYLAMINE AND TRIETHANOLAMINE ON SOLGEL-1ms™



Phase:

Amine mix:

Column:

Initial Temp:

Rate 1:

Final Temp:

Detector Type:

Detector Temp:

Carrier Gas:

Carrier Gas Flow :

Constant Flow:

Average Linear Velocity:

Mode of Injection:

Split Ratio:

Injection Volume:

Injection Temperature:

Autosampler:

Part No.:

SolGel-1ms, 0.25 μ m film10 ng/ μ L in dichloromethane

30 m x 0.32 mm ID

40 °C , 5.0 min

20 °C/min to 200 °C

200 °C, 7 min

FID

300 °C

He, 9.9 psi

2.2 mL/min

On

35 cm/sec at 100 °C

Split

50:1

0.3 μ L

250 °C

No

054798

EXPERT TIP

To prevent decreasing retention times in your chromatography, replace the septum daily.



SGE Capillary Column Part Number Listing

Phase	Length (m)	ID (mm)	Film Thickness (μm)	Part No.
BP1	10	0.1	0.1	054022
BP1	12	0.15	0.25	054028
BP1	25	0.15	0.25	054029
BP1	12	0.22	0.1	054040
BP1	12	0.22	0.25	054046
BP1	12	0.22	1	054052
BP1	15	0.22	0.25	054049
BP1	25	0.22	0.1	054041
BP1	25	0.22	0.25	054047
BP1	25	0.22	1	054053
BP1	30	0.22	0.25	054050
BP1	50	0.22	0.1	054042
BP1	50	0.22	0.25	054048
BP1	50	0.22	1	054054
BP1	60	0.22	0.25	054051
BP1	15	0.25	0.1	054039
BP1	15	0.25	0.25	054043
BP1	30	0.25	0.25	054044
BP1	30	0.25	0.5	054820
BP1	30	0.25	1	054056
BP1	60	0.25	0.25	054045
BP1	60	0.25	0.5	054812
BP1	60	0.25	1	054815
BP1	12	0.32	0.25	054058
BP1	12	0.32	0.5	054064
BP1	12	0.32	1	054070
BP1	15	0.32	0.25	054061
BP1	25	0.32	0.25	054059
BP1	25	0.32	0.5	054065
BP1	25	0.32	1	054071
BP1	25	0.32	4	054076
BP1	25	0.32	5	054081
BP1	30	0.32	0.25	054062
BP1	30	0.32	0.5	054068
BP1	30	0.32	1	054813
BP1	30	0.32	1.5	054811
BP1	30	0.32	3	054073
BP1	30	0.32	4	054077
BP1	50	0.32	0.25	054060
BP1	50	0.32	0.5	054066
BP1	50	0.32	1	054072
BP1	50	0.32	5	054082
BP1	60	0.32	0.25	054067
BP1	60	0.32	0.5	054069
BP1	60	0.32	1	054810
BP1	60	0.32	5	054085
BP1	12	0.53	1	054086
BP1	12	0.53	3	054097
BP1	15	0.53	0.5	054870
BP1	15	0.53	1	054089
BP1	25	0.53	1	054087
BP1	25	0.53	3	054098
BP1	25	0.53	5	054095
BP1	30	0.53	0.5	054092
BP1	30	0.53	1	054090
BP1	30	0.53	2.6	054819
BP1	30	0.53	3	054808
BP1	30	0.53	5	054806
BP1	50	0.53	1	054088
BP1	50	0.53	5	054096
BP1	60	0.53	0.5	054871
BP1	60	0.53	3	054809
BP1	60	0.53	5	054807
BP1-PONA	50	0.15	0.5	054950
BP1-PONA	100	0.25	0.5	054818
BPX1	10	0.1	0.1	054777
BPX1	6	0.53	2.65	0548025
BPX1	10	0.53	0.1	054803
BPX1	10	0.53	0.9	054801
BPX1	10	0.53	2.65	054802
BPX1 Aluminum Clad	5	0.53	0.1	054800
BPX1 Aluminum Clad	5	0.53	0.17	054782
BPX1 Aluminum Clad	10	0.53	0.1	054779
BPX1	10	0.53	2.65	054802
BPX1 Aluminum Clad	5	0.53	0.1	054800
BPX1 Aluminum Clad	5	0.53	0.17	054782
BPX1 Aluminum Clad	10	0.53	0.1	054779
SolGel-1ms	30	0.25	0.25	054795

Phase	Length (m)	ID (mm)	Film Thickness (μm)	Part No.
SolGel-1ms	60	0.25	0.25	054793
SolGel-1ms	30	0.32	0.25	054798
SolGel-1ms	60	0.32	0.25	054794
BP5	12	0.22	0.25	054167
BP5	25	0.22	0.25	054168
BP5	30	0.22	0.25	054171
BP5	50	0.22	0.25	054169
BP5	50	0.22	1	054175
BP5	15	0.25	0.25	054182
BP5	30	0.25	0.25	054183
BP5	30	0.25	1	054203
BP5	60	0.25	0.25	054184
BP5	60	0.25	1	054215
BP5	12	0.32	0.25	054179
BP5	15	0.32	0.25	054176
BP5	25	0.32	0.25	054180
BP5	25	0.32	0.5	054186
BP5	25	0.32	1	054192
BP5	30	0.32	0.25	054177
BP5	30	0.32	0.5	054216
BP5	30	0.32	1	054189
BP5	50	0.32	0.5	054187
BP5	50	0.32	1	054193
BP5	60	0.32	0.25	054178
BP5	60	0.32	1	054188
BP5	12	0.53	1	054197
BP5	15	0.53	1	054194
BP5	15	0.53	1.5	054199
BP5	25	0.53	1	054198
BP5	30	0.53	0.5	0541935
BP5	30	0.53	1	054195
BP5	30	0.53	5	054196
BP5	60	0.53	1.5	054204
BPX5	10	0.1	0.1	054099
BPX5	10	0.15	1.2	054106
BPX5	12	0.15	0.25	054103
BPX5	12	0.15	0.4	054107
BPX5	25	0.15	0.25	054104
BPX5	25	0.15	0.4	054108
BPX5	30	0.15	0.15	054110
BPX5	50	0.15	0.25	054105
BPX5	40	0.18	0.18	054229
BPX5	12	0.22	0.25	054112
BPX5	25	0.22	0.25	054113
BPX5	25	0.22	1	054116
BPX5	30	0.22	0.25	054142
BPX5	50	0.22	0.25	054114
BPX5	50	0.22	1	054117
BPX5	7	0.25	0.25	054149
BPX5	15	0.25	0.1	0542170
BPX5	15	0.25	0.25	054100
BPX5	15	0.25	1	054121
BPX5	30	0.25	0.1	0541011
BPX5	30	0.25	0.25	054101
BPX5	30	0.25	0.5	0541025
BPX5	30	0.25	1	054122
BPX5	60	0.25	0.25	054102
BPX5	60	0.25	1	054123
BPX5	6	0.32	1	0541261
BPX5	12	0.32	0.25	054118
BPX5	12	0.32	0.5	054124
BPX5	12	0.32	1	054127
BPX5	15	0.32	0.25	054144
BPX5	15	0.32	1	054152
BPX5	25	0.32	0.25	054119
BPX5	25	0.32	0.5	054125
BPX5	25	0.32	1	054128
BPX5	25	0.32	3	054136
BPX5	30	0.32	0.25	054145
BPX5	30	0.32	0.5	0541205
BPX5	30	0.32	1	054153
BPX5	50	0.32	0.25	054120
BPX5	50	0.32	0.5	054126
BPX5	50	0.32	1	054129
BPX5	60	0.32	0.25	054146
BPX5	60	0.32	1	054154
BPX5	12	0.53	0.25	054133
BPX5	12	0.53	1	054130

SGE Capillary Column Part Number Listing

Phase	Length (m)	ID (mm)	Film Thickness (µm)	Part No.
BPX5	12	0.53	3	054138
BPX5	15	0.53	0.5	0541344
BPX5	15	0.53	1	054147
BPX5	15	0.53	1.5	0541347
BPX5	15	0.53	3	054159
BPX5	25	0.53	0.25	054134
BPX5	25	0.53	1	054131
BPX5	25	0.53	3	054139
BPX5	30	0.53	0.5	0541345
BPX5	30	0.53	1	054148
BPX5	30	0.53	1.5	0541348
BPX5	30	0.53	3	054160
BPX5	50	0.53	1	054132
BPX5	60	0.53	1	054158
HT5	12	0.22	0.1	054631
HT5	25	0.22	0.1	054632
HT5	15	0.25	0.1	054633
HT5	30	0.25	0.1	054634
HT5	12	0.32	0.1	054641
HT5	15	0.32	0.5	054667
HT5	25	0.32	0.1	054642
HT5	30	0.32	0.5	054668
HT5	6	0.53	0.1	054655
HT5	10	0.53	0.5	054670
HT5	12	0.53	0.15	054657
HT5	15	0.53	0.5	054671
HT5	25	0.53	0.15	054658
HT5	30	0.53	0.5	054672
HT5 Aluminum Clad	12	0.22	0.1	054635
HT5 Aluminum Clad	25	0.22	0.1	054636
HT5 Aluminum Clad	12	0.32	0.1	054651
HT5 Aluminum Clad	25	0.32	0.1	054652
HT5 Aluminum Clad	50	0.32	0.1	054653
HT5 Aluminum Clad	5	0.53	0.075	054673
HT5 Aluminum Clad	6	0.53	0.1	054661
HT5 Aluminum Clad	12	0.53	0.15	054662
HT5 Aluminum Clad	25	0.53	0.15	054665
HT8	10	0.1	0.1	054690
HT8	40	0.18	Proprietary	054686
HT8	12	0.22	0.25	054674
HT8	25	0.22	0.25	054675
HT8	50	0.22	0.25	054676
HT8	30	0.25	0.25	054677
HT8	60	0.25	0.25	054683
HT8	12	0.32	0.25	054679
HT8	25	0.32	0.25	054680
HT8	50	0.32	0.25	054681
HT8	60	0.32	0.25	054682
HT8	12	0.53	0.5	054684
HT8	25	0.53	0.5	054685
BPX35	10	0.1	0.1	054699
BPX35	15	0.22	0.25	054713
BPX35	25	0.22	0.25	054711
BPX35	30	0.22	0.25	054714
BPX35	50	0.22	0.25	054712
BPX35	15	0.25	0.25	054700
BPX35	15	0.25	1	054703
BPX35	30	0.25	0.25	054701
BPX35	30	0.25	0.5	0547025
BPX35	30	0.25	1	054704
BPX35	60	0.25	0.25	054702
BPX35	60	0.25	1	054705
BPX35	15	0.32	0.25	054723
BPX35	15	0.32	0.5	054718
BPX35	15	0.32	1	054716
BPX35	25	0.32	0.25	054721
BPX35	30	0.32	0.25	054724
BPX35	30	0.32	0.5	0547158
BPX35	30	0.32	1	054717
BPX35	50	0.32	0.25	054722
BPX35	60	0.32	0.25	054725
BPX35	15	0.53	0.5	054734
BPX35	15	0.53	1	054736
BPX35	30	0.53	0.5	054735
BPX35	30	0.53	1	054737
BPX608	25	0.32	0.4	054823
BP624	25	0.22	1.2	054826
BP624	30	0.22	1.2	054827

Phase	Length (m)	ID (mm)	Film Thickness (µm)	Part No.
BP624	15	0.25	1.4	054839
BP624	30	0.25	1.4	054840
BP624	60	0.25	1.4	054842
BP624	25	0.32	1.8	054830
BP624	30	0.32	1.8	054832
BP624	50	0.32	1.8	054831
BP624	60	0.32	1.8	054841
BP624	25	0.53	3	054834
BP624	30	0.53	3	054836
BP624	50	0.53	3	054835
BP624	60	0.53	3	054838
BPX-Volatiles	20	0.18	1	054978
BPX-Volatiles	40	0.18	1	054979
BPX-Volatiles	30	0.25	1.4	054980
BPX-Volatiles	60	0.25	1.4	054981
BPX-Volatiles	30	0.32	1.8	054982
BPX-Volatiles	60	0.32	1.8	054983
BPX-Volatiles	30	0.53	3	054984
BPX-Volatiles	60	0.53	3	054985
BP10	12	0.22	0.25	054252
BP10	25	0.22	0.25	054253
BP10	50	0.22	0.25	054254
BP10	15	0.25	0.25	054255
BP10	30	0.25	0.25	054256
BP10	30	0.25	1	054271
BP10	60	0.25	0.25	054257
BP10	15	0.32	0.25	054258
BP10	15	0.32	0.5	054264
BP10	25	0.32	0.25	054262
BP10	25	0.32	0.5	054268
BP10	30	0.32	0.25	054259
BP10	30	0.32	0.5	054265
BP10	30	0.32	1	054270
BP10	50	0.32	0.5	054269
BP10	60	0.32	0.25	054260
BP10	60	0.32	0.5	054266
BP10	15	0.53	1	054282
BP10	25	0.53	1	054280
BP10	30	0.53	1	054283
BPX50	10	0.1	0.05	054739
BPX50	10	0.1	0.07	054738
BPX50	10	0.1	0.1	054740
BPX50	30	0.15	0.15	054741
BPX50	15	0.25	0.25	054750
BPX50	30	0.25	0.25	054751
BPX50	60	0.25	0.25	054752
BPX50	15	0.32	0.25	054760
BPX50	30	0.32	0.25	054761
BPX50	60	0.32	0.25	054762
BPX50	15	0.53	0.5	054770
BPX50	30	0.53	0.5	054771
BPX50	30	0.53	1	054772
BP225	25	0.22	0.25	054352
BP225	50	0.22	0.25	054353
BP225	25	0.32	0.25	054358
BP225	25	0.53	0.5	054364
BP20	10	0.1	0.1	054405
BP20	12	0.22	0.25	054420
BP20	25	0.22	0.25	054421
BP20	30	0.22	0.25	054424
BP20	50	0.22	0.25	054422
BP20	60	0.22	0.25	054425
BP20	15	0.25	0.25	054426
BP20	30	0.25	0.25	054427
BP20	30	0.25	0.5	054415
BP20	30	0.25	1	054439
BP20	60	0.25	0.25	054428
BP20	60	0.25	0.5	054458
BP20	15	0.32	0.25	054432
BP20	25	0.32	0.25	054430
BP20	25	0.32	0.5	054436
BP20	25	0.32	1	054442
BP20	30	0.32	0.25	054433
BP20	30	0.32	0.5	054438
BP20	30	0.32	1	054444
BP20	50	0.32	0.25	054431
BP20	50	0.32	0.5	054437
BP20	50	0.32	1	054443



Montluçon - 211 bis avenue J.F.Kennedy
BP 1140 - 03103 Montluçon cedex
Tél. (33) (0)4 70 03 88 55 - Fax (33) (0)4 70 03 82 60
www.interchim.com - interchim@interchim.com

SGE Capillary Column Part Number Listing

Phase	Length (m)	ID (mm)	Film Thickness (µm)	Part No.
BP20	60	0.32	0.25	054434
BP20	60	0.32	0.5	054457
BP20	60	0.32	1	054445
BP20	12	0.53	1	054447
BP20	12	0.53	2	054455
BP20	15	0.53	0.5	054961
BP20	15	0.53	1	054450
BP20	25	0.53	1	054448
BP20	25	0.53	2	054456
BP20	30	0.53	0.5	054440
BP20	30	0.53	1	054451
BP20	60	0.53	0.5	054963
BP20	60	0.53	1	0544515
SolGel-WAX™	30	0.25	0.25	054796
SolGel-WAX™	30	0.25	1	054787
SolGel-WAX™	60	0.25	0.25	054791
SolGel-WAX™	30	0.32	0.25	054788
SolGel-WAX™	30	0.32	0.5	054797
SolGel-WAX™	60	0.32	0.25	054789
SolGel-WAX™	60	0.32	0.5	054792
SolGel-WAX™	30	0.53	0.5	054786
SolGel-WAX™	30	0.53	1	054785
BP21	25	0.22	0.25	054462
BP21	50	0.22	0.25	054463
BP21	15	0.25	0.25	054464
BP21	30	0.25	0.25	054465
BP21	60	0.25	0.25	054466
BP21	12	0.32	0.25	054467
BP21	15	0.32	0.25	054470
BP21	25	0.32	0.25	054468
BP21	30	0.32	0.25	054471
BP21	50	0.32	0.25	054469
BP21	60	0.32	0.25	054472
BP21	12	0.53	0.5	054473
BP21	15	0.53	0.5	054476

Phase	Length (m)	ID (mm)	Film Thickness (µm)	Part No.
BP21	25	0.53	0.5	054474
BP21	30	0.53	0.5	054477
BP21	30	0.53	1	054478
BPX70	10	0.1	0.2	054600
BPX70	12	0.22	0.25	054601
BPX70	25	0.22	0.25	054602
BPX70	30	0.22	0.25	054612
BPX70	50	0.22	0.25	054603
BPX70	60	0.22	0.25	054613
BPX70	15	0.25	0.25	054621
BPX70	30	0.25	0.25	054622
BPX70	60	0.25	0.25	054623
BPX70	120	0.25	0.25	054624
BPX70	12	0.32	0.25	054605
BPX70	25	0.32	0.25	054606
BP21	50	0.32	0.25	054469
BP21	60	0.32	0.25	054472
BP21	12	0.53	0.5	054473
BP21	15	0.53	0.5	054476
BP21	25	0.53	0.5	054474
BP21	30	0.53	0.5	054477
BP21	30	0.53	1	054478
BPX70	10	0.1	0.2	054600
BPX70	12	0.22	0.25	054601
BPX70	25	0.22	0.25	054602
BPX70	30	0.22	0.25	054612
BPX70	50	0.22	0.25	054603
BPX70	60	0.22	0.25	054613
BPX70	15	0.25	0.25	054621
BPX70	30	0.25	0.25	054622
BPX70	60	0.25	0.25	054623
BPX70	120	0.25	0.25	054624
BPX70	12	0.32	0.25	054605
BPX70	25	0.32	0.25	054606

GC Column Replacement Guide

Column to Replace	Description	SGE Phase
DB-1, HP-1, Ultra-1, SPB-1, CP-Sil 5CB, RSL-150, RSL-160, Rtx®-1, ZB-1, CB-1, OV®-1, PE-1, 007-1(MS), SP-2100, SE-30, RH-1, CC-1, CP-Sil 5CB MS, VF-1ms & Petrocol DH	100% Dimethyl Polysiloxane	BP1
Unique highly inert phase	SolGel + 100% Dimethyl Polysiloxane	SolGel-1ms™
DB-HT Sim Dis, DB-2887, Rtx-2887, HP-1, Petrocol 2887, Petrocol EX2887	100% Dimethyl Polysiloxane	BPX1
Petrocol DH, DB-Petro	100% Dimethyl Polysiloxane	BP1-PONA
DB-5, DB-5.625, Rtx-5, HP-5, Ultra-2, PTE-5, PB-5, MDN-5, CP-Sil 8CB, VB-5 & ZB-5	5% Phenyl Polysiloxane	BP5
DB-5, DB-5ms, HP-5, Ultra-2, Rtx®-5, Rtx-5Sil MS, Rtx 5MS, AT-5, AT-5MS, 007-5MS, SPB-5, CP-Sil 8CB, VF-5ms, RSL-200, CB-5, OV®-5, PE-5, 007-2(MPS-5), SE-52, SE-54, XTI-5, PTE-5, CC-5, RH-5ms & ZB-5	5% Phenyl Polysilphenylene-siloxane	BPX5
MXT-1 SimDist, HT-SimDist, DistCB, MXT-500	5% Phenyl Polycarborane-siloxane	HT5
No equivalent, unique high temperature column with special selectivity	8% Phenyl Polycarborane-siloxane	HT8
DB-35, DB-35ms, Rtx-35, HP-35, HP-35MS, SPB-35, MDN-35, VB-50 & ZB-35	35% Phenyl Polysilphenylene-siloxane	BPX35
DB-608, Rtx-35, SPB-608	35% Phenyl Polysilphenylene-siloxane	BPX608
OV-17, SP-2250, DB-17ms, DB-17ht, Rtx-50, SPB-50, HP-50+, HP-17, VB-50/608 & ZB-50	50% Phenyl Polysilphenylene-siloxane	BPX50
DB-23, CP-Sil 88, VF-23ms, SP-2330, SP-2380, Rtx®-2330, 007-23, AT-Silar & PE-23	70% Cyanopropyl Polysilphenylene-siloxane	BPX70
Unique highly inert phase	SolGel + Polyethylene Glycol	SolGel-WAX™
DB-Wax, Rtx-Wax, Stabilwax, HP20M, HP-Wax, HP-INNOWax, Supelcowax-10, AT-Wax, Nukol, CP Wax 2CB, VB-WAX & ZB-WAX	Polyethylene Glycol	BP20 (Wax)
DB-FFAP, HP-FFAP, Stabilwax-DA, CP Wax 58CB, VB-FFAP & ZB-FFAP	Polyethylene Glycol (TPA treated)	BP21 (FFAP)
DB-1701, Rtx-1701, HP-1701, SPB-7, CP-Sil 19CB, VB-1701 & ZB-1701	14% Cyanopropylphenyl Polysiloxane	BP10 (1701)
HP-225, DB-225, Rtx-225	50% Cyanopropylphenyl Polysiloxane	BP225
DB-624, HP-VOC, Rtx Volatiles, VOCOL, VB-624 & ZB-624	Cyanopropylphenyl Polysiloxane	BP624
Cyclodex-B, Rt-BDEXm	Permethylated Beta Cyclodextrin	CYDEX-B

GC Troubleshooting and Maintenance

Symptom	Possible cause	Solution
High baseline level	Poor carrier gas quality causing phase decomposition	Replace septa and insert a new inlet liner. Ensure gas traps are installed correctly to remove moisture, organics and oxygen. Ensure high purity carrier gas is used.
	Maximum temperature of the phase has been exceeded	Lower maximum program temperature.
	Highly acid or alkaline samples	Neutralize sample before injecting
	Dirty samples	Filter sample. Use a FocusLiner™.
	Dilute sample.	
Split peaks	Contaminated solvent	Use a high purity solvent.
	Poor manual injection technique	Increase the plunger depression speed.
	Mixed solvent	Change to a single solvent
	Compound degradation	Can happen with some pesticides. Lower injector temperature. Recondition capillary column and re-inject sample.
Fronting peaks	Column inserted too far into injector	Reposition column according to manufacturer's instructions.
	Too much sample injected on to column	Dilute sample.
		Use a thicker film.
Tailing peaks		Increase the split ratio.
	Column contamination	Cut 50cm off the front of the column and re-install in the injector. Recondition column.
	Sample not suitable for phase polarity	Choose a more polar column.
	Poorly deactivated inlet liner	Replace with a new fully deactivated inlet liner.
Broad peaks	Graphite ferrule contamination in the start of the column	Cut 5cm off the front of the column and re-install in the injector
	Make-up gas flow rate for atmospheric detectors is low	Increase make up gas flow according to manufacturer's instructions.
	Carrier gas flow is low	Check carrier gas flow.
	Split gas flow is too low	Increase split flow or use the 'solvent effect' to focus peaks.
	Column contamination	Cut 50cm off the front of the column and re-install in the injector.
	Co-elution of peaks	Change column polarity or lower temp. program ramp rate to separate peaks.
	Change in sample concentration	Check injector conditions are reproducible e.g. temperature and split ratio.
	Mass spectrometer sampling rate is too low causing triangular-looking peaks	Increase sampling rate or reduce number of ions detected in SIM mode.
Shifting retention times	Leaking septum	Tighten septum cap or replace with new septum.
	Carrier gas velocity has changed	Check inlet pressure on GC. Ensure pressure in gas line and gas cylinder is OK
	Method temperature has changed	Re-check temperature method conditions
	Column dimensions and film thickness have changed after installing a new column	Re-check dimensions on column tag against column description.
	Sample concentration has changed – more has been injected on column	Dilute sample or increase split ratio.
	Dirty column. Extra non-volatile material deposited on the column has caused a change in column polarity	Cut 50cm off the front of the column and re-install in the injector Recondition column.
Loss of peak resolution	Aging column has resulted in a substantial loss of phase causing a loss in column resolving power	Replace column.
	Method temperature has changed	Re-check temperature method conditions
	Carrier gas velocity has changed	Re-check carrier gas velocity and optimize to Van Deemter optima.
	Dirty column. Extra non-volatile material deposited on the column has caused a change in column polarity	Cut 50cm off the front of the column and re-install in the injector.
	Manual injection technique or operator has changed	Ensure technique is consistent.
No peaks	GC incorrectly wired	Check all connections from GC to computer / integrator.
	Wrong detector is being monitored	Check injector number is consistent with detector number being monitored.
	FID flame is out	If using water, reduce injection volume. Water can extinguish the flame. Check flame gas pressures
	Syringe is blocked or leaking around plunger	Use a known good syringe to confirm this is the problem.
	Massive leak in system	Check all column and injector connections. Check column for breakage. This can sometimes be difficult to locate as the fused silica can break leaving the polyimide outer coating intact.
	Column is blocked	Cut 5cm off the front and back ends of the column and re-install.
Loss of sensitivity	Concentration of sample has changed	Re-confirm with a known standard concentration injection.
	Flame gas flow rates and/or make-up gas flow have changed	Check flame gas pressures
	System has become active	Replace inlet liner with a new deactivated liner.
		Cut 50cm off the front of the column, re-install in the injector and re-condition the column
Ghost peaks	Splitless conditions have changed	Re-check solvent and method temperatures.
	Syringe has become contaminated from previous sample	Ensure syringe has been thoroughly washed with solvent between injections. Sometimes this can involve 20 solvent appearing rinses.
	New standards have impurities	Confirm by using a different source of primary standards.
	Impurities in solvent	Use a different type of solvent or confirm by using a different source of the same solvent.
	Septum bleed	Can appear as discrete peaks in temperature program runs. Will disappear with isothermal analysis. Replace septum.
	Peaks are still eluting from previous run	Peaks will appear broader for that part of the chromatogram. Confirm by extending run time and ensuring all peaks have eluted from sample.
	Flashback has happened	Inject twice the amount of pure solvent (this may need to be repeated).