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.
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For further information on our full range of products, please visit [www.sge.com](http://www.sge.com)
Guidelines for Choosing Columns

1. Stationary Phase

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

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

2. Internal Diameter

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

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

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

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%.

Formula to calculate Phase Ratio

\[ \beta = \frac{id}{d_f} \]

where

- \( \beta \) = ratio
- \( id \) = column internal diameter (µm)
- \( d_f \) = film thickness (µm)

PHASE RATIO

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Above shows the phase ratio (\( \beta \)) 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.

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

For further information on our full range of products, please visit www.sge.com
## Recommended Column by Application

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<th>BPX5 BP5</th>
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<th>BPX35</th>
<th>BPX-Volatiles BPE24</th>
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<th>BPX50</th>
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- ■ Indicates recommended phases to be used for the application
- ○ Indicates alternative phases that can be used for the application

For further information on our full range of products, please visit [www.sge.com](http://www.sge.com)
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 Dibenzo-p-dioxins 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

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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 ºC) 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 ºC (1 min) - 205 ºC @ 1.8 °C/min then to 310 ºC @ 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.

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

For further information on our full range of products, please visit www.sge.com
### The list of some pesticides used in the sample, and their retention times

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<thead>
<tr>
<th>Peak number</th>
<th>Name</th>
<th>R.T. (s)</th>
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<tr>
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</table>

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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

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 BPX5

Components
1. Naphtalene
2. Acenaphthylen
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: BPX5, 0.25 µm
Column: 50 m x 0.22 mm ID
Initial Temp: 80 °C
Rate 1: 10 °C/min
Temp 1: 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

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

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

ANALYSIS OF POLYNUCLEAR AROMATIC HYDROCARBONS ON BPX5

Components
(0.5 ng each component)
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

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

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SGE wishes to acknowledge Dr P. Ambridge, Dr A. Fernandes and C. Brook at AEA Technology, Harwell, U.K.
ANALYSIS OF VOLATILE ORGANIC POLLUTANTS ON BPX-VOLATILES

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

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-Dichlorobenzene
20. Trichloroethene
21. 1,2-Dichloroethane
22. Dichloromethane
23. Bromoform
24. 1,1,2,2-Tetrachloroethane
25. Toluene
26. Toluene
27. trans-1,2-Dichloroethane
28. Tetrachloroethene
29. 1,3-Dichloropropane
30. Dibromochloromethane
31. 1,2-Dibromoethane
32. Chlorobenzene
33. Ethylbenzene
34. 1,1,2-Trichloroethane
35. p-Xylene
36. m-Xylene
37. o-Xylene
38. Styrene
39. Bromoform
40. Isopropylbenzene
41. Bromobenzene
42. 1,2,2,2-Tetrachloroethane
43. 1,2,3-Trichloropropane
44. n-Propanol
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. 1,2-Dichlorobenzene
53. 1,2-Dibromoethane
54. 1,4-Dichlorobenzene
55. 1,2-Dibromo-3-chloropropane
56. 1,2,4-Trichlorobenzene
57. Hexachlorobutadiene
58. 1,2-Dichlorobenzene
59. Naphthalene
60. 1,2,3-Trichlorobenzene

Chromatogram showing analysis of commonly screened volatile organic pollutants

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APPLICATIONS USING BPX90

HCCH isomers and HCB

Separation of hexabromocyclododecanes

Selectivity for pesticides and thiophosphate esters

ANALYSIS OF VOLATILES IN DRINKING WATER ON 25 M BP624 COLUMN

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

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

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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. ICB 170

Aroclor 1254

Environmental

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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

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ANALYSIS OF EUCALYPTUS OIL ON SOLGEL-WAX™

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

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

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.

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

**ANALYSIS OF TASMANIAN LAVENDER OIL SOLGEL-WAX™**

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

**ANALYSIS OF LAVENDER OIL ON CYDEX-B**

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

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

**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-Octalone
8. cis-Linaloide
9. trans-Linalool oxide
10. Linalool L
11. Octenyl acetate
12. Camphor
13. Lavandulol
14. Borneol L
15. Terpinen-4-ol
16. ß-Terpineol
17. Linalool acetate
18. Lavandulol Acetate
19. Geranyl Acetate
20. ß-Sabinene
21. 1-B-Caryophyllene
22. ß-Cadinine
23. ß-Caryophyllene oxide

**Phases**
- CYDEX-B, 0.25 µm film
- BPX5, 0.25 µm film
- SolGel-WAX™, 0.25 µm film

**Columns**
- Neat
- Lavender Oil in ethanol
- Neat

**Initial Temp:**
- Isothermal at 90 °C
- 40 °C, 1 min
- 40 °C, 1 min

**Rate 1:**
- 8 °C/min to 220 °C
- 5 °C/min to 260 °C
- 8 °C/min to 220 °C

**Final Temp:**
- 220 °C, 5 min
- 260 °C
- 220 °C, 5 min

**Detector:**
- FID
- Mass Spectrometer
- Mass Spectrometer

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**ANALYSIS OF WINE ON BP20**

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

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 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

Phase: BP20, 1.0 µm
Column: 25 m x 0.32 mm ID
Initial Temp: 40 °C, 2 min
Rate: 5 °C/min
Temp 2: 50 °C
Rate 2: 15 °C/min
Final Temp: 190 °C
Carrier Gas: H₂, 6 psi
Injection Mode: 2 µL
Column Part Number: 054442

**ANALYSIS OF TEATREE OIL ON BPX5**

Components:
1. Thujene
2. α-Pinene
3. Sabinene
4. 3-Octanol
5. B-Pinene
6. α-Pinylidene
7. α-Terpinene
8. p-Cymene
9. Limonene
10. 1,8-Cineole
11. γ-Terpinene
12. Terpinolene
13. Terpinen-4-ol
14. α-Terpineol
15. α-Gurjunene
16. (trans)-B-Caryophyllene
17. Aromadendrene
18. Alloborneol
19. Linalene
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: FID
Sensitivity: 128 x 10⁻¹²AFS
Injection Mode: Split
Column Part Number: 054447

**EXPERT TIP**

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

For further information on our full range of products, please visit www.sge.com
ANALYSIS OF OMEGA-3 FATTY ACIDS USING A BPX70

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

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.

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 cis 9
16. C18:1 cis 12
17. C18:1 cis 12
18. C18:2 trans 9,12
19. C18:2 cis 9,12
20. C18:3 cis 9,12,15
21. C18:3 cis 9,12,1,15
22. C18:4 cis 9,9,12,15
23. C20
24. C21:1 cis 11
25. C20:2 cis 11,14
26. C20:3 cis 8,11,14
27. C20:4 cis 8,11,14,17
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

FAME POLARITY TEST

WHAT IS DIFFERENT?
• BPX90 is a highly polar phase of the poly (diisocyanopropylsiloxane) 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.

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.
ANALYSIS OF PUFA-1 MARINE FAME ON BPX70

Phase: BPX70, 0.25 µm film
Column: 25 m x 0.22 mm ID
Initial Temp: 150 °C, 0 min
Program Rate: 2 °C/min
Final Temp: 210 °C, 5 min
Carrier Gas: He, 15 psi
Detector: FID, 280 °C
Sensitivity: 32 x 10⁻¹²AFS
Injection Mode: Split, 50:1
Column Part Number: 054602

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

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.

ANALYSIS OF PUFA-2 ANIMAL FAME ON BPX70

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 10⁻¹⁰AFS
Injection Mode: Split, 50:1
Column Part Number: 054602

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

ANALYSIS OF PUFA-1 MARINE FAME ON BPX70

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 10⁻¹⁰AFS
Injection Mode: Split, 50:1
Column Part Number: 054603

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

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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.

**FAST**

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

**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:** 1 µL

**Injection Temperature:** 250 °C

**Autosampler:** Yes

**Liner Type:** 4 mm ID FocusLiner™ with single taper

**Liner Part Number:** 092003

**Column Part Number:** 054101

**Phase:** BPX5, 0.10 µm film

**TRPH (C8-C40) Standard:** 5 ng/µL in dichloromethane

**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 HTS**

**POLYWAX 655**

**REFINERY LUBRICATION OIL**

**Phase:** HTS, 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:** He, 20 mL/min

**Solvent:** CS₂

**Column Part Number:** 054661

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### 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.

![Graph showing separation](image)

### UNLEADED GASOLINE ON BPXS

<table>
<thead>
<tr>
<th>Phase:</th>
<th>BPX5, 0.25 µm film</th>
</tr>
</thead>
<tbody>
<tr>
<td>Column:</td>
<td>30 m x 0.25 mm ID</td>
</tr>
<tr>
<td>Column Part Number:</td>
<td>054101</td>
</tr>
</tbody>
</table>

#### Sample Introduction:
- **Injector Temp:** 240 °C
- **Injection Volume:** 0.1 µL
- **Autosampler Syringe:** 0.5 µL Removable Needle
  - **Part No.** 000410
- **Septa:** Auto-Sep™
  - **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

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**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**

- **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

Standard mix for HTSD using BPX1-SimD

Enlarged section of the chromatogram above

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.

For further information on our full range of products, please visit www.sge.com
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 Diazod Dyes on BPX35
- Analysis of Ketones on Thick Film BPX5
- Analysis of Triethylamine and Triethanolamine on SolGel-1ms™
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: H2, 6 psi
Column Part Number: 054433

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

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ANALYSIS OF AMINES ON BP1

Components
1. Aniline
2. Decylamine
3. Dicyclohexylamine
4. Dodecylamine
5. Tetradecylamine
6. Tetradecylamine
7. 2, 4-Dinitrophenol
8. 2-Methyl-4, 6-dinitrophenol

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: N2
Injection Volume: 0.1 µL
Column Part Number: 054097

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

ORGANIC ACIDS IN WATER (0.03M OXALIC ACID)

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-Capric Acid
8. n-Heptanoic Acid
9. Lactic Acid

ORGANIC ACIDS IN WATER
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

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.

ANALYSIS OF ORGANIC ACIDS IN WATER ON BP21

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ANALYSIS OF AROMATIC AMINES ON BPX35

Components
1. Indoline
2. o-Toluidine
3. 2,4-Diaminoanisole
4. p-Chloroaniline
5. p-a residine
6. 2-Methylaniline
7. 2,6-Dimethylaniline
8. 1,4-Phenyldiamine
9. Nitro
10. Biphenylamine
11. Benzidine

EXPERT TIP
Using a thicker film helps prevent amines from tailing.

ANALYSIS OF AROMATIC AMINES FROM DIAZO DYES ON BPX35

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. Nitro
10. Biphenylamine
11. Benzidine

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. 2-Hexanone
10. 3-Hexanone
11. Methyl oxide
12. Cyclopentanone
13. 2-Methyl-3-hexanone
14. 4-Methyl-2-hexanone
15. 2-Octanone
16. Heptanone
17. 2-Undecanone
18. Cyclohexanone
19. 3-Hexanone
20. 2-Hexanone
21. 1-Octanone
22. 2-Octanone
23. 2-Dodecanone

**Phase:** BPX5, 1.0 µm film

**Sample:** 300 ppm in dichloromethane

**Column:**
- 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
- Column Part Number: 054123

EXPERT TIP

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

For further information on our full range of products, please visit [www.sge.com](http://www.sge.com)
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

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<table>
<thead>
<tr>
<th>Method</th>
<th>Phase Composition</th>
<th>SGE Phase Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>Dimethylpolysiloxane oil</td>
<td>BP1, SOLGEL-1ms™</td>
</tr>
<tr>
<td>G2</td>
<td>Dimethylpolysiloxane gum</td>
<td>BP1, SOLGEL-1ms</td>
</tr>
<tr>
<td>G3</td>
<td>50% Phenyl - 50% Methylpolysiloxane</td>
<td>BPX50</td>
</tr>
<tr>
<td>G4</td>
<td>3-Cyanopropylpolysiloxane</td>
<td>BPX70</td>
</tr>
<tr>
<td>G5</td>
<td>50% 3-Cyanopropyl - 50% Phenylmethylsilicone</td>
<td>BP225</td>
</tr>
<tr>
<td>G6</td>
<td>Polyethylene glycol (average molecular weight of 950-1,050)</td>
<td>BP20(WAX), SOLGEL-WAX™</td>
</tr>
<tr>
<td>G7</td>
<td>Polyethylene glycol (average molecular weight of 3,000-3,700)</td>
<td>BP20(WAX), SOLGEL-WAX</td>
</tr>
<tr>
<td>G8</td>
<td>Polyethylene glycol (average molecular weight of 15,000)</td>
<td>BP20(WAX), SOLGEL-WAX</td>
</tr>
<tr>
<td>G9</td>
<td>75% Phenyl - 25% Methylpolysiloxane</td>
<td>BPX50</td>
</tr>
<tr>
<td>G10</td>
<td>25% Phenyl - 25% Cyanopropylmethylsilicone</td>
<td>BP225</td>
</tr>
<tr>
<td>G11</td>
<td>Polyethylene glycol (average molecular weight of 380-420)</td>
<td>BP20(WAX), SOLGEL-WAX</td>
</tr>
<tr>
<td>G12</td>
<td>Polyethylene glycol TPA (Carbowax 20M terephthalic acid)</td>
<td>BP21(FFAP)</td>
</tr>
<tr>
<td>G13</td>
<td>5% Phenyl - 95% Methylpolysiloxane BP5, BPX5</td>
<td>BPX5</td>
</tr>
<tr>
<td>G14</td>
<td>Polyethylene glycol &amp; diepoxide esterified with nitroterephthalic acid</td>
<td>BP21(FFAP)</td>
</tr>
<tr>
<td>G15</td>
<td>1% Vinyl - 5% Phenylmethylpolysiloxane</td>
<td>BP5, BPX5</td>
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<tr>
<td>G16</td>
<td>Phase G1 plus a tailing inhibitor</td>
<td>BP1, SOLGEL-1ms</td>
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<tr>
<td>G17</td>
<td>Polyethylene glycol (average molecular weight of 1,500)</td>
<td>BP20(WAX), SOLGEL-WAX</td>
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<td>G18</td>
<td>Phenyldimethylsiloxane (10% phenyl substituted)</td>
<td>BP5, BPX5</td>
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<td>G19</td>
<td>35% Phenyl - 65% Dimethylvinylsiloxane</td>
<td>BPX35</td>
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<td>G20</td>
<td>6% Cyanopropylphenyl - 94% Dimethylpolysiloxane</td>
<td>BP624</td>
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<td>G21</td>
<td>14% Cyanopropylphenyl - 86% methylpolysiloxane</td>
<td>BP10 (1701)</td>
</tr>
</tbody>
</table>

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

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ANALYSIS OF TRICYCLIC ANTIDEPRESSANTS ON BPX35

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

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

DIOXANE IMPURITIES
Phase: BP20, 1.0 µm
Column: 25 m 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. Isopropl alcohol
5. Acetonitrile
6. Dichloromethane
7. 2-Butanone
8. Ethyl acetate
9. Benzene

COMMON SOLVENT MIXTURE
Phase: BPX5, 1.0 µm film
Sample: neat
Column: 60m x 0.25 mm ID
Initial Temp: 32 °C, 5 min.
Rate: 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

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ANALYSIS OF COMMON PHARMACEUTICAL SOLVENT ON BPX-VOLATILES

Phase: BPX-Volatiles, 1.4 µm film
Sample: USEPA 502.2 mix: 200 ppm in Methanol
Initial Temp: 30 °C, 15 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 psi
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: 4 mm ID Single Taper Liner
Liner Part No: 092017
Column Part No: 054980
Full Scan / SIM: Full scan 45-450

Components
1. Dichlorodifluoromethane
2. Vinyl chloride
3. Chloroform
4. Trichloroethylene
5. 1,1,1,2-Tetrachloroethane
6. 1,2-Dichloroethane
7. 1,2-Dichlorobenzene
8. 1,1,1-Trichloroethane
9. 1,2-Dibromoethane
10. 1,2-Dichloropropane
11. 1,3-Dichloropropene
12. 1,1-Dichloroethane
13. 2-Chlorotoluene
14. 1,2,4-Trimethylbenzene
15. 1,2-Dibromoethane
16. 1,3-Dichlorobenzene
17. 1,2-Dichlorobenzene
18. 1,2-Dichloropropane
19. 1,2-Dichloroethane
20. 1,2-Dibromoethane
21. 2-Chlorotoluene
22. 1,2-Dichlorobenzene
23. 1,3-Dichlorobenzene
24. 1,2-Dibromoethane
25. 1,2-Dichloropropane
26. 1,2-Dichloroethane
27. 1,2-Dichlorobenzene
28. 1,2-Dichloroethane
29. 1,2-Dichloropropane
30. 1,2-Dichlorobenzene
31. 1,2-Dibromoethane
32. Chlorobenzene
33. Ethylbenzene
34. Toluene
35. m-Xylene
36. p-Xylene
37. o-Xylene
38. Styrene
39. Bromoform
40. Isopropylbenzene
41. Bromobenzene
42. 1,2,2-Trichloroethane
43. 1,2-Dichloroethane
44. 1,1-Dichloroethane
45. 2-Chlorobenzene
46. 1,3,5-Trichlorobenzene
47. 1,1-Dichloroethane
48. 1,2-Dichloroethane
49. 1,2-Dibromoethane
50. sec-Butylbenzene
51. 1,2-Dichlorobenzene
52. 1,2-Dibromoethane
53. 1,2-Dibromoethane
54. 1,2-Dibromoethane
55. 1,2-Dichlorobenzene
56. 1,2-Dichloroethane
57. 1,2-Dibromoethane
58. Hexachlorobutadiene
59. Naphthalene
60. 1,2,3-Trichlorobenzene
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145. 1,2,3-Trichlorobenzene
146. 1,2,3-Trichlorobenzene
147. 1,2,3-Trichlorobenzene
148. 1,2,3-Trichlorobenzene
149. 1,2,3-Trichlorobenzene
150. 1,2,3-Trichlorobenzene

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**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
**Column Part No:** 054980
**Full Scan / SIM:** Full scan 30-450

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**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. Methyl-t-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-Butyl 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
**Column Part No:** 054980
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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

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ANALYSIS OF ACID/NEUTRAL DRUGS ON BPX35

<table>
<thead>
<tr>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ethosuximide</td>
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<tr>
<td>2. Barbital</td>
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<tr>
<td>3. Aprobartal</td>
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<tr>
<td>4. Butobarbital</td>
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<td>5. Amedobartal</td>
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<td>6. Pentobarbital</td>
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<td>7. Secobarbital</td>
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<tr>
<td>8. Meprobamate</td>
</tr>
<tr>
<td>9. Carisoprodal</td>
</tr>
<tr>
<td>10. Glutethimide</td>
</tr>
<tr>
<td>11. Phenobarbital</td>
</tr>
<tr>
<td>12. Methaqualone</td>
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<tr>
<td>13. Primidone</td>
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</tbody>
</table>

ACID/NEUTRAL DRUGS

Phase: BPX35, 0.25 µm
Column: 25 m x 0.22 mm ID
Initial Temp: 100 °C, 1 min
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

<table>
<thead>
<tr>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Benzocaine</td>
</tr>
<tr>
<td>2. Unknown</td>
</tr>
<tr>
<td>3. Meperidine</td>
</tr>
<tr>
<td>4. Diphenhydramine</td>
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<tr>
<td>5. Lidocaine</td>
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<tr>
<td>6. Tripelennamine</td>
</tr>
<tr>
<td>7. Amitriptyline</td>
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<td>8. Tetracaine</td>
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<td>9. Pyrilamine</td>
</tr>
<tr>
<td>10. Unknown</td>
</tr>
<tr>
<td>11. Diazepam</td>
</tr>
<tr>
<td>12. Flurazepam</td>
</tr>
<tr>
<td>13. Papaverine</td>
</tr>
<tr>
<td>14. Triazolam</td>
</tr>
</tbody>
</table>

BASIC DRUGS

Phase: BPX35, 0.25 µm
Column: 25 m 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

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ANALYSIS OF UNDERIVATIZED BARBITURATES ON BP5

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-Dimethylsulfoxide
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 3: 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

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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

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<table>
<thead>
<tr>
<th>Phase</th>
<th>Length (m)</th>
<th>ID (mm)</th>
<th>Film Thickness (µm)</th>
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</tr>
</tbody>
</table>

For further information on our full range of products, please visit www.sge.com
### SGE Capillary Column Part Number Listing

<table>
<thead>
<tr>
<th>Phase</th>
<th>Length (m)</th>
<th>ID (mm)</th>
<th>Film Thickness (µm)</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0.33</td>
<td>0.25</td>
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</tbody>
</table>

### GC Column Replacement Guide

<table>
<thead>
<tr>
<th>Column to Replace</th>
<th>Description</th>
<th>SGE Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB-1, HP-1, Ultra-1, SPB-1, CP-Sil SCB, RSL-150, RSL-160, RtxB-1, ZB-1, CB-1, OVb-1, PE-1, 007-1(MS), SP-2100, SE-30, RH-1, CC-1, CP-Sil 5CB MS, VF-1ms, Petrocol DH</td>
<td>100% Dimethyl Polysiloxane</td>
<td>BP1</td>
</tr>
<tr>
<td>DBX-1 SimDis, DB-2887, Rtx-2887, HP-1, Petrocol 2887, Petrocol EX2887</td>
<td>Petrocol DH, DB-Petro</td>
<td>BPX1</td>
</tr>
<tr>
<td>DB-5, DB-5.625, Rtx-5, HP-5, Ultra-2, PTE-5, PB-5, MDN-5, CP-Sil 8CB, VB-5 &amp; ZB-5</td>
<td>5% Phenyl Polysiloxane</td>
<td>BP5</td>
</tr>
<tr>
<td>DB-5, DB-5ms, HP-5, Ultra-2, RtxB-5, Rtx-Si5 M5, Rtx Si5ms, AT-5, AT-SM5, 007-5MS, SPb-5, CP-WAXCB, VF-5ms, RSL-200, CB-5, OVb-5, PE-5, 007-2(MPS-5), SE-52, SE-54, XTi-5, PTE-5, CC-5, RH-5ms, ZB-5</td>
<td>5% Phenyl Polysilphenylene-siloxane</td>
<td>BPX5</td>
</tr>
<tr>
<td>MXT-1 SimDist, HT-SimDist, DistCB, MXT-500</td>
<td>No equivalent, unique high temperature column with special selectivity</td>
<td>HT5</td>
</tr>
<tr>
<td>DB-608, Rtx-35, SP-608</td>
<td>35% Phenyl Polysilphenylene-siloxane</td>
<td>BPX3</td>
</tr>
<tr>
<td>OV-17, SP-2250, DB-17ms, DB-17ht, Rtx-50, SP-50, HP-50+, HP-17, VB-70/608, ZB-70</td>
<td>50% Phenyl Polysilphenylene-siloxane</td>
<td>BPX50</td>
</tr>
<tr>
<td>DB-23, CP-Sil 88, VF-23ms, SP-2330, SP-2380, RtxB-2330, 007-23, AT-Silar, PE-23</td>
<td>70% Cyanopropyl Polysilphenylene-siloxane</td>
<td>BPX70</td>
</tr>
<tr>
<td>DB-FFAP, HP-FFAP, Stabilwax-DA, CP Wax 58CB, VB-FFAP, ZB-FFAP</td>
<td>Polylene Glycol (TPA treated)</td>
<td>BP21 (FFAP)</td>
</tr>
<tr>
<td>DB-1701, Rtx-1701, HP-1701, SP-7, CP-Sil 19CB, VB-1701, ZB-1701</td>
<td>14% Cyanopropylphenyl Polysiloxane</td>
<td>BP10 (1701)</td>
</tr>
<tr>
<td>HP-225, DB-225, Rtx-225</td>
<td>50% Cyanopropylphenyl Polysiloxane</td>
<td>BP225</td>
</tr>
<tr>
<td>DB-624, HP-VOC, Rtx Volatiles, VOCOL, VB-624, ZB-624</td>
<td>Cyanopropylphenyl Polysiloxane</td>
<td>BP624, BPX-Volatiles</td>
</tr>
<tr>
<td>Cyclodex 8, R-8DEXm</td>
<td>Permethylated Beta Cyclodextrin</td>
<td>CYDEX-B</td>
</tr>
<tr>
<td>Unique highly polar phase</td>
<td>90% Cyanopropyl Polysilphenylene-siloxane</td>
<td>BPX90</td>
</tr>
</tbody>
</table>

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## GC Troubleshooting and Maintenance

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Septum bleed and/or contaminated liner</strong></td>
<td>Replace septa and insert a new inlet liner.</td>
<td><strong>Solution:</strong> Ensure gas traps are installed correctly to remove moisture, organics and oxygen. Ensure high purity carrier gas is used.</td>
</tr>
<tr>
<td><strong>Poor carrier gas quality causing phase decomposition</strong></td>
<td></td>
<td>Lower maximum program temperature.</td>
</tr>
<tr>
<td><strong>Maximum temperature of the phase has been exceeded</strong></td>
<td></td>
<td>Neutralize sample before injecting.</td>
</tr>
<tr>
<td><strong>Highly acid or alkaline samples</strong></td>
<td></td>
<td>Filter sample. Use a FocusLiner™.</td>
</tr>
<tr>
<td><strong>Dirty samples</strong></td>
<td></td>
<td>Dilute sample.</td>
</tr>
<tr>
<td><strong>Contaminated solvent</strong></td>
<td></td>
<td>Use a high purity solvent.</td>
</tr>
<tr>
<td><strong>High baseline level</strong></td>
<td></td>
<td><strong>Solution:</strong> Increase the plunger depression speed.</td>
</tr>
<tr>
<td><strong>Symptom</strong></td>
<td></td>
<td><strong>Solution:</strong> Change to a single solvent.</td>
</tr>
<tr>
<td><strong>Compound degradation</strong></td>
<td></td>
<td>Recondition capillary column and re-inject sample.</td>
</tr>
<tr>
<td><strong>Column inserted too far into injector</strong></td>
<td></td>
<td>Reposition column according to manufacturer’s instructions.</td>
</tr>
<tr>
<td><strong>Fronting peaks</strong></td>
<td></td>
<td>Dilute sample. Use a thicker film. Increase the split ratio.</td>
</tr>
<tr>
<td><strong>Tailing peaks</strong></td>
<td></td>
<td><strong>Solution:</strong> Choose a more polar column.</td>
</tr>
<tr>
<td><strong>Sample not suitable for phase polarity</strong></td>
<td></td>
<td>Replace with a new fully deactivated inlet liner.</td>
</tr>
<tr>
<td><strong>Poorly deactivated inlet liner</strong></td>
<td></td>
<td><strong>Solution:</strong> Change column polarity or lower temp. program ramp rate to separate peaks.</td>
</tr>
<tr>
<td><strong>Broad peaks</strong></td>
<td></td>
<td><strong>Solution:</strong> Increase sampling rate or reduce number of ions detected in SIM mode.</td>
</tr>
<tr>
<td><strong>Make-up gas flow rate for atmospheric detectors is low</strong></td>
<td></td>
<td><strong>Solution:</strong> Increase make up gas flow according to manufacturer’s instructions.</td>
</tr>
<tr>
<td><strong>Carrier gas flow is low</strong></td>
<td></td>
<td><strong>Solution:</strong> Check carrier gas flow.</td>
</tr>
<tr>
<td><strong>Split gas flow is too low</strong></td>
<td></td>
<td><strong>Solution:</strong> Increase split flow or use the ‘solvent effect’ to focus peaks.</td>
</tr>
<tr>
<td><strong>Column contamination</strong></td>
<td></td>
<td>Cut 50cm off the front of the column and re-install in the injector. Check injector conditions are reproducible e.g. temperature and split ratio.</td>
</tr>
<tr>
<td><strong>Sample concentration has changed</strong></td>
<td></td>
<td><strong>Solution:</strong> Increase make up gas flow according to manufacturer’s instructions.</td>
</tr>
<tr>
<td><strong>Sample concentration has changed – more has been injected on column</strong></td>
<td></td>
<td><strong>Solution:</strong> Increase make up gas flow according to manufacturer’s instructions.</td>
</tr>
<tr>
<td><strong>Dirty column. Extra non-volatile material deposited on the column has caused a change in column polarity</strong></td>
<td></td>
<td>Cut 50cm off the front of the column and re-install in the injector. Recheck column dimensions and film thickness after installing a new column.</td>
</tr>
<tr>
<td><strong>Loss of peak resolution</strong></td>
<td></td>
<td><strong>Solution:</strong> Dilute sample or increase split ratio.</td>
</tr>
<tr>
<td><strong>Aging column has resulted in a substantial loss of phase causing a loss in column resolving power</strong></td>
<td></td>
<td><strong>Solution:</strong> Recheck column dimensions and film thickness after installing a new column.</td>
</tr>
<tr>
<td><strong>Carrier gas velocity has changed</strong></td>
<td></td>
<td>Recheck carrier gas speed and optimize to Van Deemter optima.</td>
</tr>
<tr>
<td><strong>Dirty column. Extra non-volatile material deposited on the column has caused a change in column polarity</strong></td>
<td></td>
<td><strong>Solution:</strong> Recheck temperature method conditions.</td>
</tr>
<tr>
<td><strong>Manual injection technique or operator has changed</strong></td>
<td></td>
<td><strong>Solution:</strong> Recheck temperature method conditions.</td>
</tr>
<tr>
<td><strong>No peaks</strong></td>
<td></td>
<td><strong>Solution:</strong> Increase make up gas flow according to manufacturer’s instructions.</td>
</tr>
<tr>
<td><strong>GC incorrectly wired</strong></td>
<td></td>
<td><strong>Solution:</strong> Recheck temperature method conditions.</td>
</tr>
<tr>
<td><strong>Wrong detector is being monitored</strong></td>
<td></td>
<td><strong>Solution:</strong> Recheck carrier gas quality causing phase decomposition. <strong>Solution:</strong> Ensure sample is compatible with the detector.</td>
</tr>
<tr>
<td><strong>FID flame is out</strong></td>
<td></td>
<td>Recheck temperature method conditions.</td>
</tr>
<tr>
<td><strong>System has become active</strong></td>
<td></td>
<td><strong>Solution:</strong> Ensure sample is compatible with the detector. <strong>Solution:</strong> Recheck carrier gas quality causing phase decomposition.</td>
</tr>
<tr>
<td><strong>Loss of sensitivity</strong></td>
<td></td>
<td><strong>Solution:</strong> Increase make up gas flow according to manufacturer’s instructions.</td>
</tr>
<tr>
<td><strong>Concentration of sample has changed</strong></td>
<td></td>
<td><strong>Solution:</strong> Recheck temperature method conditions.</td>
</tr>
<tr>
<td><strong>Flame gas flow rates and/or make-up gas flow have changed</strong></td>
<td></td>
<td><strong>Solution:</strong> Ensure sample is compatible with the detector. <strong>Solution:</strong> Recheck carrier gas quality causing phase decomposition.</td>
</tr>
<tr>
<td><strong>System has become active</strong></td>
<td></td>
<td><strong>Solution:</strong> Recheck temperature method conditions.</td>
</tr>
<tr>
<td><strong>Splitless conditions have changed</strong></td>
<td></td>
<td><strong>Solution:</strong> Ensure sample is compatible with the detector. <strong>Solution:</strong> Recheck carrier gas quality causing phase decomposition.</td>
</tr>
<tr>
<td><strong>Syringe has become contaminated from previous sample</strong></td>
<td></td>
<td><strong>Solution:</strong> Ensure syringe has been thoroughly washed with solvent between injections. Sometimes this can involve 20 solvent rinses. <strong>Solution:</strong> Recheck temperature method conditions.</td>
</tr>
<tr>
<td><strong>New standards have impurities</strong></td>
<td></td>
<td><strong>Solution:</strong> Confirm by using a different source of primary standards. <strong>Solution:</strong> Recheck temperature method conditions.</td>
</tr>
<tr>
<td><strong>Impurities in solvent</strong></td>
<td></td>
<td><strong>Solution:</strong> Ensure sample is compatible with the detector. <strong>Solution:</strong> Recheck carrier gas quality causing phase decomposition.</td>
</tr>
<tr>
<td><strong>Septum bleed</strong></td>
<td></td>
<td><strong>Solution:</strong> Ensure syringe has been thoroughly washed with solvent between injections. Sometimes this can involve 20 solvent rinses. <strong>Solution:</strong> Recheck temperature method conditions.</td>
</tr>
<tr>
<td><strong>Peaks are still eluting from previous run</strong></td>
<td></td>
<td><strong>Solution:</strong> Confirm by extending run time and ensuring all peaks have eluted from sample. <strong>Solution:</strong> Recheck temperature method conditions.</td>
</tr>
<tr>
<td><strong>Flashback has happened</strong></td>
<td></td>
<td><strong>Solution:</strong> Confirm by extending run time and ensuring all peaks have eluted from sample. <strong>Solution:</strong> Recheck temperature method conditions.</td>
</tr>
</tbody>
</table>

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