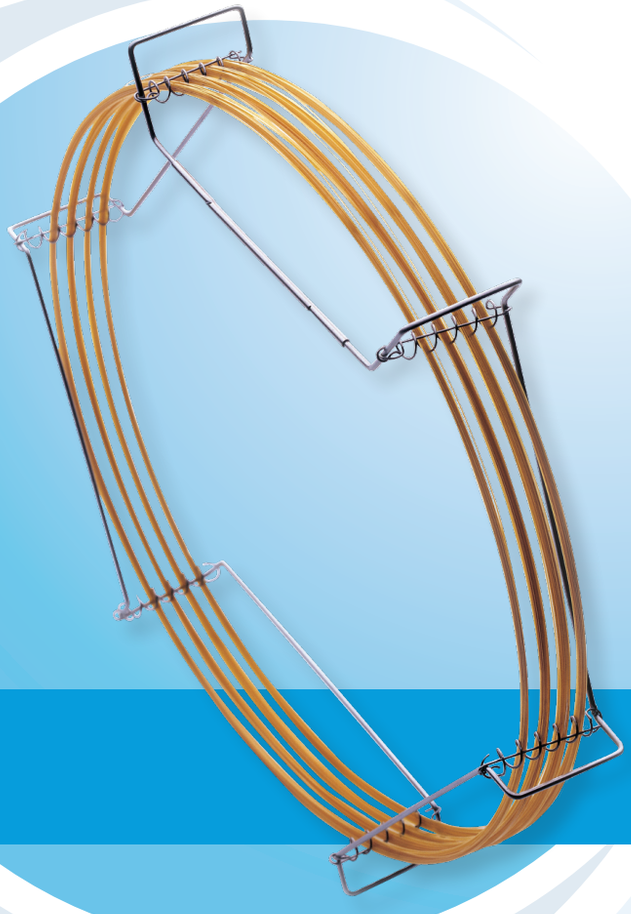


Applications Guide

Environmental

Fuels and Petrochemical

Pharmaceutical

Food, Flavors and Fragrances

Chemical

Forensic

50 SGE years 1960 - 2010

SGE Analytical Science

www.sge.com

AUSTRALIA & PACIFIC REGION CHINA EUROPE INDIA JAPAN MIDDLE EAST USA

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.

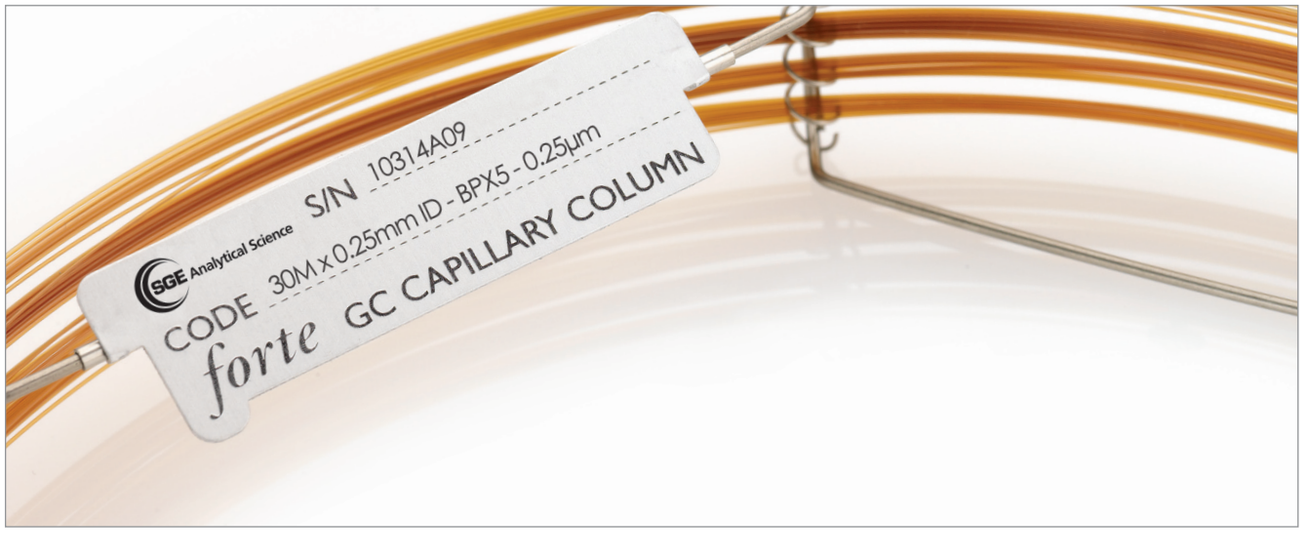
forte™ GC Capillary Columns

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.

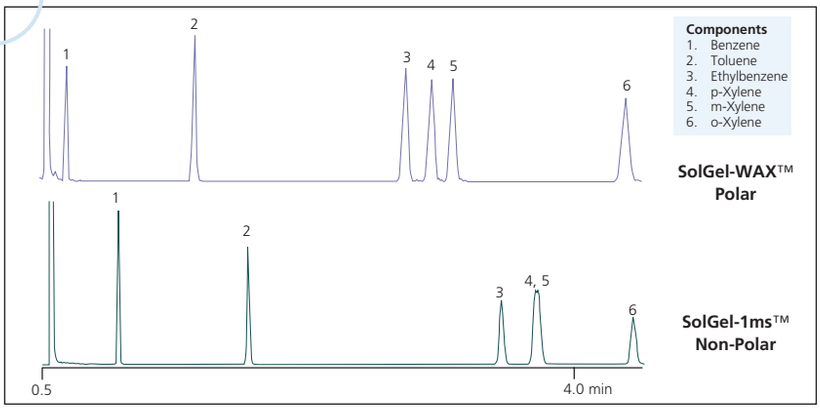
SGE offers a comprehensive range of *forte*™ GC capillary columns for almost any chromatographic application providing the best possible combination of, Performance, Robustness, Reproducibility, Low Bleed and Inertness.

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.



Contents

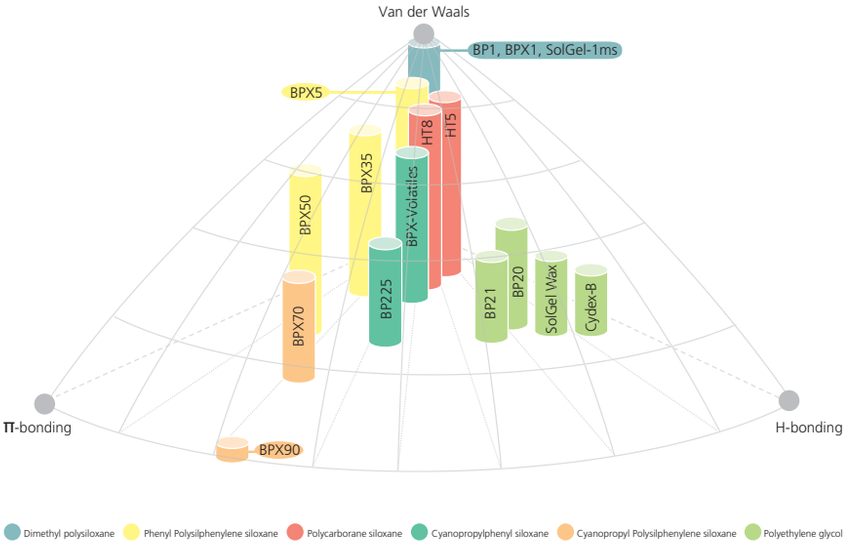
1 Stationary Phase



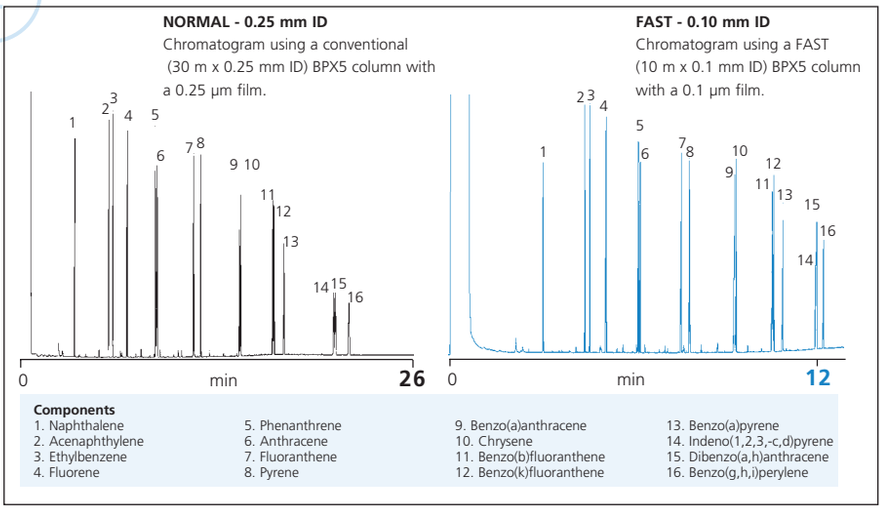
*Effect of Stationary Phase. BTEX analysis on a polar (*SolGel-WAX™*) column and a 100% dimethyl polysiloxane (SolGel-1ms™), both 30 m x 0.25 mm ID X 0.25 µm film.*

- 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 and BPX70)
- To separate compounds that differ more in their hydrogen bonding capacities (for example aldehydes and alcohols), polythylene glycol type phases are best suited - SolGel-WAX™, BP20 (WAX) and BP21 (FFAP)

Stationary Phase Polarity



2 Internal Diameter



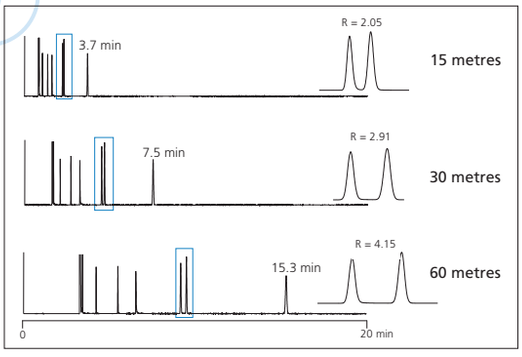
Effect of Internal Diameter. Polynuclear Aromatic Hydrocarbon (PAH) analysis.

- 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.

For further information on our full range of products, please visit **www.sge.com**

SGE Analytical Science

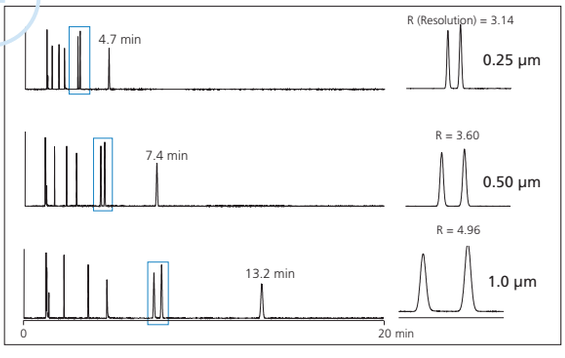
3 Column Length



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.

$$ß = \frac{id}{4d_f}$$

where
ß = ratio
id = column internal diameter (µm)
d_f = film thickness (µm)

Formula to calculate Phase Ratio

- From the phase ratio value ß, a column can be categorized for the type of application it would best suit. The smaller the ß 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 ß 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 (ß) 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

	PHASE													
Application	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 - Componds													⊙	
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

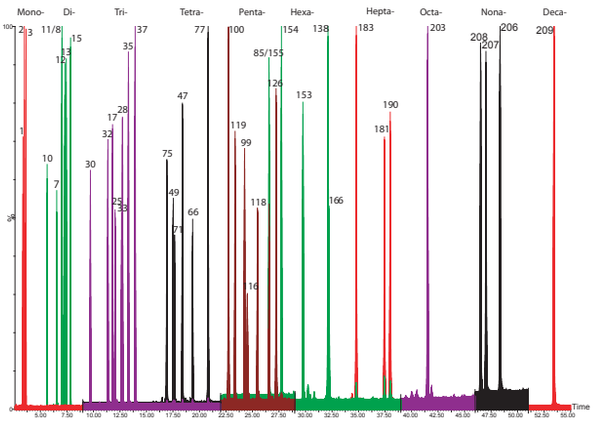
The widespread use of GC-MS for Environmental analyses requires both low bleed and inertness. The broad range of compounds of interest means that medium polarity phases become more useful. BPX5, BPX35, and BPX50 provide a range of polarities, all with low bleed, high temperature limits, and robustness.

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

Applications

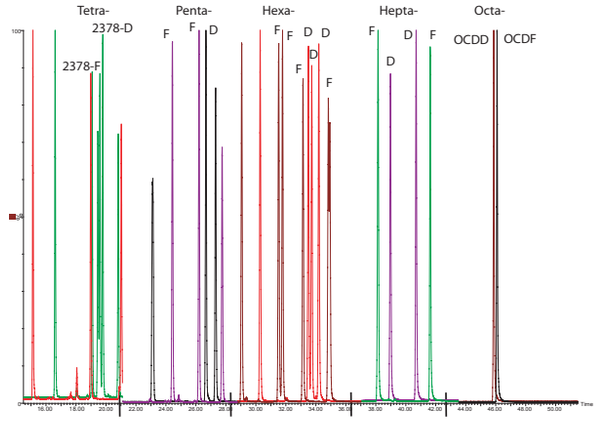
- Analysis of PCB'S, PCDT'S, and other complex mixtures using BPX5 and SolGel-1ms
- HT8: The Perfect PCB Column
- Fast Pesticide Screening Using a BPX5 GC Capillary Column
- Analysis of Polychlorinated Dibenzodioxins and Furans on BPX5
- Analysis of Polynuclear Aromatic Hydrocarbons on BPX35
- Analysis 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 PCB'S, PCDT'S, AND OTHER COMPLEX MIXTURES USING BPX5 AND SOLGEL-1ms



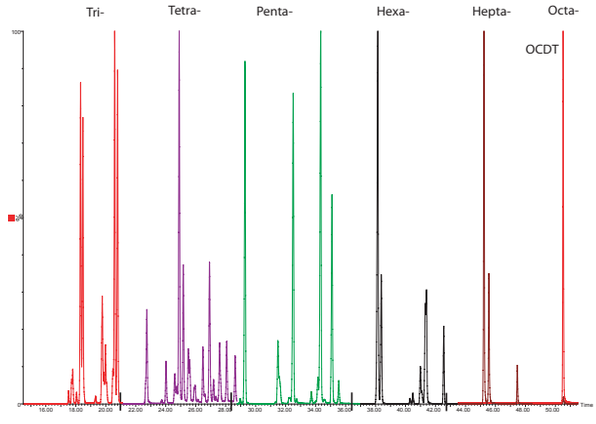
SIM 7-Group Analysis of 44 mono- to deca-PBDE's via cool-on-column (3-µL). Deca-PBDE 209 at 310 °C, PBDEs 33/28 and 138/166 partially resolved, PBDE 85 coeluted with 155.

- 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 µm
- 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 µL) 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 µm
- 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



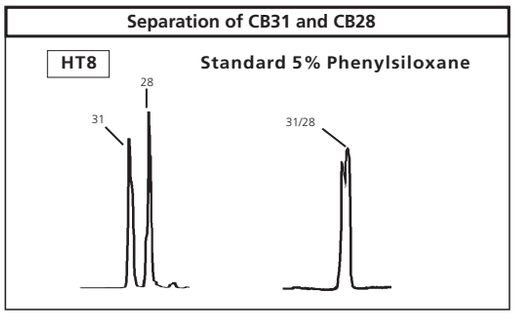
ACKNOWLEDGEMENT
Paul H. Peterman, US Geological Survey, Columbia Environmental Research Center. For additional information see SGE application note AN-0030-C.

EXPERT TIP

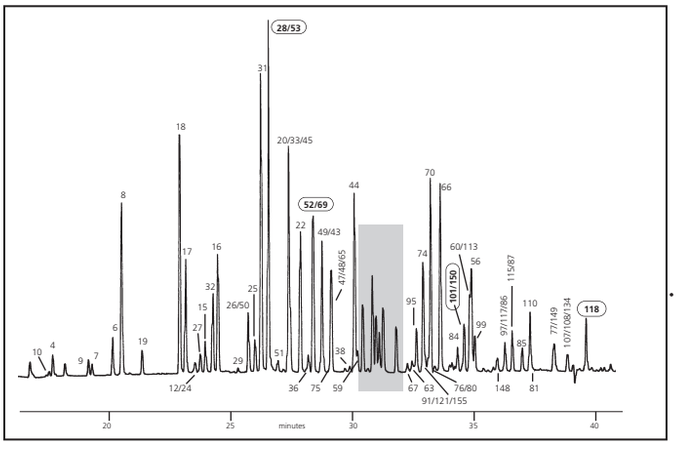
SGE liners undergo a high temperature deactivation process making them ideal for using with active compounds

SGE Analytical Science

HT8: THE PERFECT PCB COLUMN

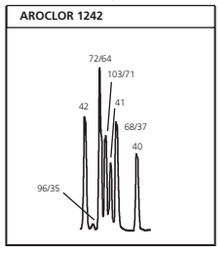


Chromatogram on the left demonstrates clearly the significant difference in selectivity of the HT8 column. By GC/MS, quantitation of CB28 using a standard 5% phenylpolysiloxane column is impossible as coelution with CB31 (with the same number of chlorines) occurs.
HT8 separates the two congeners by a full minute allowing quantitation to be performed with ease.

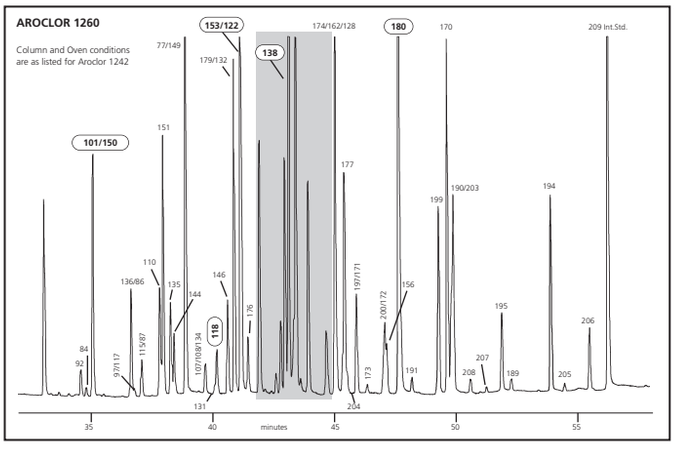


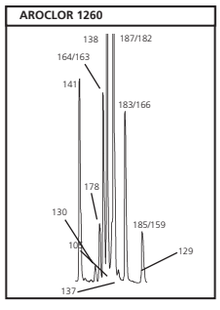
AROCLOR 1242

Phase:	**HT8, 0.25 µm film**
Column:	**50 m x 0.22 mm ID**
Initial Temp:	80 °C, 2 min
Rate 1:	30 °C/min
Temp 2:	170 °C
Rate 2:	3 °C/min
Final Temp:	Split, 300 °C
Carrier Gas:	**He, 40 psi**
Detector:	ECD, 330 °C



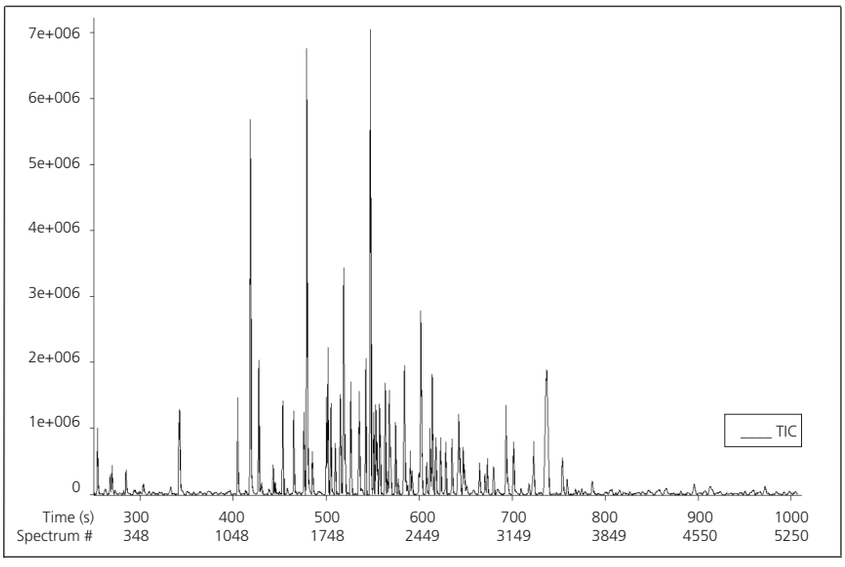
Congener #	Cl Position	Cl #	Identification by GC/MS
42	23-24	4	✓
96	236-26	5	✓
35	34-3	3	
64	235-4	4	✗
72	25-35	4	
103	246-25	5	✓
71	26-34	4	
41	234-2	4	✓
68	24-35	4	✓
37	34-4	3	
100	246-24	5	✓

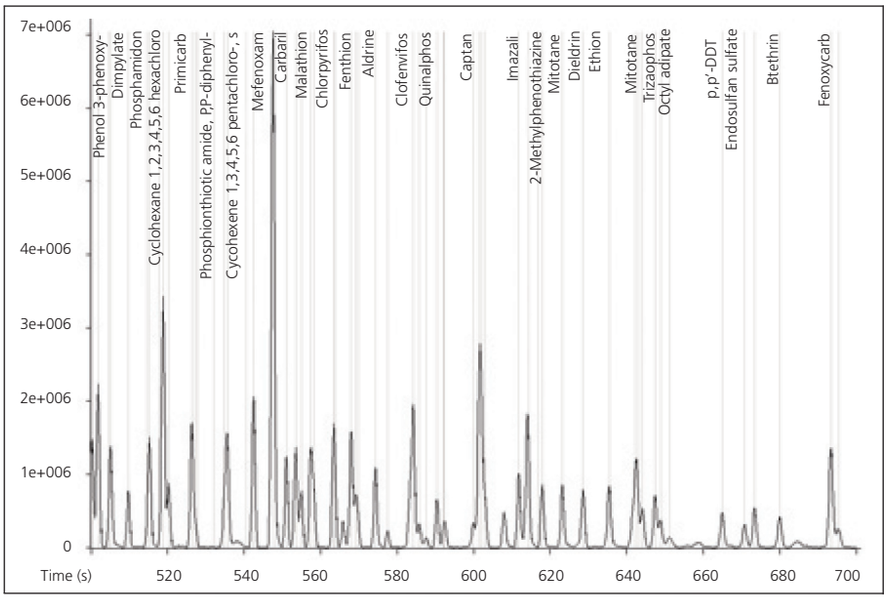


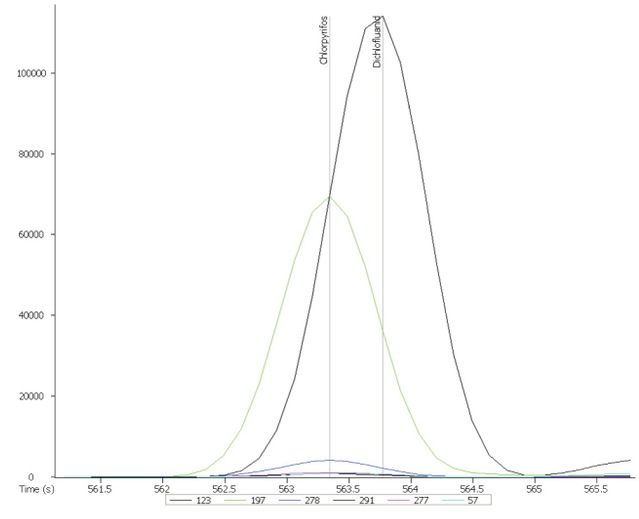


Congener #	Cl Position	Cl #	Identification by GC/MS
130	234-235	6	✓
178	2356-235	7	✓
141	2345-25	6	
164	236-345	6	✗
163	2356-34	6	
138	234-245	6	✓
160	23456-3	6	✓
175	2346-235	7	
158	2346-34	6	✓
187	2356-245	7	✗
182	2345-246	7	
129	2345-23	6	✓

FAST PESTICIDE SCREENING USING A BPX5 GC CAPILLARY COLUMN







Phase:	**SGE *forte* BPX5DX**
Column:	**40 m x 0.18 mm ID x 0.18 µm**
Initial Temp:	80 °C, 1 min
Rate 1:	25 °C/min to 300 °C
Final Temp:	300 °C, 7 min
Detector Type:	LECO™ TOF Mass spectrometer
Carrier Gas:	He
Carrier Gas Flow:	constant flow mode at 1 mL/min
Average Linear Velocity:	~75 cm/sec
Injection Mode:	splitless
Injection Temperature:	270 °C
Total run time:	16.8 min
Detector voltage:	1700 V
Data acquisition speed:	10 Hz
Column Part Number:	**054229**

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

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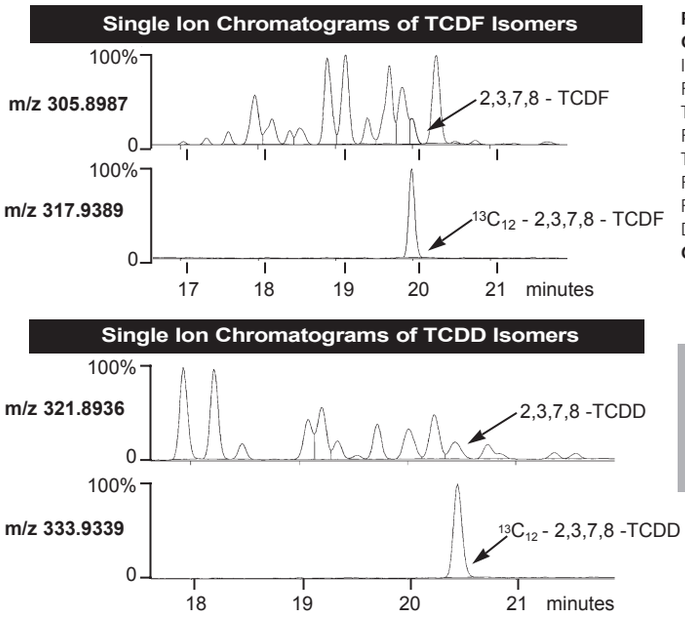
Peak number	Name	R.T. (s)
1	Methamidophos	341.292
2	Dichlorovos	342.291
3	Phosphorodithioic acid, O,O-diethyl ester	381.561
4	Mevinphos	404.552
5	Carbamic acid, phenyl-, 1-methylethyl ester	418.261
6	Methacrifos	427.4
7	Benzene, (3-chloro-1-propenyl)	433.969
8	Butyl dimethyl phosphate	436.539
9	1-Naphthalenol	442.965
10	Bibenzyl	445.107
11	Cyclohexene, pentachloro-	449.534
12	Heptenophos	453.39
13	Endosulfan	462.672
14	Omethoate	465.099
15	Diphenylamine	476.095
16	Carbamic acid, (4-chlorophenyl), 1-methylethyl ester	479.094
17	Monocrotophos	485.091
18	Cyclohexane, 1,2,3,4,5,6-hexachloro-	500.228
19	Benzene, hexachloro-	501.799
20	Phenol, 3-phenoxy-	504.512
21	Dimethoate	505.083
22	Dimpylate	509.796
23	Phosphamidon	514.651
24	α-Lindane	515.222
25	Benzonitrile, pentachloro-	517.792
26	Cyclohexane, 1,2,3,4,5,6-hexachloro-	518.792
27	Etrimfos	520.22
28	Pirimicarb	526.36
29	Tetrachloroisophthalonitrile	527.217
30	Phosmet	527.788
31	Phosphinothioic amide, P,P-diphenyl-	532.072
32	Phosphamidon	534.786
33	γ-Lindane	535.642
34	Cyclohexene, 1,3,4,5,6-pentachloro-, ç-	540.498
35	Methyl chlorpyrifos	542.497
36	Mefenoxam	547.78
37	Pirimiphos methyl	551.065
38	Carbaril	553.492
39	Heptachlor	554.92
40	Malathion	557.348
41	Fenitrothion	558.205
42	Chlorpyrifos	563.346
43	Dichlofluanid	563.774
44	Fenthion	567.915
45	Parathion	569.2
46	Triadimefon	569.772
47	Aldrine	574.341
48	cis-Chlorfenvinphos	577.483
49	Clofenvinfos	584.194

Peak number	Name	R.T. (s)
50	Penconazole	585.765
51	Tolylfluanide	587.622
52	Quinalphos	590.478
53	Procymidone	592.191
54	Captan	599.902
55	Methidathion	601.33
56	o,p'-DDE	602.044
57	Folpet	602.901
58	Imazalil	611.755
59	Bupirimate	614.325
60	2-Methylphenothiazine	616.896
61	p,p'-DDE	617.895
62	Mitotane	623.179
63	Dieldrin	628.605
64	Ethion	635.46
65	Mitotane	642.314
66	m,p'-DDD	643.171
67	o,p'-DDT	644.17
68	Triazophos	647.455
69	Endosulfan I	648.883
70	Octyl adipate	651.168
71	p,p'-DDT	665.019
72	Endosulfan sulfate	670.731
73	Tebuconazole	673.444
74	Bifenthrin	680.013
75	Fenoxycarb	693.436
76	Bromopropylate	695.436
77	Phosmet	701.576
78	Endrin ketone	709.43
79	λ-Cyhalothrin	718.141
80	Tetradifon	721.854
81	Phosalone	723.282
82	Fenarimol	754.126
83	Azinphos-ethyl	759.124
84	Permethrin	768.264
85	Permethrin	774.975
86	Pyridaben	786.114
87	Cyfluthrin	805.534
88	Cyfluthrin	807.248
89	Cypermethrin	819.957
90	Cypermethrin	826.383
91	Cypermethrin	831.238
92	Cypermethrin	833.095
93	Esfenvalerate	895.927
94	Fenvalerate α	914.062
95	Difenoconazole	950.476
96	Difenoconazole	956.617
97	Deltamethrin	972.182

The list of some pesticides used in the sample, and their retention times

ANALYSIS OF POLYCHLORINATED DIBENZODIOXINS AND FURANS ON BPX5



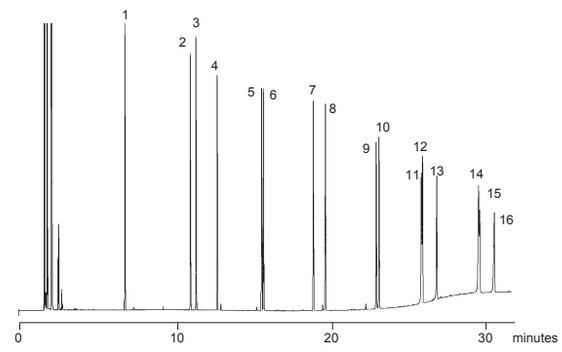
Phase:	**BPX5, 0.25 µm**
Column:	**50 m x 0.22 mm ID**
Initial Temp:	80 °C
Rate 1:	10 °C/min
Temp1:	240 °C
Rate 2:	2 °C/min
Temp 2 :	280 °C
Rate 3:	10 °C/min
Final Temp:	320 °C
Detector:	Mass Spectrometer
Column Part Number:	**054114**

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

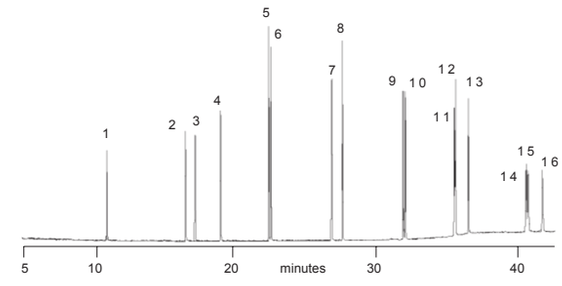


Components

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:	**BPX35, 0.25 µm**
Column:	**30 m x 0.22 mm ID**
Initial Temp:	100 °C,1 min
Rate:	10 °C/min
Final Temp:	360 °C, 10 min
Carrier Gas:	He, 25 psi
Detector:	FID 380 °C
Column Part Number:	**054714**

ANALYSIS OF POLYNUCLEAR AROMATIC HYDROCARBONS ON BPX5



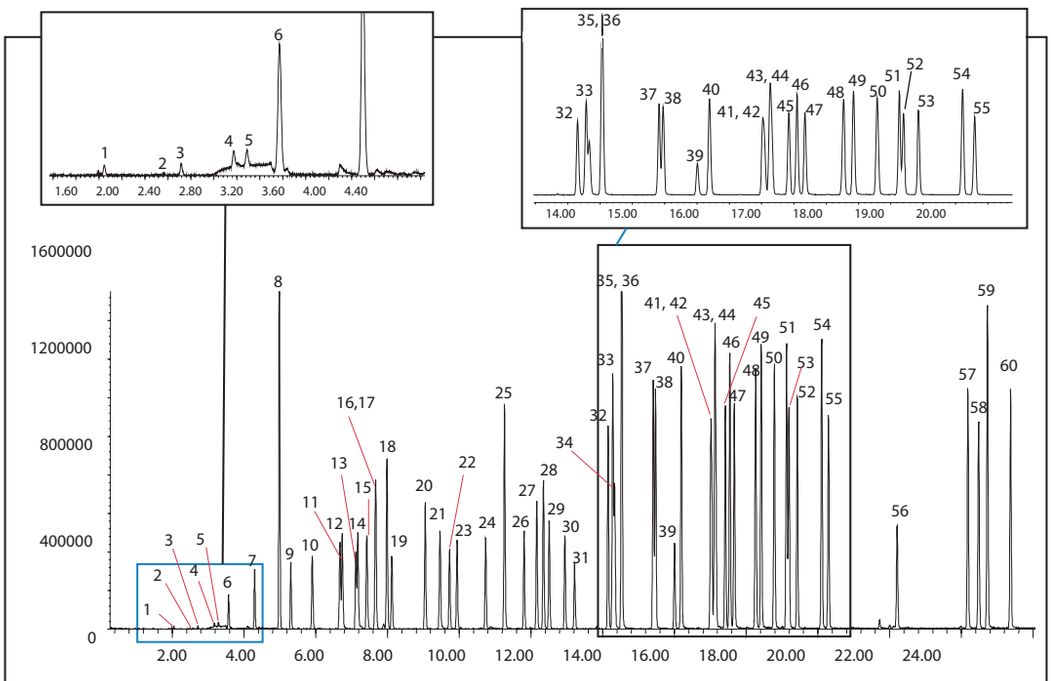
Components
(0.5ng each component)

1. Naphtalene
2. Acenaphtylene
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:	**BPX5, 0.25 µm film**
Column:	**25 m x 0.22 mm ID**
Initial Temp:	50 °C, 2 min
Rate:	8 °C/min
Final Temp:	290 °C, 10 min
Carrier Gas:	HP5971 MSD
Detector:	Split 40:1
Carrier Gas:	He, 15 psi
Column Part Number:	**054113**

ANALYSIS OF VOLATILE ORGANIC POLLUTANTS ON BPX-VOLATILES



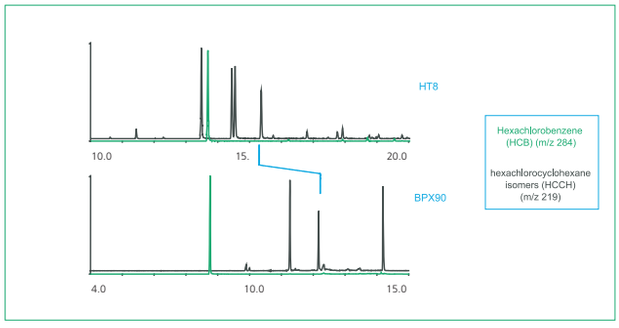
Chromatogram showing analysis of commonly screened volatile organic pollutants

Components

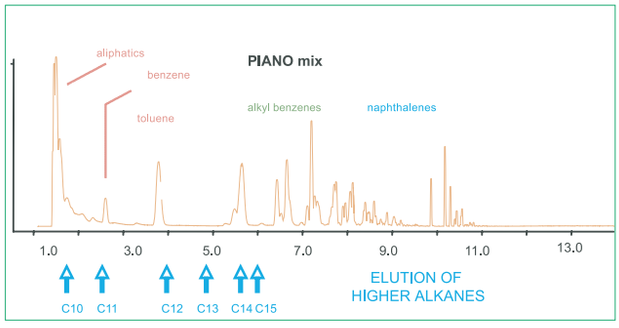
1. Dichlorodifluoromethane
2. Chloromethane
3. Vinyl chloride
4. Bromomethane
5. Chloromethane
6. Trichlorofluoromethane
7. 1,1-Dichloroethene
8. Dichloromethane
9. trans-1,2-Dichloroethene
10. 1,1-Dichloroethane
11. 2,2-Dichloropropane
12. cis-1,2-Dichloroethene
13. Bromochloromethane
14. Chloroform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

Phase:	**BPX-Volatiles 1 µm film**
502.2 mix:	**200 ppm in Methanol**
Column:	**40 m x 0.18 mm ID**
Initial Temp:	40 °C , 0 min
Rate 1:	6 °C to 210 °C
Rate 2:	15 °C to 240 °C
Final Temp:	240 °C, 5 min
Detector Type:	Mass Spectrometer
Carrier Gas:	He, 40.3 psi
Carrier Gas Flow :	1.2 mL/min
Constant Flow:	On
Average Linear Velocity:	35 cm/sec at 40 °C
Injection Mode:	Split
Split Ratio:	50:1
Injection Volume:	1 µL
Injection Temperature:	250 °C
Autosampler:	No
Liner Type :	4 mm ID Single Taper Liner
Liner Part Number:	**092017**
Column Part Number:	**054860**
ms-NoVent™Part No:	113400
HP5973 restrictor:	113409
Full scan:	45-450 m/z

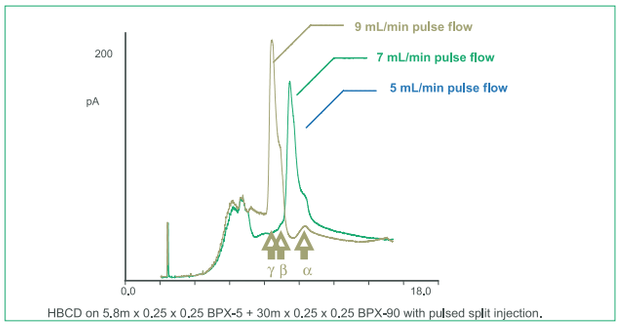
APPLICATIONS USING BPX90



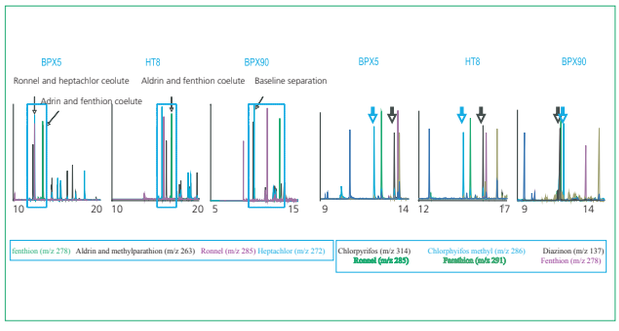
HCCH isomers and HCB



Separation of aromatics

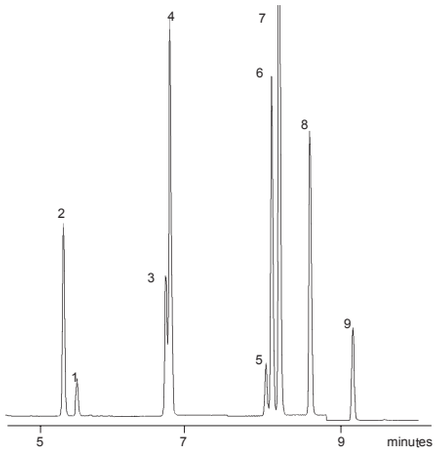


Separation of hexabromocylododecanes



Selectivity for pesticides and 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 and m-Xylene
8. o-Xylene
9. Bromofluorobenzene

VOLATILES IN DRINKING WATER

Phase:	**BP624, 1.2 µm**
Column:	**25 m x 0.22 mm ID**
Initial Temp:	50 °C, 2 min
Rate:	15 °C/min
Final Temp:	170 °C
Detector:	HP5970 MSD
Injection Mode:	Hexadecane extract
Carrier Gas:	He, 15 psi
Column Part Number:	**054826**

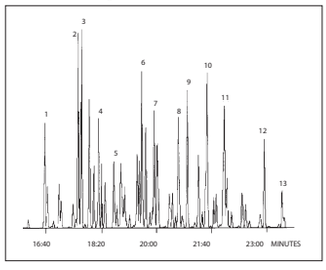
EXPERT TIP

Condition column at either 20 ° above the maximum method temperature or the recommended maximum column temperature (whichever is lower).

SGE Analytical Science

POLYCHLORINATED BIPHENYLS PCB ANALYSIS

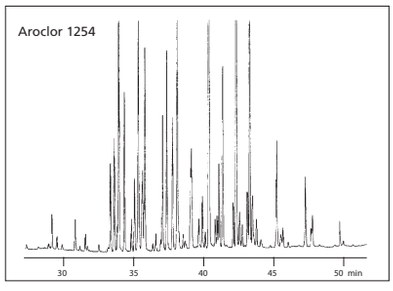
GC/MS Analysis of PCB mixture



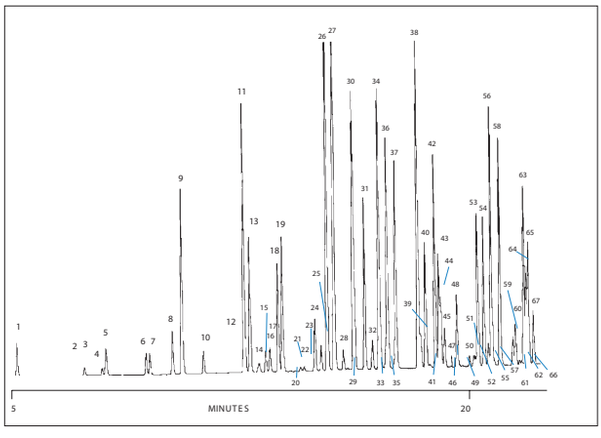
Components
1. PCB 18
2. PCB 31
3. PCB 28
4. PCB 52
5. PCB 44
6. PCB 70
7. PCB 101
8. PCB 110
9. PCB 149
10. PCB 153
11. PCB 138
12. PCB 180
13. PCB 170

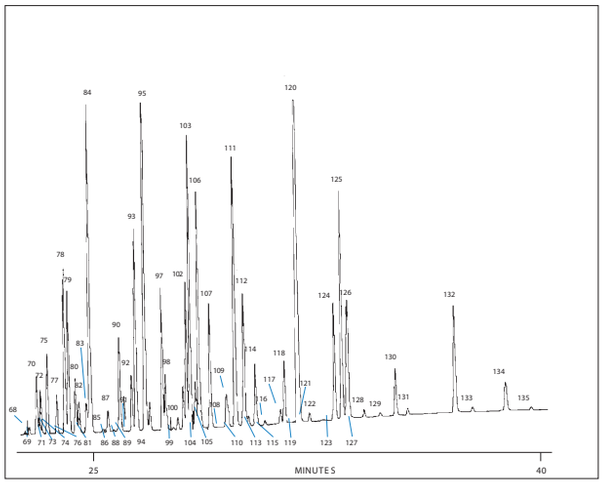
Phase:	**HT8, 0.25 µm**
Column:	**25 m x 0.22 mm ID**
Initial Temp:	60 °C, 2 min
Rate:	12 °C/min
Final Temp:	360 °C, 10 min
Detector:	Ion Trap MS
Injection Mode:	PTV
Carrier Gas:	He, 15 psi

Performance Specifications
HT8 8% Phenyl (Equiv) Polycarborane - Siloxane
Minimum Operating Temp.: -20 °C
Maximum Cycling Temp.: 370 °C (Polyimide)



Phase:	**HT8, 0.25 µm**
Column:	**50 m x 0.22 mm ID**
Initial Temp:	60 °C
Rate 1:	40 °C/min
Temp 1:	200 °C
Rate 2:	3 °C/min
Temp 2:	320 °C
Detector:	ECD
Carrier Gas:	He, 40 psi





PCB ANALYSIS

Phase:	**HT8, 0.25 µm film**
Column:	**50 m x 0.22 mm ID**
Initial Temp:	90 °C, 1 min
Rate 1:	20 °C/min
Temp 1:	170 °C,7.5 min
Rate 2:	3.5 °C/min
Temp 2:	285 °C
Rate 3:	20 °C/min
Temp 3:	320 °C
Carrier Gas:	H_2, 43 cm/sec
Detector:	ECD

Components
1. PCB1
2. PCB2
3. PCB3
4. PCB10
5. PCB4
6. PCB9
7. PCB7
8. PCB6
9. PCB 8/5
10. PCB19
11. PCB18
12. PCB11
13. PCB17
14. PCB13
15. PCB24
16. PCB27
17. PCB15
18. PCB32
19. PCB16
20. PCB54
21. PCB23
22. PCB34
23. PCB29
24. PCB26
25. PCB25
26. PCB31
27. PCB8/53
28. PCB51
29. PCB21
30. PCB33/45/20
31. PCB22
32. PCB46
33. PCB36
34. PCB52/69
35. PCB43
36. PCB49
37. PCB47/48/75
38. PCB44
39. PCB59
40. PCB42
41. PCB35
42. PCB64
43. PCB71/103
44. PCB41
45. PCB37
46. PCB68
47. PCB100
48. PCB40
49. PCB57
50. PCB67
51. PCB63
52. PCB102
53. PCB95
54. PCB74
55. PCB121/155/91
56. PCB70
57. PCB80
58. PCB66
59. PCB96/55
60. PCB84/92
61. PCB125
62. PCB90
63. PCB101
64. PCB60
65. PCB56
66. PCB152
67. PCB99
68. PCB119
69. PCB83
70. PCB136
71. PCB86
72. PCB97
73. PCB89
74. PCB115
75. PCB87
76. PCB154
77. PCB85
78. PCB10/81
79. PCB151
80. PCB144
81. PCB147
82. PCB135
83. PCB77/82
84. PCB149
85. PCB124
86. PCB143
87. PCB134/107/131
88. PCB123
89. PCB133
90. PCB118
91. PCB165
92. PCB143/114
93. PCB132/179
94. PCB122
95. PCB153
96. PCB176
97. PCB141
98. PCB105
99. PCB137
100. PCB130
101. PCB178
102. PCB163
103. PCB138
104. PCB160
105. PCB158/175
106. PCB187/182
107. PCB183/129
108. PCB126
109. PCB185
110. PCB159/202
111. PCB174/128
112. PCB177/201
113. PCB167
114. PCB171
115. PCB197
116. PCB173
117. PCB200
118. PCB156/172
119. PCB157
120. PCB180
121. PCB193
122. PCB191
123. PCB198
124. PCB199
125. PCB170
126. PCB190/196/203
127. PCB169
128. PCB208
129. PCB207
130. PCB195
131. PCB189
132. PCB194
133. PCB205
134. PCB206
135. PCB209

Part Number:
054676

Food, Flavors and Fragrances

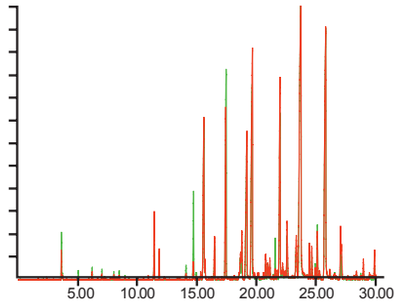
GC analysis in the Food, Flavors and Fragrances area covers a diverse range of compounds that vary in both polarity and boiling point. As a consequence a range of different columns are often required. Chromatograms are often complex, and any single column may not give enough separation of all of the 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, specialized 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.

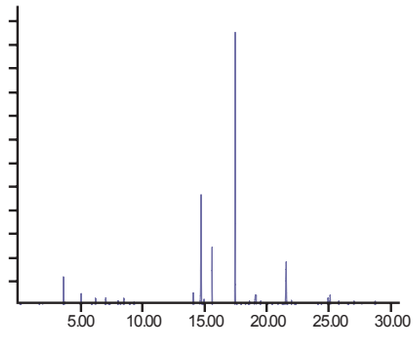
Applications

- 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

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.

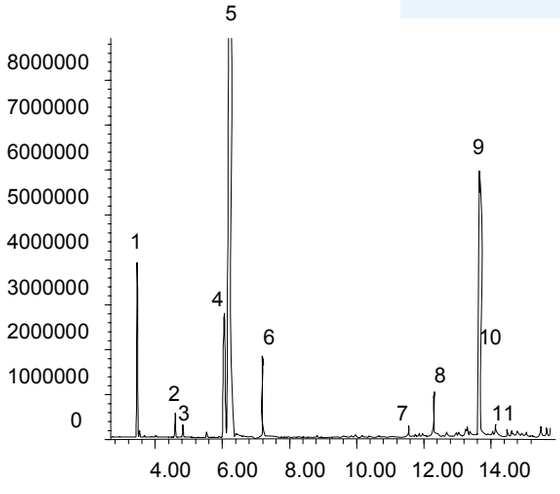
EXPERIMENTAL CONDITIONS

Column:	SGE ***forte*** 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 Flavors, France, for providing these chromatograms. For more information see SGE application note AN-0020-C.

ANALYSIS OF EUCALYPTUS OIL ON SOLGEL-WAX™

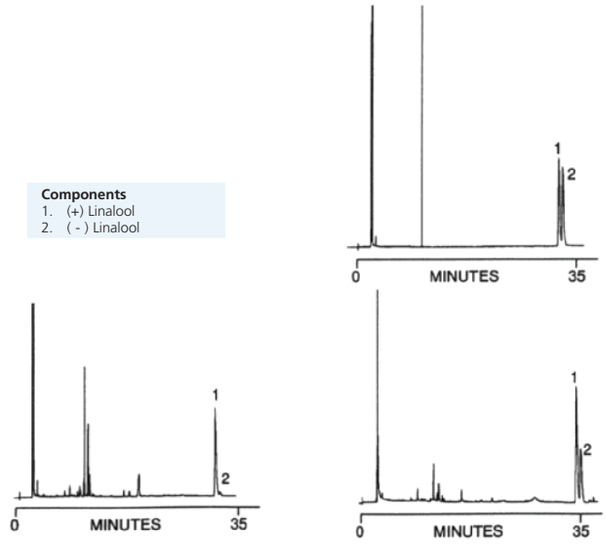
Components
1. α-Pinene
2. ß -Pinene
3. Sabinene
4. Limonene
5. 1,8 -Cineole
6. *p*-Cymene
7. Linalool L
8. Terpinen-4-ol
9. α-Terpineol
10. α-Terpinenyl acetate
11. d-Carvoαne



Phase:	**SolGel-WAX™, 0.25 µm 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 µL
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

ANALYSIS OF LAVENDER OIL ON CYDEX-B

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



EXPERT TIP

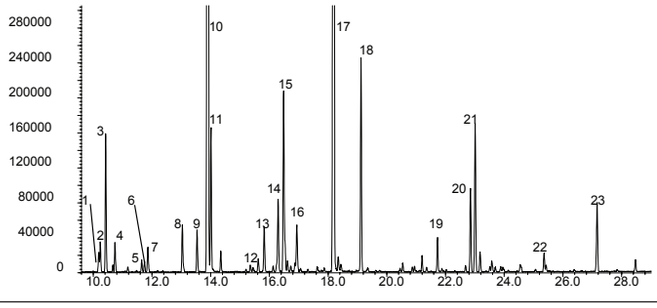
Better resolution is often obtained from chiral columns by using lower temperatures and higher carrier gas velocities than for conventional columns.

LAVENDER OIL

Phase:	**CYDEX-B, 0.25 µm 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
Column Part Number:	**054901**

ANALYSIS OF LAVENDER OIL ON BPX5

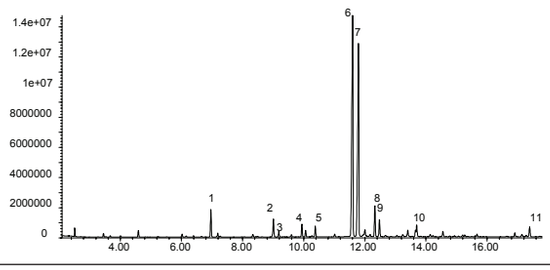
Components
1. ß- Pinene
2. 1-Octen-3-ol
3. 3-Octanol
4. 3-Octanol
5. p-Cymene
6. Limonene
7. cis-Ocimene
8. cis-Linaloxide
9. trans-Linalool oxide
10. Linalool L
11. Octenyl acetate
12. Camphor
13. Lavandulol
14. Borneol L
15. Terpinen-4-ol
16. α-Terpineol
17. Linalyl acetate
18. Lavundyl Acetate
19.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



Phase:	**BPX5, 0.25 µm 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 µL
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 µm 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 µL
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

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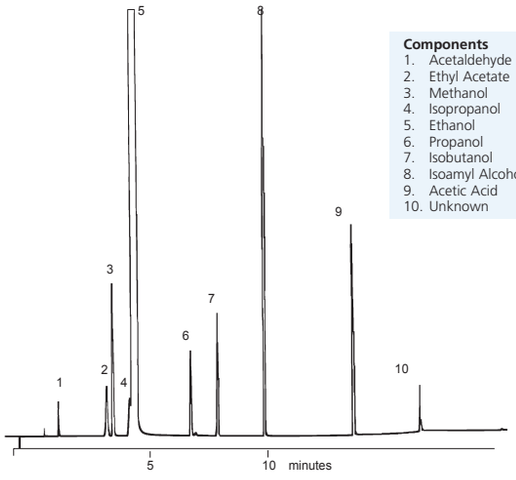
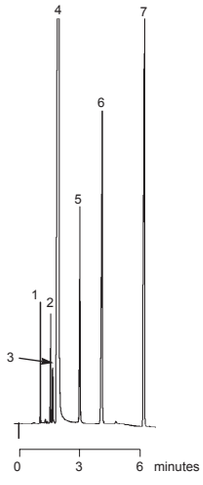
ANALYSIS OF WINE ON BP20



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 µm**
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:	H_2 ,6psi
Injection Mode:	2 µL
Column Part Number:	**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

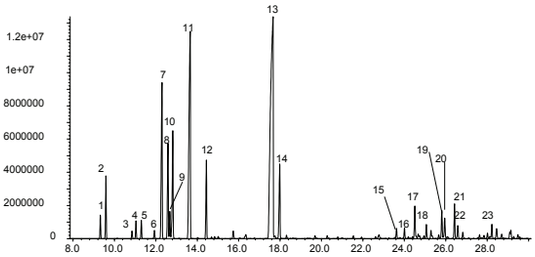
EXPERT TIP

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

Phase:	**BP20, 1.0 µm**
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
Column Part Number:	**054447**

ANALYSIS OF TEATREE OIL ON BPX5

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

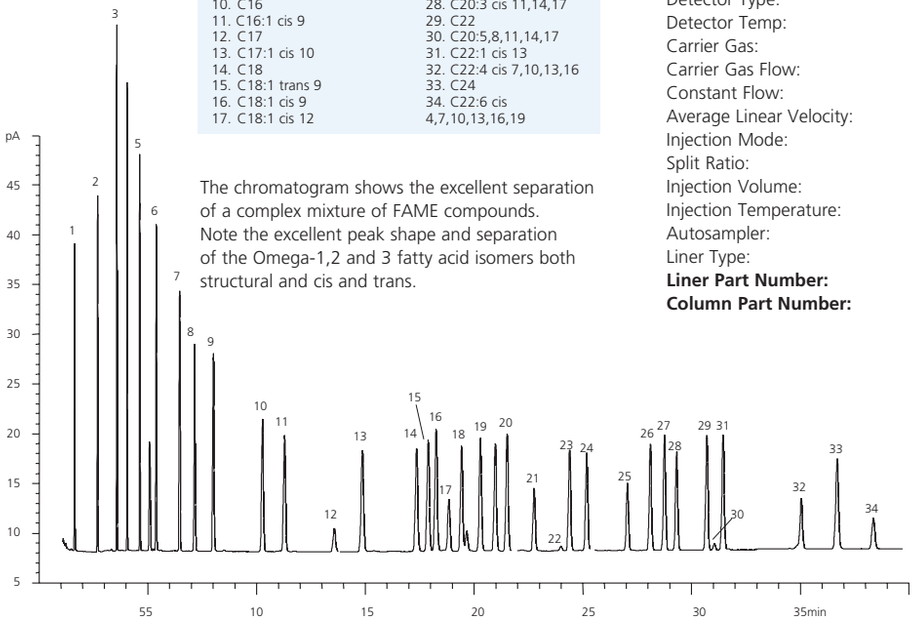


Phase:	**BP20, 0.25 µm film**
Column:	**30 m x 0.25 mm ID**
Initial Temp:	40 °C, 1 min
Rate 1:	5 °C/min to 200 °C
Final Temp:	200 °C
Detector Type:	Mass Spectrometer
Carrier Gas:	He, 7.0 psi
Constant Flow:	1.0 mL/min.
Average Linear Velocity:	36 cm/sec at 40 °C
Injection Mode:	Split
Split Ratio:	200:1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

ANALYSIS OF OMEGA-3 FATTY ACIDS USING A BPX70

Components

1. C6
2. C8
3. C10
4. C11
5. C12
6. C13
7. C14
8. C14:1 cis 9
9. C15
10. C16
11. C16:1 cis 9
12. C17
13. C17:1 cis 10
14. C18
15. C18:1 trans 9
16. C18:1 cis 9
17. C18:1 cis 12
18. C18:2 trans 9,12
19. C18:2 cis 9,12
20. C18:3 cis 6,9,12
21. C18:3 cis 9,12,15
22. C18:4 cis 6,9,12,15
23. C20
24. C21:1 cis 11
25. C20:2 cis 11,14
26. C20:3 cis 8,11,14
27. C20:4 cis 5,8,11,14
28. C20:3 cis 11,14,17
29. C22
30. C20:5,8,11,14,17
31. C22:1 cis 13
32. C22:4 cis 7,10,13,16
33. C24
34. C22:6 cis 4,7,10,13,16,19

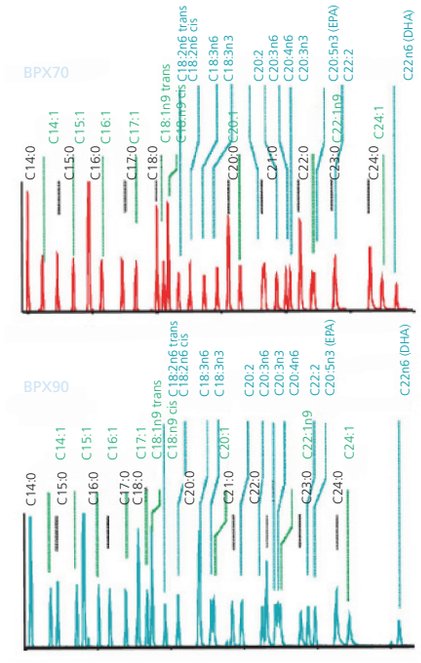


The chromatogram shows the excellent separation of a complex mixture of FAME compounds. Note the excellent peak shape and separation of the Omega-1,2 and 3 fatty acid isomers both structural and cis and trans.

Phase:	**BPX70, 0.25 µm film**
Sample:	**10 ppm in methanol**
Column:	**25 m x 0.32 mm ID**
Initial Temp:	80 °C, 2 min
Rate 1:	50 °C/min to 130 °C, 10 min
Rate 2:	2 °C/min to 172°C
Final Temp:	172 °C , 6 min
Detector Type:	FID
Detector Temp:	300 °C
Carrier Gas:	He, 10 psi
Carrier Gas Flow:	2.2 mL/min.
Constant Flow:	On
Average Linear Velocity:	39 cm/sec at 80 °C
Injection Mode:	Split
Split Ratio:	58:1
Injection Volume:	1 µL
Injection Temperature:	250 °C
Autosampler:	No
Liner Type:	4 mm ID Focus Liner™
Liner Part Number:	**092002**
Column Part Number:	**054606**

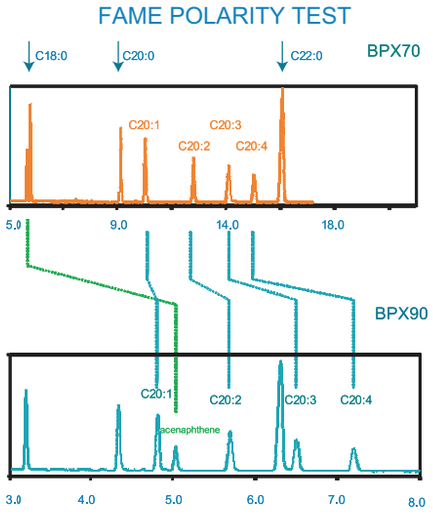
ACKNOWLEDGEMENT
SGE would like to thank Masterfoods UK for supplying the sample and chromatographic conditions for this chromatogram. For more information see SGE technical poster TP-0100-C

BPX90 – A HIGHLY POLAR PHASE FOR FAME ANALYSIS



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.



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.

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.

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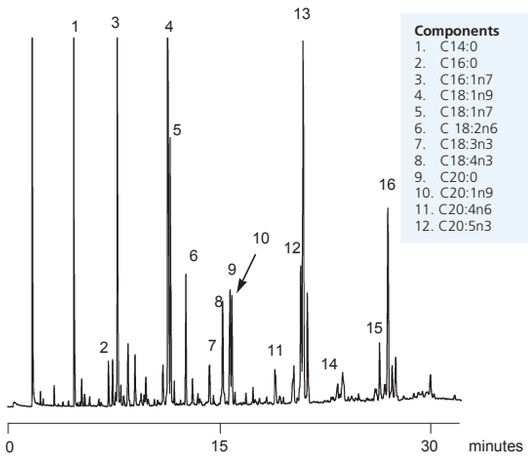
ANALYSIS OF PUFA-1 MARINE FAME ON BPX70



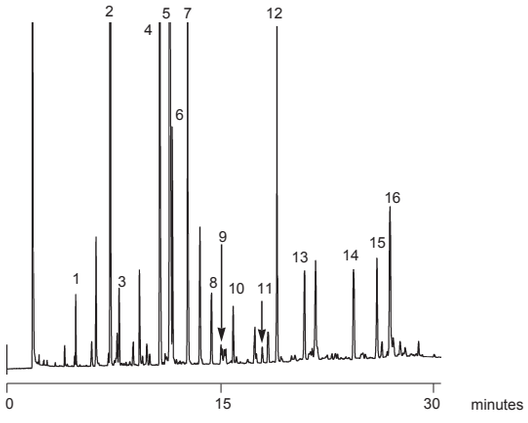
Components
1. C14:0
2. C16:0
3. C16:1n7
4. C18:1n9
5. C18:1n7
6. C 18:2n6
7. C18:3n3
8. C18:4n3
9. C20:0
10. C20:1n9
11. C20:4n6
12. C20:5n3

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^{-12}AFS
Injection Mode:	Split, 50:1
Column Part Number:	**054602**

ANALYSIS OF PUFA-2 ANIMAL FAME ON BPX70

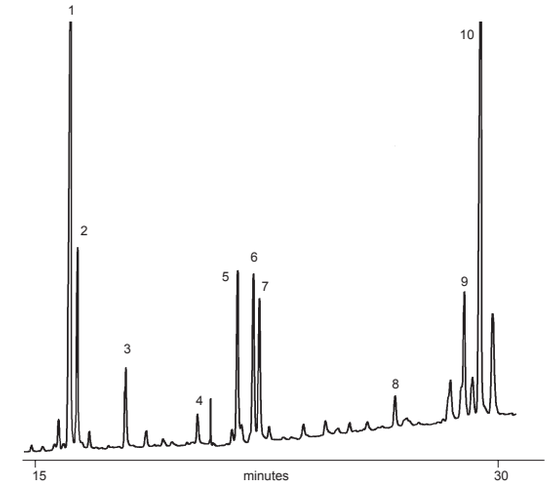


Components
1. C14:0
2. C16:0
3. C16:1n7
4. C18:0
5. C18:1n9
6. C 18:2n7
7. C18:2n6
8. C18:3n3
9. C20:0
10. C20:1n11
11. C20:3n6
12. C20:4n6
13. C20:5n3
14. C22:4n6
15. C22:5n3
16. C22:6n3

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^{-12}AFS
Injection Mode:	Split, 50:1
Column Part Number:	**054602**

ANALYSIS OF PUFA-1 MARINE FAME ON BPX70



Components
1. C18:1n9
2. C18:1n7
3. C18:2n6
4. C18:3n3
5. C18:4n3
6. C 20:0
7. C20:1n9
8. C20:4n6
9. C20:5n3
10. C22:1n11

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^{-12}AFS
Injection Mode:	Split, 50:1
Column Part Number:	**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 and 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.

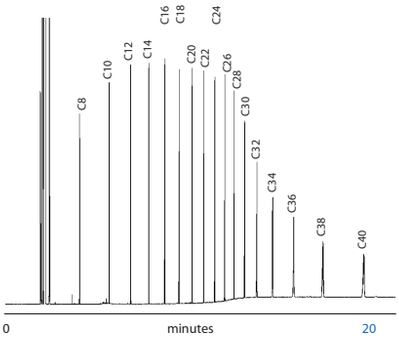
Applications

- Total Recoverable Petroleum Hydrocarbons (TRPH) Analysis on Standard and Fast BPX5
- Analysis of Polywax 655 and 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

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

NORMAL

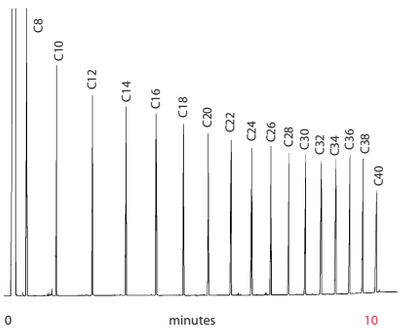
Chromatogram showing separation of Total Recoverable Petroleum Hydrocarbons using a conventional 30 m x 0.25 mm ID BPX5 column with a 0.25 micron film.



Phase:	**BPX5, 0.25 µm film**
TRPH (C8-C40):	**5 ng/µL in dichloromethane**
Column:	**30 m x 0.25 mm ID**
Initial Temp:	40 °C , 2 min
Rate 1:	30 °C/min to 330 °C
Rate 2:	NA
Final Temp:	330 °C, 9 min
Detector Type:	FID, 350 °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 °C
Injection Mode:	Split, 120:1
Purge On Time:	NA
Purge On (Split) Vent Flow:	160 mL/min
Injection Volume:	1µL
Injection Temperature:	250 °C
Autosampler:	Yes
Liner Type :	4 mm ID FocusLiner™ with single taper
Liner Part Number:	**092003**
Column Part Number:	**054101**

FAST

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



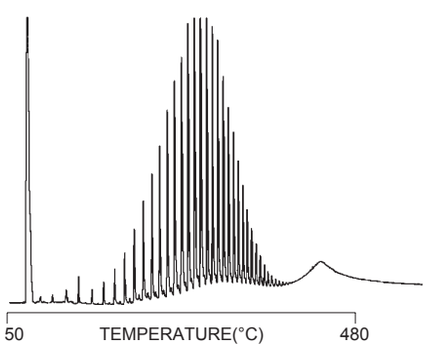
Phase:	**BPX5, 0.10 µm film**
TRPH (C8-C40) Standard:	**5 ng/µL in dichlormethane**
Column:	**10 m x 0.10 mm ID**
Initial Temp:	40 °C , 1 min
Rate 1:	30 °C/min to 330 °C
Rate 2:	NA
Final Temp:	330 °C, 0 min
Detector Type:	FID, 350 °C
Carrier Gas:	He, 28 psi
Carrier Gas Flow :	0.52 mL/min
Constant Flow:	On
Average Linear Velocity:	55 cm/sec at 40 °C
Injection Mode:	Split, 120:1
Purge On Time:	NA
Purge On (Split) Vent Flow:	62 mL/min
Injection Volume:	1 µL
Injection Temperature:	250 °C
Autosampler:	Yes
Liner Type :	2.3 mm ID FocusLiner™
Liner Part Number:	**092005**
Column Part Number:	**054099**

ANALYSIS OF POLYWAX 655 AND REFINERY LUBRICATION OIL ON HT5

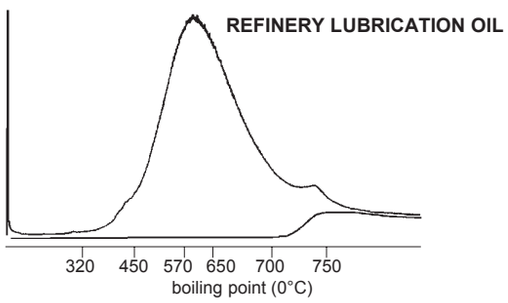
POLYWAX 655 AND REFINERY LUBRICATION OIL

Phase:	**HT5, 0.1 µm**
Column:	**6 m x 0.53 mm ID**
Initial Temp:	50 °C
Rate:	10 °C/min
Final Temp:	480 °C, 15 min
Detector:	FID
Sensitivity:	40 x 10^{-12} AFS
Injection Mode:	On-Column
Carrier Gas:	H_2, 20 mL/min
Solvent:	CS_2
Column Part Number:	**054661**

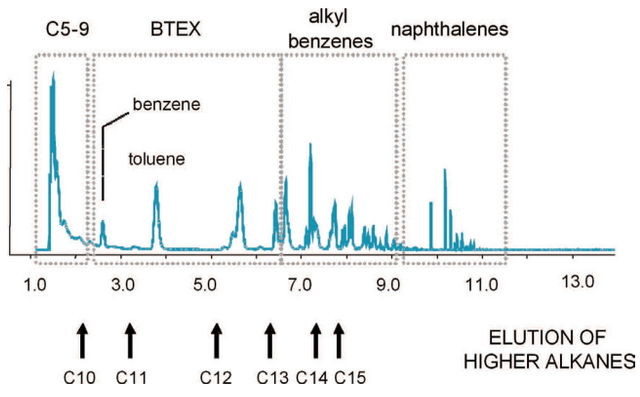
POLYWAX 655



REFINERY LUBRICATION OIL



THE SEPARATION OF AROMATICS FROM OLEFINS IN PETROLEUM SAMPLES USING BPX90



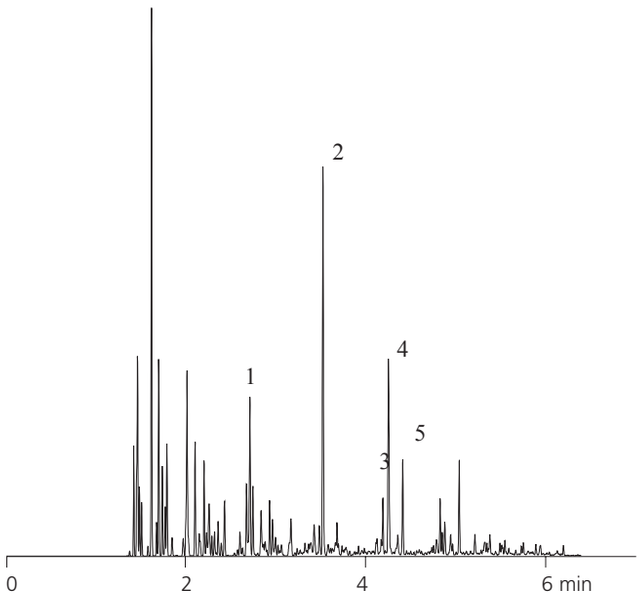
The separation of a petroleum sample using a BPX90 column (30 m x 0.25 mm ID, 250 micron film) showing the resolution of aromatic families and the separation from more abundant alkanes.

UNLEADED GASOLINE ON BPX5

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

Column Part Number: **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 µL
Autosampler Syringe:	0.5 µL Removable Needle **Part No. 000410**
Septa:	Auto-Sep T™ **Part No. 041882**
Injection Type:	Split
Purge On Time:	NA
Purge On (Split) Vent:	200 mL/min
Split Ratio:	149 :1
Liner Type:	FocusLiner™ 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

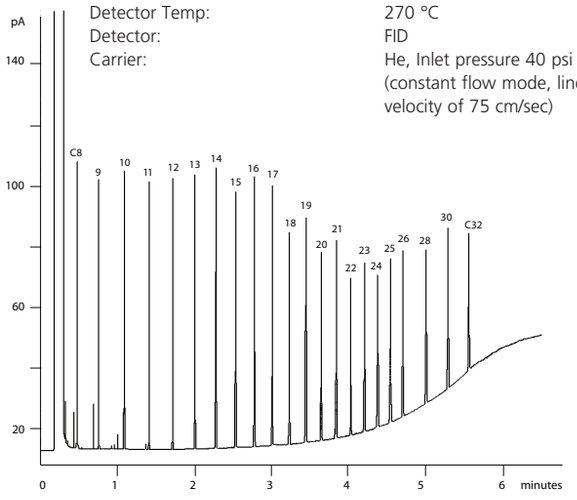
Detector Parameters:

Detector Type:	FID @ 280 °C

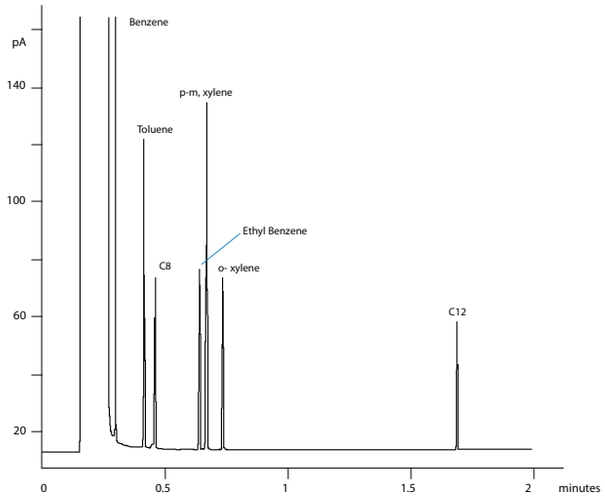
SGE Analytical Science

FAST GC FOR TPH ANALYSIS

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

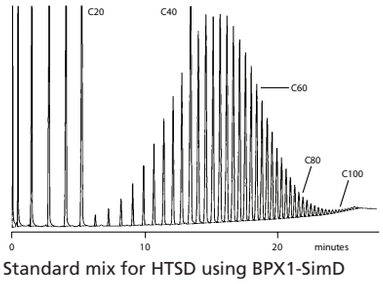


Chromatogram of TPH standards from C8 to C32

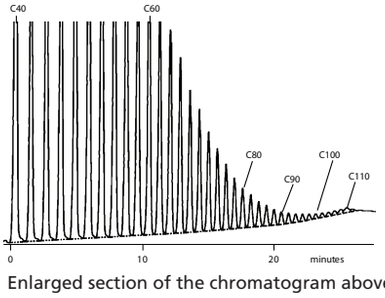


Chromatogram showing elution of BTEX in under one minute

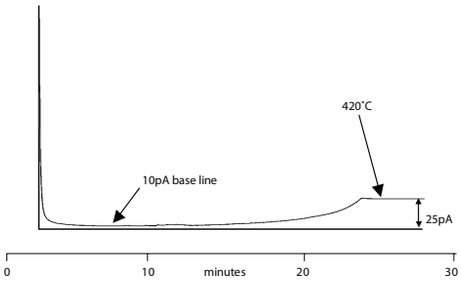
SIMULATED DISTILLATION USING BPX1-SIMD



Standard mix for HTSD using BPX1-SimD



Enlarged section of the chromatogram above



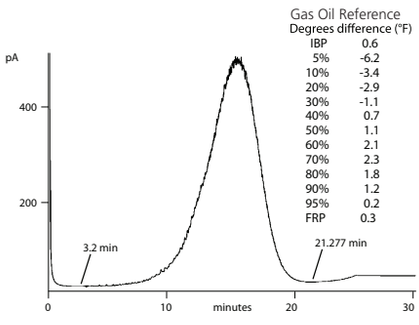
CS2 Blank

Phase:	**BPX1, 0.1 µm**
Column:	**5 m x 0.53 mm ID**
Initial Temp:	40 °C
Rate:	15 °C
Final Temp:	420 °C, 5 min
Detector Temp:	440 °C
Carrier Gas:	He, 10 mL/min
Instrument:	HP 6890
Column Part Number:	**054800**

Separation Systems Injector	
Initial Temp:	40 °C
Rate:	15 °C
Final Temp:	420 °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

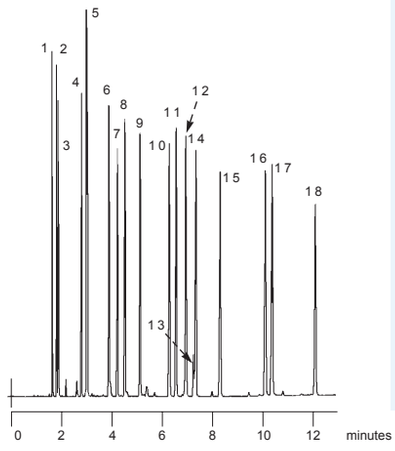
Chemical

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

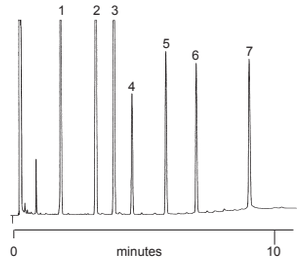
EXPERT TIP

After installing a new column purge with oxygen free carrier gas for at least 30 minutes before heating GC oven.

ALCOHOLS

Phase:	**BP20, 0.25 µm film**
Column:	**30 m x 0.25 mm ID**
Initial Temp:	45 °C, 2 min
Rate:	3 °C/min
Final Temp:	80 °C, 0 min
Detector:	FID
Sensitivity:	128 x 10^{-12} AFS
Injection Mode:	Split
Column Part Number:	**054427**

ANALYSIS OF ALIPHATIC ALCOHOLS ON BP1



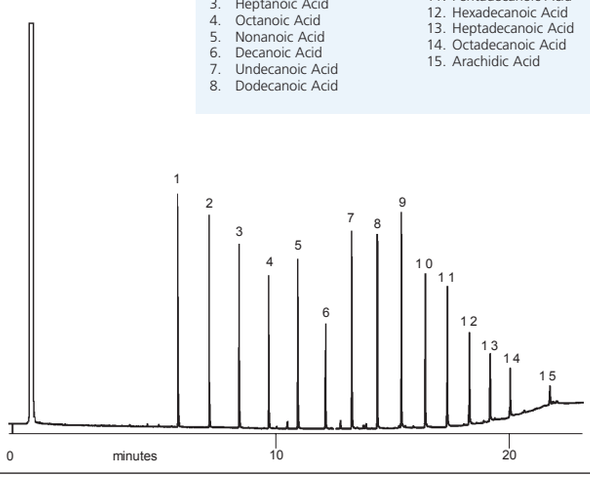
Components
1. Octanol
2. Decanol
3. Undecanol
4. Dodecanol
5. Tetradecanol
6. Hexadecanol
7. Eicosanol

ALCOHOLS

Phase:	**BP1, 3.0 µm film**
Column:	**12 m x 0.53 mm ID**
Initial Temp:	100 °C
Rate:	10 °C/min
Final Temp:	260 °C
Carrier Gas:	N_2
Injection Volume:	0.1 µL
Column Part Number:	**054097**

ANALYSIS OF 15 ORGANIC ACIDS ON BP20

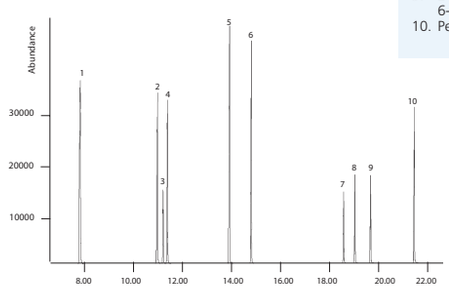
Components
1. Valeric Acid
2. Caproic Acid
3. Heptanoic Acid
4. Octanoic Acid
5. Nonanoic Acid
6. Decanoic Acid
7. Undecanoic Acid
8. Dodecanoic Acid
9. Tridecanoic Acid
10. Tetradecanoic Acid
11. Pentadecanoic Acid
12. Hexadecanoic Acid
13. Heptadecanoic Acid
14. Octadecanoic Acid
15. Arachidic Acid



ORGANIC ACIDS

Phase:	**BP20, 0.25 µm**
Column:	**30 m x 0.32 mm ID**
Initial Temp:	70 °C
Rate:	10 °C/min
Final Temp:	260 °C, 5 min
Detector:	FID
Injection Mode:	Split
Carrier Gas:	H_2, 6 psi
Column Part Number:	**054433**

US EPA 625 PHENOLS MIX ON BPX50

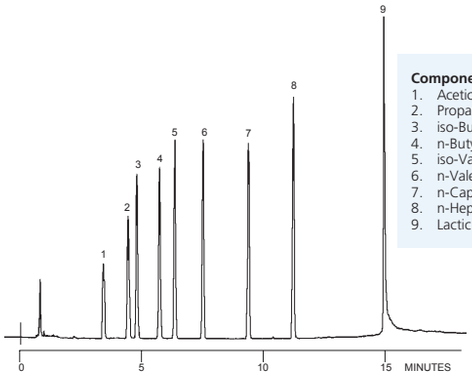


Components
1. 2-Chlorophenol
2. 2-Nitrophenol
3. 2, 4-Dimethylphenol
4. 2, 4-Dichlorophenol
5. 4-Chloro-3-methylphenol
6. 2, 4, 6-Trichlorophenol
7. 2, 4- Dinitrophenol
8. 4-Nitrophenol
9. 2-Methyl-4, 6-dinitrophenol
10. Pentachlorophenol

US EPA 625 PHENOLS MIX

Phase:	**BPX50, 0.25 µm**
Column:	**30 m x 0.25 mm ID**
Injector Mode:	Split, 40:1
Initial Oven Temp:	50°C, 1 min
Rate 1:	8 °C/min
Final Temp:	300 °C, 10 min
Detector:	HP 5973 MSD
Column Part Number:	**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

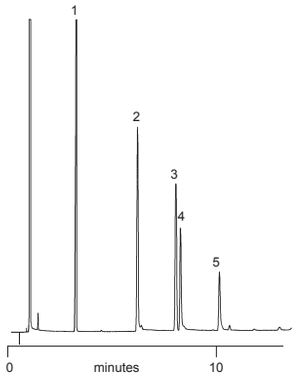
EXPERT TIP

On-column injection and the addition of a 0.03M 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:	**BP21, 0.5 µm film**
Column:	**30 m x 0.53 mm ID**
Initial Temp:	85 °C, 0 min
Rate:	6 °C/min
Final Temp:	180 °C, 5 min
Detector:	FID
Sensitivity:	64 x 10^{-12} AFS
Injection Mode:	On-Column
Column Part Number:	**054477**

ANALYSIS OF AMINES ON BP1



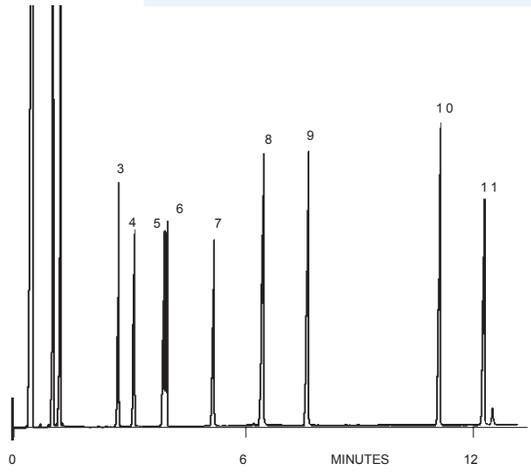
Components
1. Aniline
2. Decylamine
3. Dicyclohexylamine
4. Dodecylamine
5. Tetradecylamine

ANALYSIS OF AMINES

Phase:	**BP1, 3.0 µm film**
Column:	**12 m x 0.53 mm ID**
Initial Temp:	70 °C
Rate:	10 °C/min
Final Temp:	250 °C
Carrier Gas:	N_2
Injection Volume:	0.1 µL
Column Part Number:	**054097**

ANALYSIS OF AROMATIC AMINES ON BP5

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



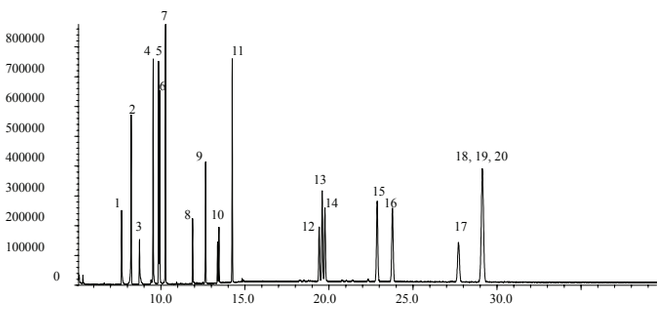
EXPERT TIP

Using a thicker film helps prevent amines from tailing.

Phase:	**BP5, 1.0 µm film**
Column:	**12 m x 0.53 mm ID**
Initial Temp:	60 °C, 0 min
Rate:	10 °C/min
Final Temp:	190 °C, 0 min
Detector:	FID
Sensitivity:	128 x 10^{-12}AFS
Injection Mode:	Split
Column Part Number:	**054197**

ANALYSIS OF AROMATIC AMINES FROM DIAZO DYES ON BPX35

Components
1. Indolin
2. o-Toluidine
3. 2,4-Diaminoanisole
4. p-Chloroailine
5. p-a residine
6. 2,4,6-Trimethylaniline
7. 4-Chlorotoludine
8. Unknown
9. 2-Naphtylamine
10. Unknown
11. 4-Aminodiphenyl
12. 4,4′-Oxydianiline
13. 4,4′-Diaminodiphenylmethane
14. Benzidine
15. 3,3′-Dimethyl-4,4′diaminodiphenyl-methane
16. 3,3′-dimethylbenzidine
17. 4,4′-Thiodianiline
18. 3,3′-Dichlorobenzidine
19. 4,4′-Methylene-bis(2chloraniline)
20. 3,3′-Dimethoxybenzidine



Phase:	**BPX35 0.25 µm film**
Azo Dyes Standard:	**10 ppm solution in DCM**
Column:	**30 m x 0.25 mm ID**
Initial Temp:	50 °C, 2 min
Rate 1:	15 °C/min to 240 °C
Rate 2:	10 °C/min to 280 °C
Final Temp:	280 °C, 25 min
Detector Type:	MSD
Carrier Gas:	He, 7.1 psi
Carrier Gas Flow :	1.0 mL/min
Constant Flow:	On
Average Linear Velocity:	36 cm/sec at 50 °C
Injection Mode:	Splitless
Purge On Time:	1.0 min
Purge On (Split) Vent Flow:	60 mL/min
Injection Volume:	1 µL
Injection Temperature:	250 °C
Autosampler:	No
Liner Type :	4 mm ID Double Taper
Liner Part Number:	**092018**
Column Part Number:	**054701**

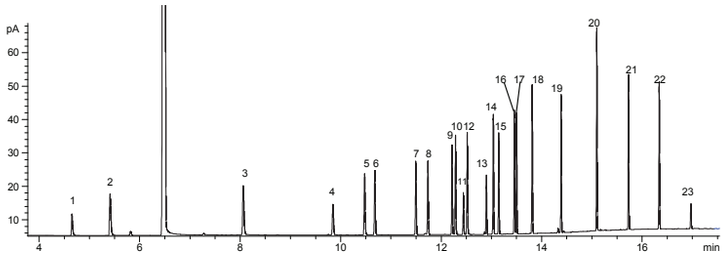
EXPERT TIP

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

ANALYSIS OF KETONES ON THICK FILM BPX5

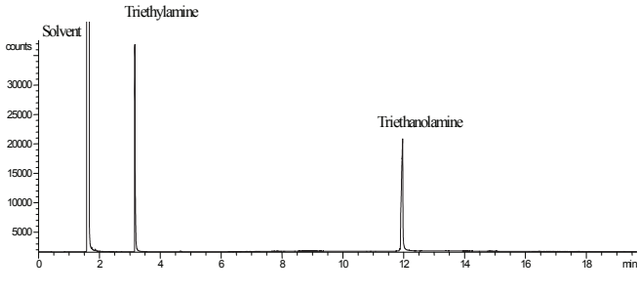
Components

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



Phase:	**BPX5, 1.0 µm film**
Sample:	**300 ppm in dichloromethane**
Column:	**60 m x 0.25 mm ID**
Initial Temp:	40 °C , 5 min
Rate 1:	10 °C/min to 80 °C
Rate 2:	30 °C/min to 260 °C
Final Temp:	260 °C, 4 min
Detector Type:	FID
Detector Temp:	360 °C
Carrier Gas:	He, 27.6 psi
Carrier Gas Flow :	1.9 mL/min
Constant Flow:	On
Average Linear Velocity:	35 cm/sec at 40 °C
Injection Mode:	Split
Split Ratio:	100:1
Injection Volume:	0.4 µL
Injection Temperature:	250 °C
Autosampler:	No
Liner Type :	4 mm ID Single Taper Liner
Liner Part Number:	**092017**
Column Part Number:	**054123**

ANALYSIS OF TRIETHYLAMINE AND TRIETHANOLAMINE ON SOLGEL-1ms™



Phase:	**SolGel-1ms, 0.25 µm film**
Amine mix:	**10 ng/µL in dichloromethane**
Column:	**30 m x 0.32 mm ID**
Initial Temp:	40 °C , 5.0 min
Rate 1:	20 °C/min to 200 °C
Final Temp:	200 °C, 7 min
Detector Type:	FID
Detector Temp:	300 °C
Carrier Gas:	He, 9.9 psi
Carrier Gas Flow :	2.2 mL/min
Constant Flow:	On
Average Linear Velocity:	35 cm/sec at 100 °C
Mode of Injection:	Split
Split Ratio:	50:1
Injection Volume:	0.3 µL
Injection Temperature:	250 °C
Autosampler:	No
Column Part Number:	**054798**

EXPERT TIP

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

Pharmaceutical

GC analysis of Pharmaceuticals covers a wide range of compounds that can vary greatly in their molecular weight, reactivity, and pH. From the analysis of low molecular weight residual solvents on a G43 (BPX-Volatiles) to higher molecular weight compounds on a G42 (BPX35), a wide range of GC columns are often specified in the test methods.

Proper deactivation of GC consumables such as liners and columns becomes increasingly important where system inertness has to be demonstrated. SGE's unique, high temperature gas phase deactivation ensures maximum inertness and minimal activity from our columns and consumables.

Applications

- USP Methods
- Analysis of Tricyclic Antidepressants on BPX35
- Analysis of Dioxane Impurities on BP20
- Analysis of a Common Solvent Mixture on a Thick Film BPX5
- Analysis of a Common Pharmaceutical Solvent on BPX-Volatiles
- Analysis of a Common Pharmaceutical Solvent on BPX-Volatiles
- Analysis of Class I Solvents on BPX-Volatiles
- Analysis of the Separation of the Class III Solvents on BPX-Volatiles

USP Methods

Method	Phase Composition	SGE Phase Recommendation
G1	Dimethylpolysiloxane oil	BP1, SOLGEL-1ms™
G2	Dimethylpolysiloxane gum	BP1, SOLGEL-1ms
G3	50% Phenyl - 50% Methylpolysiloxane	BPX50
G5	3-Cyanopropylpolysiloxane	BPX70
G7	50% 3-Cyanopropyl - 50% Phenylmethylsilicone	BP225
G14	Polyethylene glycol (average molecular weight of 950-1,050)	BP20(WAX), SOLGEL-WAX™
G15	Polyethylene glycol (average molecular weight of 3,000-3,700)	BP20(WAX), SOLGEL-WAX
G16	Polyethylene glycol (average molecular weight of 15,000)	BP20(WAX), SOLGEL-WAX
G17	75% Phenyl - 25% Methylpolysiloxane	BPX50
G19	25% Phenyl - 25% Cyanopropylmethylsilicone	BP225
G20	Polyethylene glycol (average molecular weight of 380-420)	BP20(WAX), SOLGEL-WAX
G25	Polyethylene glycol TPA (Carbowax 20M terephthalic acid)	BP21(FFAP)
G27	5% Phenyl - 95% Methylpolysiloxane BP5,	BPX5
G28	25% Phenyl - 75% Methylpolysiloxane	BPX35
G32	20% Phenylmethyl - 80% Dimethylpolysiloxane	BPX35
G35	Polyethylene glycol & diepoxide esterified with nitroterephthalic acid	BP21(FFAP)
G36	1% Vinyl - 5% Phenylmethylpolysiloxane	BP5, BPX5
G38	Phase G1 plus a tailing inhibitor	BP1, SOLGEL-1ms
G39	Polyethylene glycol (average molecular weight of 1,500)	BP20(WAX), SOLGEL-WAX
G41	Phenylmethyldimethylsilicone (10% phenyl substituted)	BP5, BPX5
G42	35% Phenyl - 65% Dimethylvinylsiloxane	BPX35
G43	6% Cyanopropylphenyl - 94% Dimethylpolysiloxane	BP624
G46	14% Cyanopropylphenyl - 86% methylpolysiloxane	BP10 (1701)

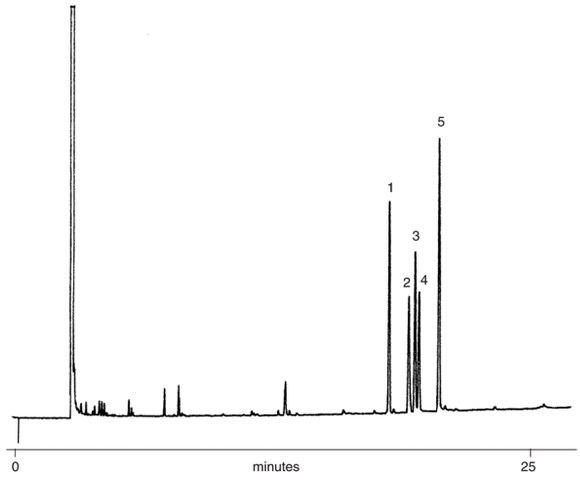
Fused Silica Tubing

- Quality guaranteed
- Chemically inert and thermally stable
- Suitable for organic and aqueous solvents
- Ideal for biotechnology applications
- Custom-made tubing available upon request
- Available deactivated for guard column material
- Tubing protected with a high temperature Polyimide resin (+400 ˚C)

ETP multiplier

- Air stable
- 2 year shelf life guarantee
- Discrete dynode design results in extend operating life
- Total compatibility with all major quadrupole, magnetic sector and TOF instruments

ANALYSIS OF TRICYCLIC ANTIDEPRESSANTS ON BPX35

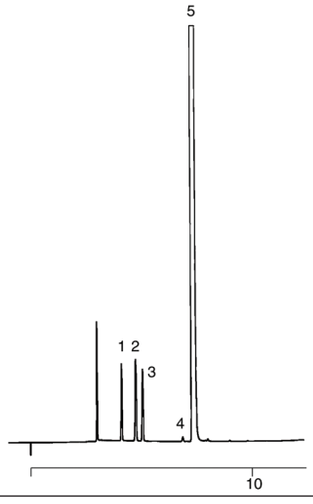


Components
1. Amitriptyline
2. Trimipramine
3. Nortriptyline
4. Doxepin
5. Desipramine

TRICYCLIC ANTIDEPRESSANTS

Phase:	**BPX35, 0.25 µm**
Column:	**25 m x 0.22 mm ID**
Initial Temp:	210 °C, 1 min
Rate:	5 °C/min
Final Temp:	280 °C
Carrier Gas:	Helium, 150 kpa
Injection Mode:	Split (20:1)
Detector:	FID, 380 °C
Column Part Number:	**054711**

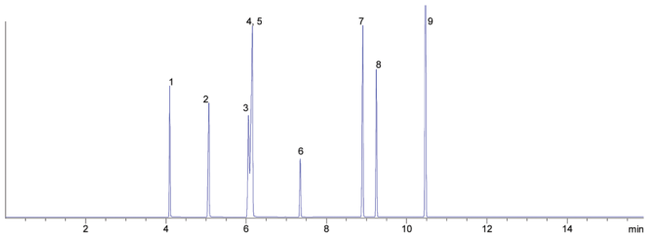
ANALYSIS OF DIOXANE IMPURITIES ON BP20



Components
1. Methanol
2. Dichloromethane
3. Ethanol
4. Dioxane impurity
5. Dioxane

Phase:	**BP20, 1.0 µm**
Column:	**25m x 0.53 mm ID**
Initial Temp.:	40°C, 2 min
Rate:	10 °C/min
Final Temp.:	120 °C
Detector:	FID, 280 °C
Injector Mode:	Split, 30:1,
Carrier Gas:	Hydrogen, 2 psi
Injection Volume:	0.2 µL
Column Part Number.:	**054448**

ANALYSIS OF A COMMON SOLVENT MIXTURE ON A THICK FILM BPX5

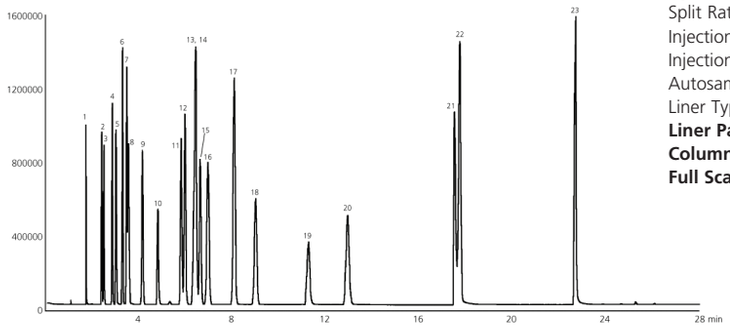


Components
1. Methanol
2. Ethanol
3. Acetone
4. Isopropyl alcohol
5. Acetonitrile
6. Dichloromethane
7. 2-Butanone
8. Ethyl acetate
9. Benzene

Phase:	**BPX5, 1.0 µm film**
Sample:	**neat**
Column:	**60m x 0.25 mm ID**
Initial Temp:	32 °C, 5 min.
Rate 1:	20 °C/min to 190 °C,
Final Temp:	190°C, 2 min.
Detector Type:	FID
Detector Temp.:	360 °C
Carrier Gas:	He, 26.9 psi
Carrier Gas Flow:	1.9 mL/min.
Constant Flow:	On
Average Linear Velocity:	35 cm/sec at 40 °C
Injection Mode:	Split
Split Ratio:	100:1
Injection Volume:	0.3 µL
Injection Temperature:	250 °C
Autosampler:	No
Liner Type:	4 mm ID Single Taper Liner
Liner Part Number:	**092017**
Column Part Number:	**054123**

ANALYSIS OF COMMON PHARMACEUTICAL SOLVENT ON BPX-VOLATILES

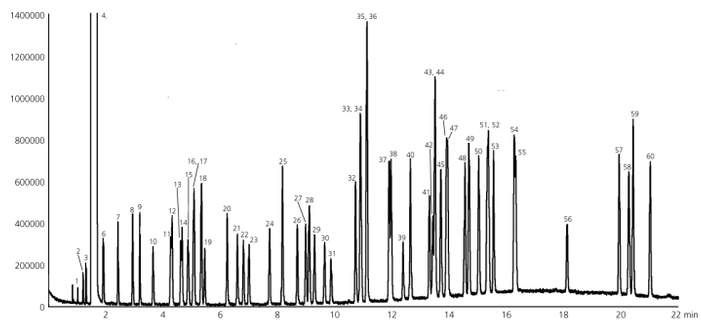
Components
1. Methanol
2. Ethanol
3. Ethyl ether
4. Acetone
5. iso-propyl alcohol
6. Acetonitrile
7. Methylene chloride
8. t-Butanol
9. Hexane
10. Propanol
11. 2-Butanone
12. Ethyl acetate
13. 2-Butanol
14. Tetrahydrofuran
15. Chloroform
16. Cyclohexane
17. Benzene
18. n-Heptane
19. n-Butanol
20. 1,4-Dioxane
21. Pyridine
22. Toluene
23. Dimethylformamide



Phase:	**BPX-Volatiles, 1.4 µm film**
Sample:	**200 ppm in methanol**
Column:	**30 m x 0.25 mm ID**
Initial Temp:	35 °C, 15 min
Rate 1:	5 °C/min to 100 °C
Final Temp:	100 °C, 2 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 35 °C
Injection Mode:	Split
Split Ratio:	100:1
Injection Volume:	0.5 µL
Injection Temp:	250 °C
Autosampler:	No
Liner Type:	4 mm ID Single Taper Liner
Liner Part Number:	**092017**
Column Part No:	**054980**
Full Scan / SIM:	**Full scan 25-450**

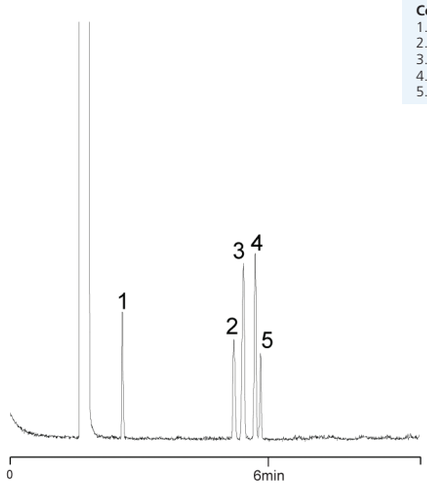
ANALYSIS OF COMMON PHARMACEUTICAL SOLVENT ON BPX-VOLATILES

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



Phase:	**BPX-Volatiles 1.4 µm film**
USEPA 502.2 mix:	**200 ppm in Methanol**
Column:	**30 m x 0.25 mm ID**
Initial Temp:	40 °C, 0 min
Rate 1:	6 °C to 210 °C
Rate 2:	15 °C to 240 °C
Final Temp:	240 °C, 5 min
Detector Type:	Mass Spectrometer
Carrier Gas:	He, 22.8
Carrier Gas Flow:	1.3 mL/min
Constant Flow:	On
Average Linear Velocity:	35 cm/sec at 40 °C
Injection Mode:	Split
Split Ratio:	50:1
Injection Volume:	1 mL
Injection Temp:	250 °C
Autosampler:	No
Liner Type:	4mm ID Single Taper Liner
Liner Part No:	**092017**
Column Part No:	**054980**
Full Scan / SIM:	**Full scan 45-450**

ANALYSIS OF CLASS I SOLVENTS ON BPX-VOLATILES



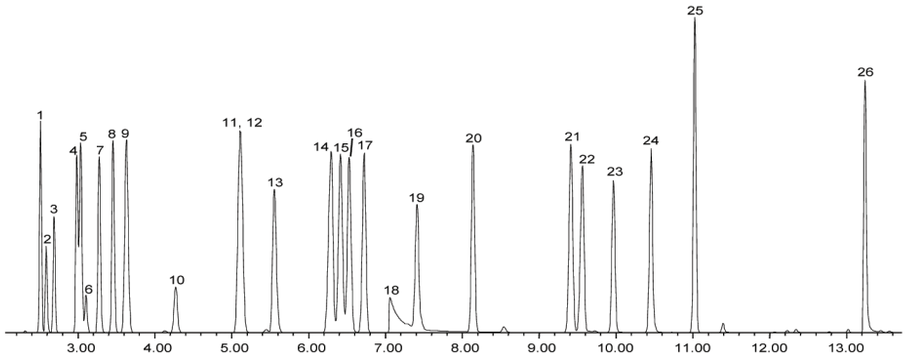
Components
1. 1,1-Dichloroethene
2. 1,1,1-Trichloroethane
3. Carbon tetrachloride
4. Benzene
5. 1,2-Dichloroethane

Phase:	**BPX-Volatiles 1.4 µm film**
Sample:	**200 ppm in methanol**
Column:	**30 m x 0.25 mm ID**
Initial Temp:	40 °C, 1 min
Rate 1:	6 °C/min to 80 °C
Final Temp:	80 °C
Detector Type:	Mass Spectrometer
Carrier Gas:	He, 6.7 psi
Carrier Gas Flow:	0.9 mL/min
Constant Flow:	On
Average Linear Velocity:	35 cm/sec at 50 °C
Injection Mode:	Split
Split Ratio:	100:1
Injection Volume:	0.4 µL
Injection Temp:	250 °C
Autosampler:	No
Liner Type:	4 mm ID Single Taper Liner
Liner Part Number:	**092017**
Column Part No:	**054980**
Full Scan / SIM:	**Full scan 30-450**

ANALYSIS OF THE SEPARATION OF THE CLASS III SOLVENTS ON BPX-VOLATILES

Components
1. Pentene
2. Ethanol
3. Ethyl ether
4. Acetone
5. iso-Propyl alcohol
6. Ethyl formate
7. Methyl acetate
8. Dichloromethane
9. Methylt-butyl ether
10. n-Propanol
11. Ethyl acetate
12.2-Butanone (MEK)
13. Tetrahydrofuran
14. iso-Butanol
15. sec-Butanol
16. iso-Propyl acetate
17. Heptane
18. Acetic acid
19. n-Butanol
20. Propyl acetate
21. 4-Methyl-2-pentanone
22. Iso-Amyl alcohol
23. Iso-Butyl acetate
24. n-Amyl alcohol
25. Butyl acetate
26. Dimethyl sulfoxide

Phase:	**BPX-Volatiles 1.4 µm film**
Sample:	**200 ppm in methanol**
Column:	**30 m x 0.25 mm ID**
Initial Temp:	50 °C, 5 min
Rate 1:	10 °C/min to 85 °C, 1 min
Rate 2:	15 °C/min to 170 °C,
Final Temp:	170 °C
Detector Type:	Mass Spectrometer
Carrier Gas:	He, 6.7 psi
Carrier Gas Flow:	0.9 mL/min
Constant Flow:	On
Average Linear Velocity:	35 cm/sec at 50 °C
Injection Mode:	Split
Split Ratio:	100:1
Injection Volume:	0.4 µL
Injection Temp:	250 °C
Autosampler:	No
Liner Type:	4 mm ID Single Taper Liner
Liner Part Number:	**092017**
Column Part No:	**054980**



Forensic

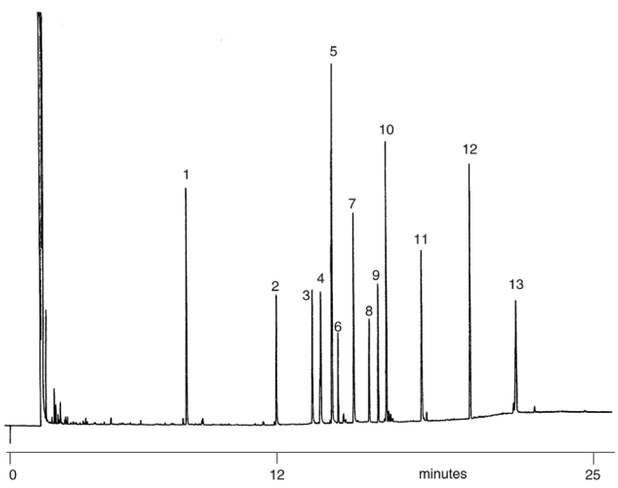
Forensic and Toxicology analyses face similar challenges as those found in pharmaceutical assays. These methods are often very challenging due to the analysis of very active compounds as well as coming from samples that are detrimental to GC systems. These compounds are generally basic in nature that makes inertness of the system components critical to successful determinations.

The robustness is another critical aspect of clinical analyses. The natures of sample compounds and matrices are extremely arduous on the analytical system. SGE's columns are designed to withstand these ordeals and provide excellent lifetimes in difficult analyses.

Applications

- Analysis of Acid/Neutral Drugs on BPX35
- Analysis of Basic Drugs on BPX35
- Analysis of Underivatized Barbiturates on BP5
- Analysis of Various Drugs on BPX50
- Analysis of a Variety of Antidepressant and Anticonvulsant Drugs on BPX50

ANALYSIS OF ACID/NEUTRAL DRUGS ON BPX35

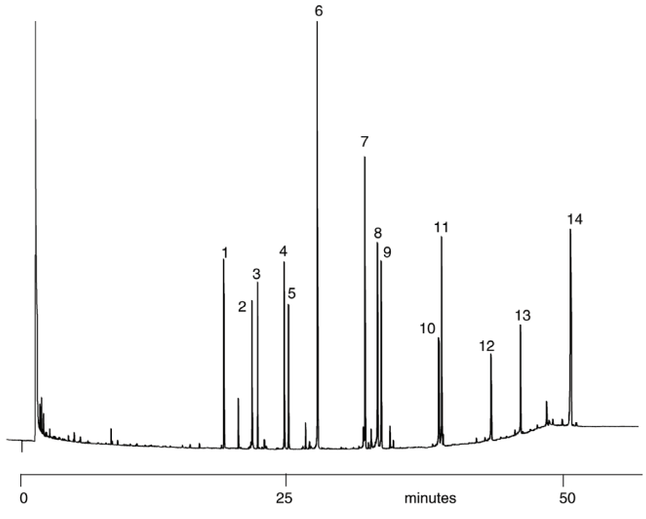


Components
1. Ethosuximide
2. Barbital
3. Aprobarbital
4. Butabarbital
5. Amobarbital
6. Pentabarbital
7. Secobarbital
8. Meprobamate
9. Carisoprodal
10. Glutethimide
11. Phenobarbital
12. Methaqualone
13. Primidone

ACID/NEUTRAL DRUGS

Phase:	**BPX35, 0.25 µm**
Column:	**25 m x 0.22 mm ID**
Initial Temp:	100 °C, 1min
Rate:	10 °C/min
Final Temp:	300 °C, 5 min
Carrier Gas:	He, 150 kpa
Injection Mode:	Split, (20:1)
Detector:	FID, 380 °C
Column Part Number:	**054711**

ANALYSIS OF BASIC DRUGS ON BPX35

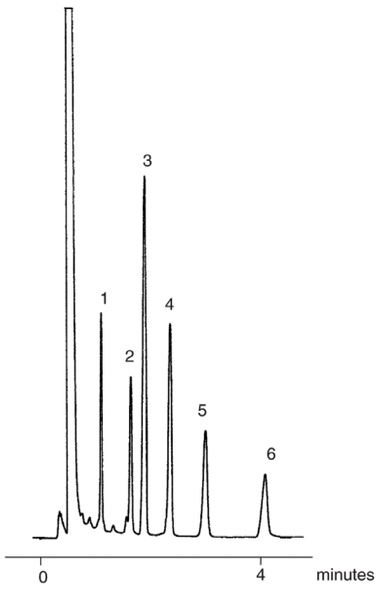


Components
(Concentration: 100-200 ug/ml)
1. Benzocaine
2 Unknown
3. Meperidine
4. Diphenhydramine
5. Lidocaine
6. Tripelennamine
7. Amitriptyline
8. Tetracaine
9. Pyrilamine
10. Unknown
11. Diazepam
12. Flurazepam
13. Papaverine
14. Triazolam

BASIC DRUGS

Phase:	**BPX35, 0.25 µm**
Column:	**25m x 0.22 mm ID**
Initial Temp:	100 °C
Rate:	5 °C/min
Final Temp.:	325 °C, 5 min.
Carrier Gas:	Helium 150 kpa
Injection Mode:	Split, 0.5 µL (20:1)
Detector:	FID, 380 °C
Column Part Number:	**054711**

ANALYSIS OF UNDERIVATIZED BARBITURATES ON BP5



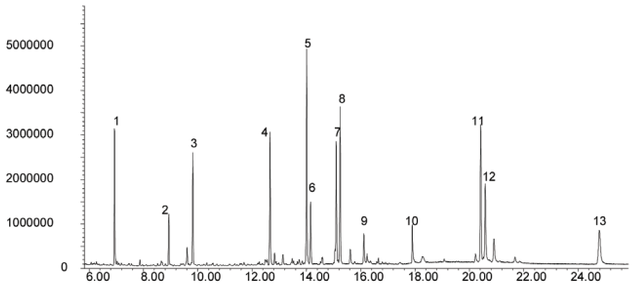
Components
1. Barbital
2. Butabarbital
3. Amobarbital
4. Pentabarbital
5. Secobarbital
6. Hexabarbital

UNDERIVATIZED BARBITURATES

Phase:	**BP5, 1.0 µm**
Column:	**12m x 0.53 mm I.D.**
Temp:	195 °C
Carrier Gas:	Hydrogen
Carrier Flow:	10 mL/min
Injection Volume:	0.1 µL
Column Part Number:	**054197**

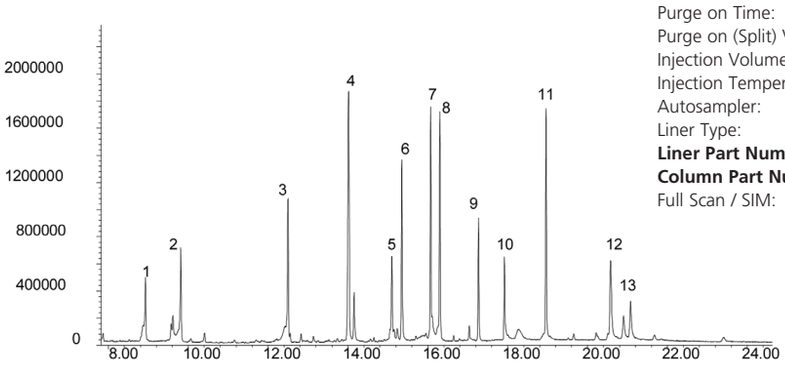
ANALYSIS OF VARIOUS DRUGS ON BPX50

Components
1. N,N-Dimethylaniline
2. Benzothiazole
3. Selegeline
4. Pethidine
5. Unknown
6. a-octadecene
7. Octadecanoic acid butyl ester
8. Methadone
9. N,N-Dimethylstearamide
10. Chloroquine
11. Dextromoramide
12. Sitosterol
13. Buspirone



Phase:	**BPX50, 0.25 µm film**
Sample:	**5-10 ppm in methanol**
Column:	**30 m x 0.25 mm ID**
Initial Temp:	150 °C, 0.5 min.
Rate 1:	10 °C/min to 180 °C,
Rate 2:	1.5 °C/min to 220 °C
Rate 2:	30 °C/min to 260 °C
Final Temp:	260 °C, 5 min.
Detector Type:	FID
Detector Temp.:	320 °C
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:	Splitless
Purge on Time:	0.5 min
Purge on (Split) Vent Flow:	60 mL/min
Injection Volume:	1 µL
Injection Temperature:	250 °C
Autosampler:	No
Liner Type:	4 mm ID Single Taper Liner
Liner Part Number:	**092017**
Column Part Number:	**054751**
Full Scan / SIM:	Full scan 45-450

ANALYSIS OF A VARIETY OF ANTIDEPRESSANT AND ANTICONVULSANT DRUGS ON BPX50



Phase:	**BPX50, 0.25 µm film**
Sample:	**5-10 ppm in methanol**
Column:	**30 m-x 0.25 mm ID**
Initial Temp:	150 °C, 0.5 min.
Rate 1:	10 °C/min to 180 °C,
Rate 2:	1.5 °C/min to 220 °C
Rate 2:	30 °C/min to 260 °C
Final Temp:	260 °C, 5 min.
Detector Type:	FID
Detector Temp.:	320 °C
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:	Splitless
Purge on Time:	0.5 min
Purge on (Split) Vent Flow:	60 mL/min
Injection Volume:	1 µL
Injection Temperature:	250 °C
Autosampler:	No
Liner Type:	4 mm ID Single Taper Liner
Liner Part Number:	**092017**
Column Part Number:	**054751**
Full Scan / SIM:	Full scan 45-450

FocusLiner™ improves reproducibility by:

Promoting uniform sample vaporization

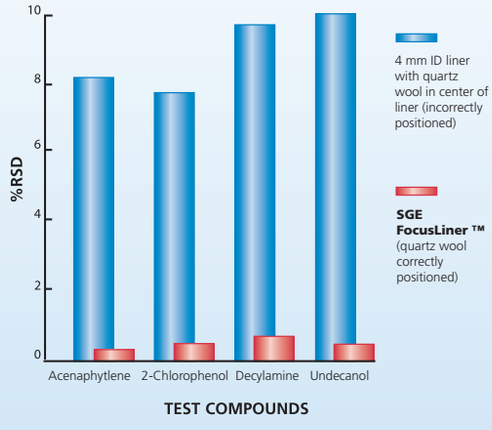
Maximizing sample vaporization on an inert surface

Acting as a particulate filter for dirty samples

Improving injection reproducibility 10-fold

Wiping needle tip during injection through fixed quartz wool

Liner deactivated at high temperatures with wool in situ using SGE's high quality deactivation processes



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

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
BP21	25	0.53	0.5	054474
BP21	30	0.53	0.5	054477
BP21	30	0.53	1	054478
BP21	25	0.53	0.5	054474

Phase	Length (m)	ID (mm)	Film Thickness (µm)	Part No.
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
BPX90	15	0.25	0.25	054570
BPX90	15	0.32	0.50	054573
BPX90	30	0.25	0.25	054580
BPX90	60	0.25	0.25	054590
BPX90	60	0.32	0.50	05493
BPX90	30	0.25	0.25	054980

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, BPX-Volatiles**
Cyclodex-B, Rt-BDEXm	Permethylated Beta Cyclodextrin	**CYDEX-B**
Unique highly polar phase	90% Cynopropyl Polysilphenylene-siloxane	**BPX90**

Symptom	Possible cause	Solution
High baseline level	Septum bleed and/or contaminated liner	Replace septa and insert a new inlet liner.
	Poor carrier gas quality causing phase decomposition	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.
	Contaminated solvent	Use a high purity solvent.
Split peaks	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.
	Column inserted too far into injector	Reposition column according to manufacturer's instructions.
Fronting peaks	Too much sample injected on to column	Dilute sample.
		Use a thicker film.
		Increase the split ratio.
Tailing peaks	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.
	Graphite ferrule contamination in the start of the column	Cut 5cm off the front of the column and re-install in the injector
Broad peaks	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	Verify carrier gas flow rate.
		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
	Splitless conditions have changed	Re-check solvent and method temperatures.
Ghost peaks	Syringe has become contaminated from previous sample	Ensure syringe has been thoroughly washed with solvent between injections. Sometimes this can involve 20 solvent 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. Could also be from sample vial septa
	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). Carrier gas lines may also need to be cleaned

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