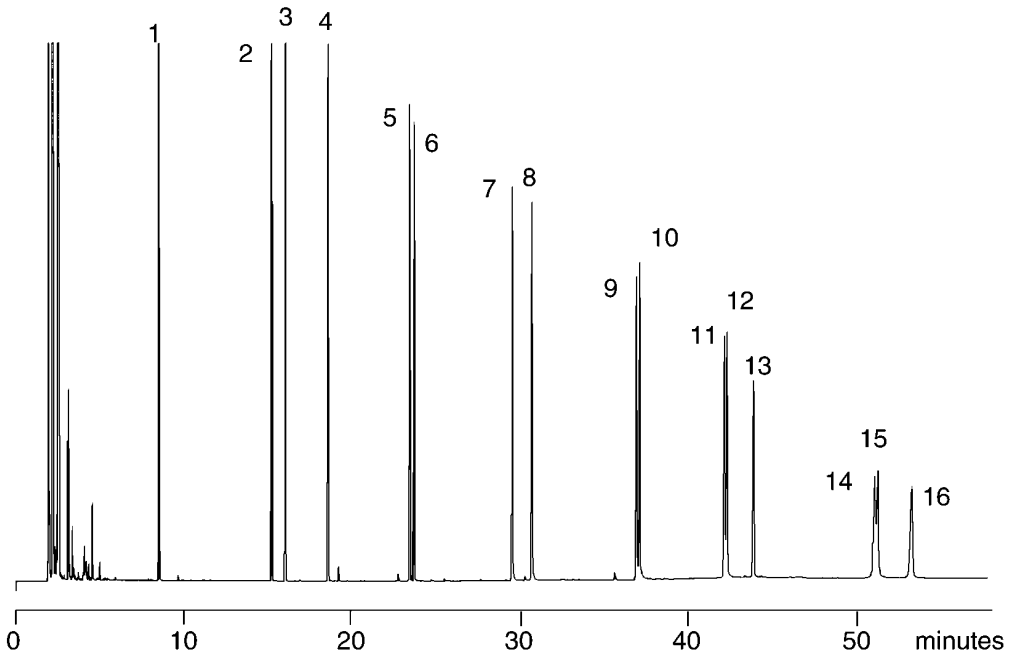
ANALYSIS OF POLYNUCLEAR AROMATIC HYDROCARBONS (PAH) ON BPX5

Column Part No.: 054142

Phase:	BPX5, 0.25 µm film
Column:	30 m x 0.22 mm ID
Initial Temp:	100 °C, 1 min
Rate:	5 °C/min
Final Temp:	380 °C , 20 min
Carrier Gas:	He, 20 psi
Detector:	FID, 370 °C



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

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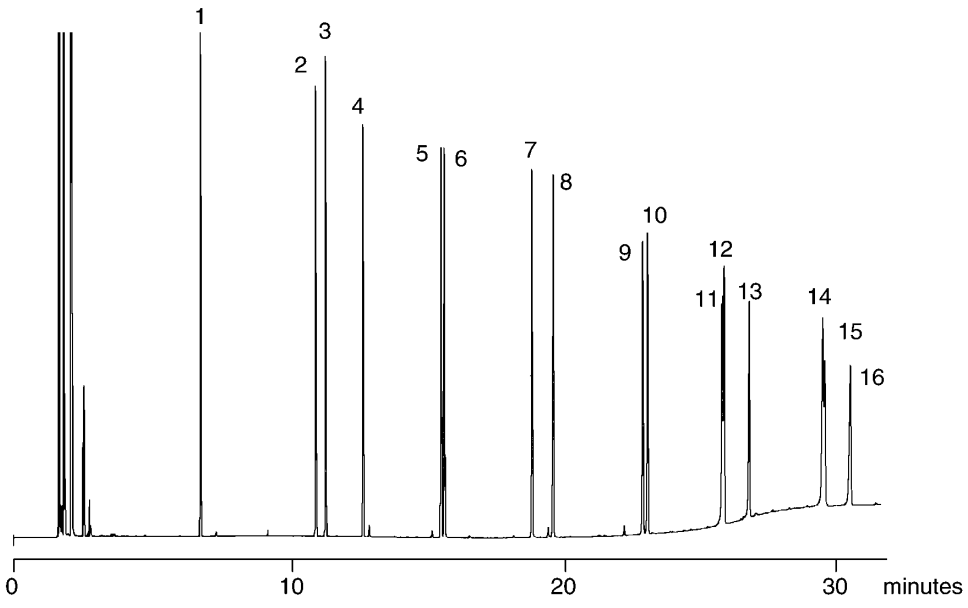
ANALYSIS OF POLYNUCLEAR AROMATIC HYDROCARBONS ON BPX35

Column Part No.: 054714

Phase:	BPX35, 0.25 µm film
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



Components
1. Naphthalene
2. Acenaphthylene
3. Acentaphthene
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

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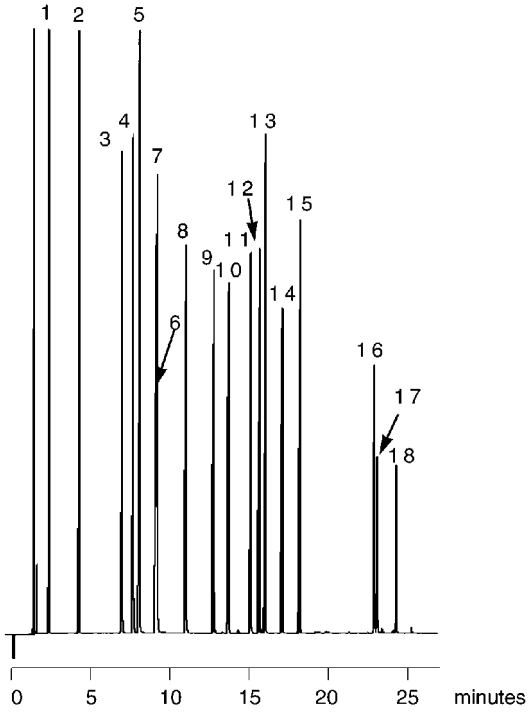
ANALYSIS OF SUBSTITUTED AROMATICS ON BP5

SUBSTITUTED AROMATICS

Column Part No.: 054168

Phase:	BP5, 0.25 µm film
Column:	25 m x 0.22 mm ID
Initial Temp:	40 °C, 4 min
Rate 1:	2 °C/min
Temp 2:	60 °C
Rate 2:	5 °C/min
Final Temp:	80 °C, 2 min
Detecotr:	FID
Sensitivity:	64 x 10^{-12} AFS
Injection Mode:	Split



Components

1. Benzene
2. Toluene
3. Chlorobenzene
4. Ethylbenzene
5. m, p-Xylene
6. o-Xylene
7. Styrene
8. iso Propylbenzene
9. n-Propylbenzene
10. 1,3,5-Trimethylbenzene
11. 1,2,4-Trimethylbenzene
12. m-Dichlorobenzene
13. sec-Buthylbenzene, p-Dichlorobenzene
14. o-Dichlorobenzene
15. Butyl-benzene
16. 1,2,4 - Trichlorobenzene
17. Napthalene
18. Hexachlorobutadine

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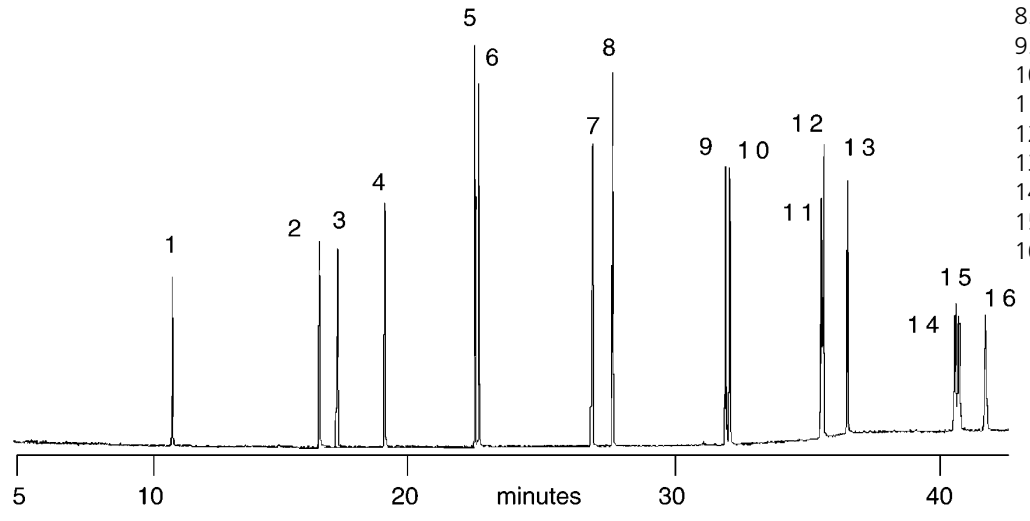
ANALYSIS OF POLYNUCLEAR AROMATIC HYDROCARBONS ON BPX5

Polynuclear Aromatic Hydrocarbons (EPA 625 PAHs)

Column Part No.: 054113

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
Detector:	HP5971 MSD
Injection Mode:	Split 40:1
Carrier Gas:	He, 15 psi

Notes: BPX5 is a low bleed, chemically inert column ideal for this and other GC-MS applications.



Components
1. Naphthalene
2. Acenaphthylene
3. Acenaphthene
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 - cd) pyrene
15. Dibenzo (a,h) anthracene
16. Benzo (g,h,i) perylene

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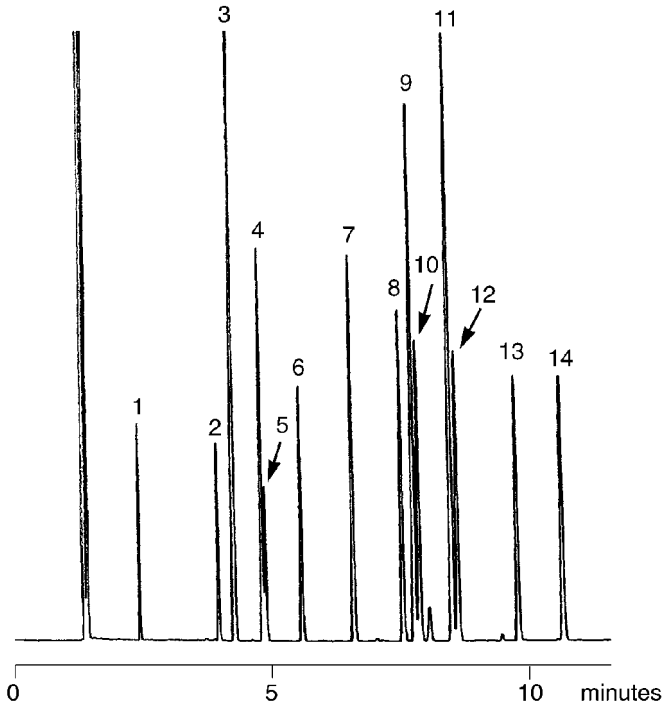
ANALYSIS OF SUBSTITUTED BENZENES ON HT5

SUBSTITUTED BENZINES

Column Part No.: 054642

Phase:	HT5, 0.1 µm film
Column:	25 m x 0.32 mm ID (Polymide Clad)
Initial Temp:	40 °C, 2 min
Program Rate:	4 °C/min
Final Temp:	70 °C, 4 min
Carrier Gas:	H_2, 6 psi
Detector:	FID
Sensitivity:	32 x 10^{-12} AFS
Injection Mode:	Split

Notes: BP21 provides excellent peak shape for all fatty acids including Acetic acid



Components
1. Toluene
2. Ethylbenzene
3. m & p-Xylene
4. Styrene
5. o-Xylene
6. iso-Propylbenzene
7. n-Propylbenzene
8. 1, 3, 5-Trimethylbenzene
9. α-Methylstyrene
10. tert-Butylbenzene
11. 1, 2, 4-trimethylbenzene & iso-butylbenzene
12. sec-Butylbenzene
13. ß-Methylstyrene
14. n-Butylbenzene

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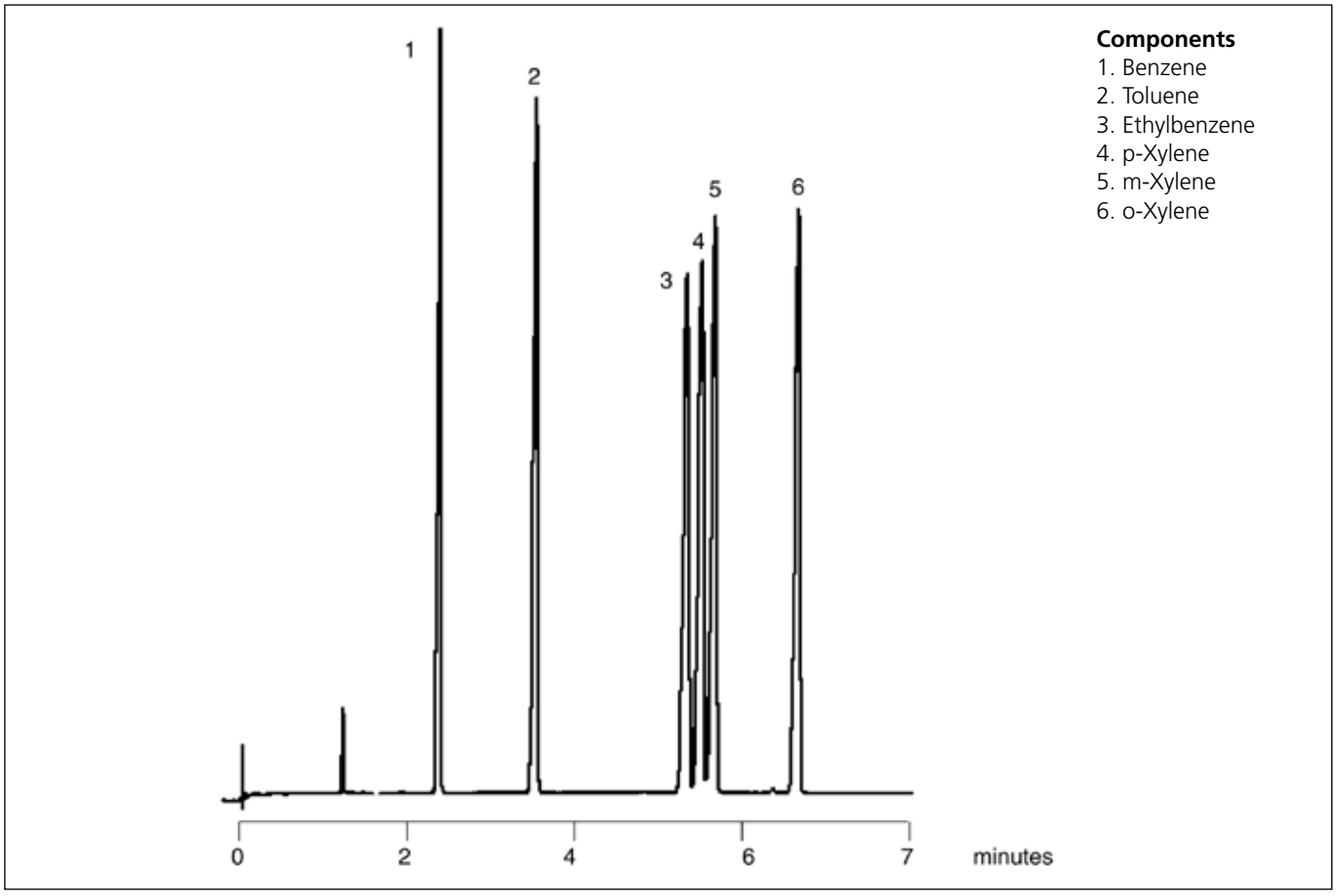
ANALYSIS OF AROMATIC POLLUTANTS IN WATER ON BP20

AROMATIC POLLUTANTS WATER

Column Part No.: 054448

Phase:	BP20, 1.0 µm film
Column:	25 m x 0.53 mm ID
Initial Temp:	Isothermal at 60 °C
Detector:	FID
Sensitivity:	32 x 10^{-12} AFS
Injection Mode:	Split

Notes: BP20 columns are compatible with aqueous injections.



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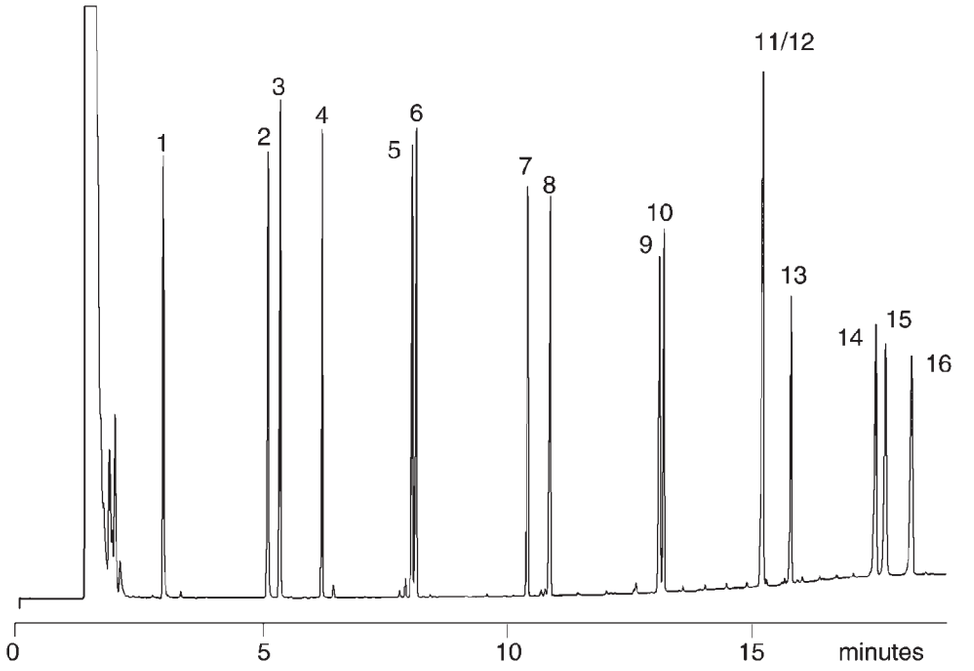
APPLICATION NOTE

Analysis of Polynuclear Aromatic Hydrocarbons on HT8

Column Part No.: 054675

Phase:	HT8, 0.25 µm film
Column:	25 m x 0.22 mm ID
Initial Temp:	150 °C, 1 min
Rate:	4 °C/min
Final Temp:	380 °C, 5 min
Carrier Gas:	He, 20 psi
Detector:	FID



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

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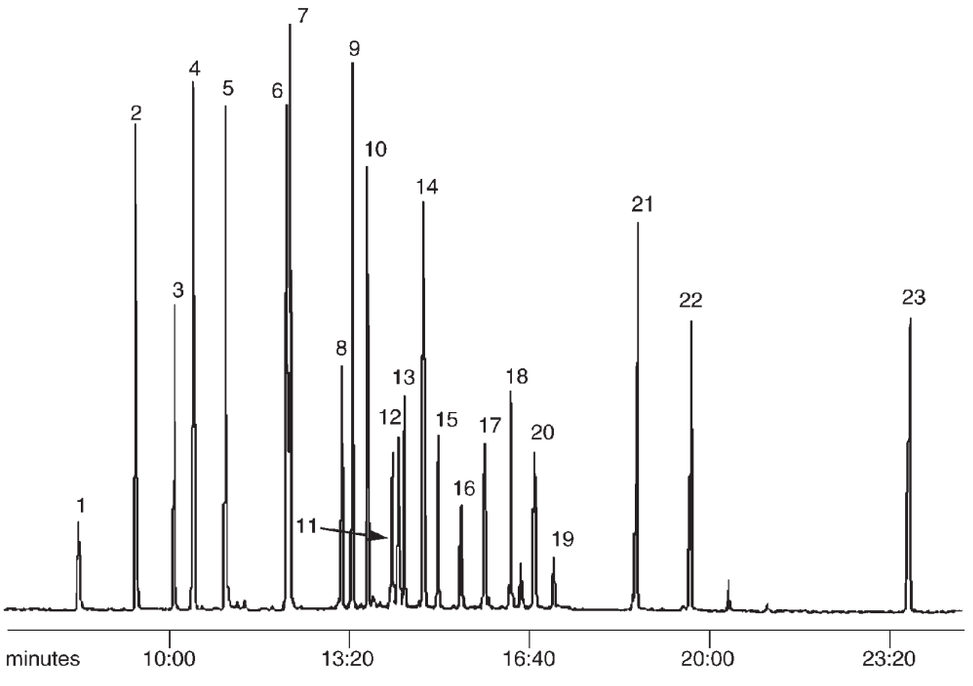
APPLICATION NOTE

Analysis of Nitroaromatics on HT8

NITROAROMATICS

Column Part No.:	**054675**
Phase:	HT8, 0.25 µm film
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

Notes: HT8 provides excellent separation of these components with short analysis times. HT8 is also a low bleed column providing compatability with GC-MS applications.



Components

1. Nitrobenzene
2. 2-Nitrotoluene
3. 3-Nitrotoluene
4. 4-Nitrotoluene
5. 2,3-Diaminotoluene
6. 2,4-Diamotoluene
7. 2,6-Diamotoluene
8. 1,4-Dinitrobenzene
9. 2,6-Dinitrotoluene
10. 1,3-Dinitrobenzene
11. 2-Nitro-6-aminotoluene
12. 1,2-Dinitrobenzene
13. 5-Nitro-6-aminotoluene
14. 2,4-Dinitrotoluene
15. 2,3-Dinitrotoluene
16. 3-Nitro-4-aminotoluene
17. 3,4-Dinitrotoluene
18. 2,4,6-Trinitrotoluene
19. 1,3,5-Trinitrobenzene
20. 4-Nitro-6-aminotoluene
21. 2,6-Dinitro-4-aminotoluene
22. 2,4-Dinitro-6-aminotoluene
23. 2,4 - Dinitrodiphenylamine

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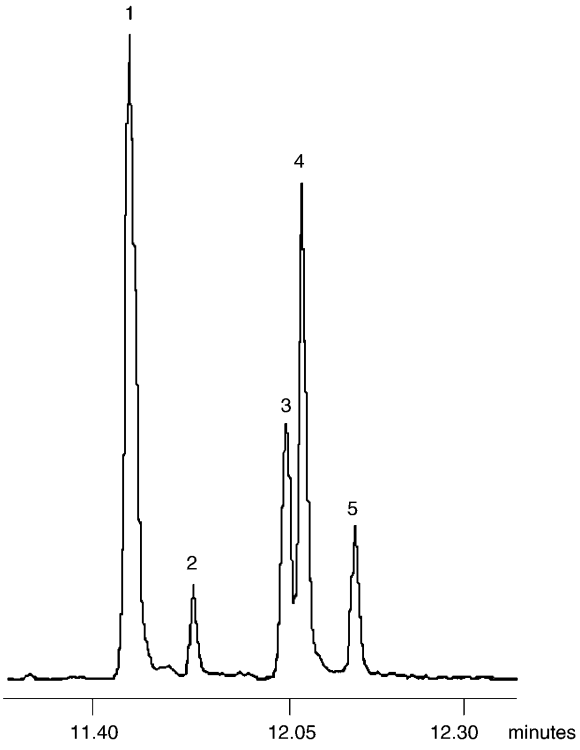
ANALYSIS OF POLYNUCLEAR AROMATIC HYDROCARBONS ON HT8

Column Part No.: 054675

Phase:	HT8, 0.25 µm film
Column:	25 m x 0.22 mm ID
Initial Temp:	80 °C
Rate:	20 °C/min
Final Temp:	380 °C, 1 min
Detector:	Ion Trap MS
Injection Mode:	PTV
Carrier Gas:	He, 15 psi

Notes: HT8 provides good separation of Benzo (e) pyrene and Benzo (a) pyrene.



Components
1. Benezo (b,j,k) fluoranthene
2. Benzo (a) fluoranthene
3. Benzo (e) pyrene
4. Benzo (a) pyrene
5. Perylene

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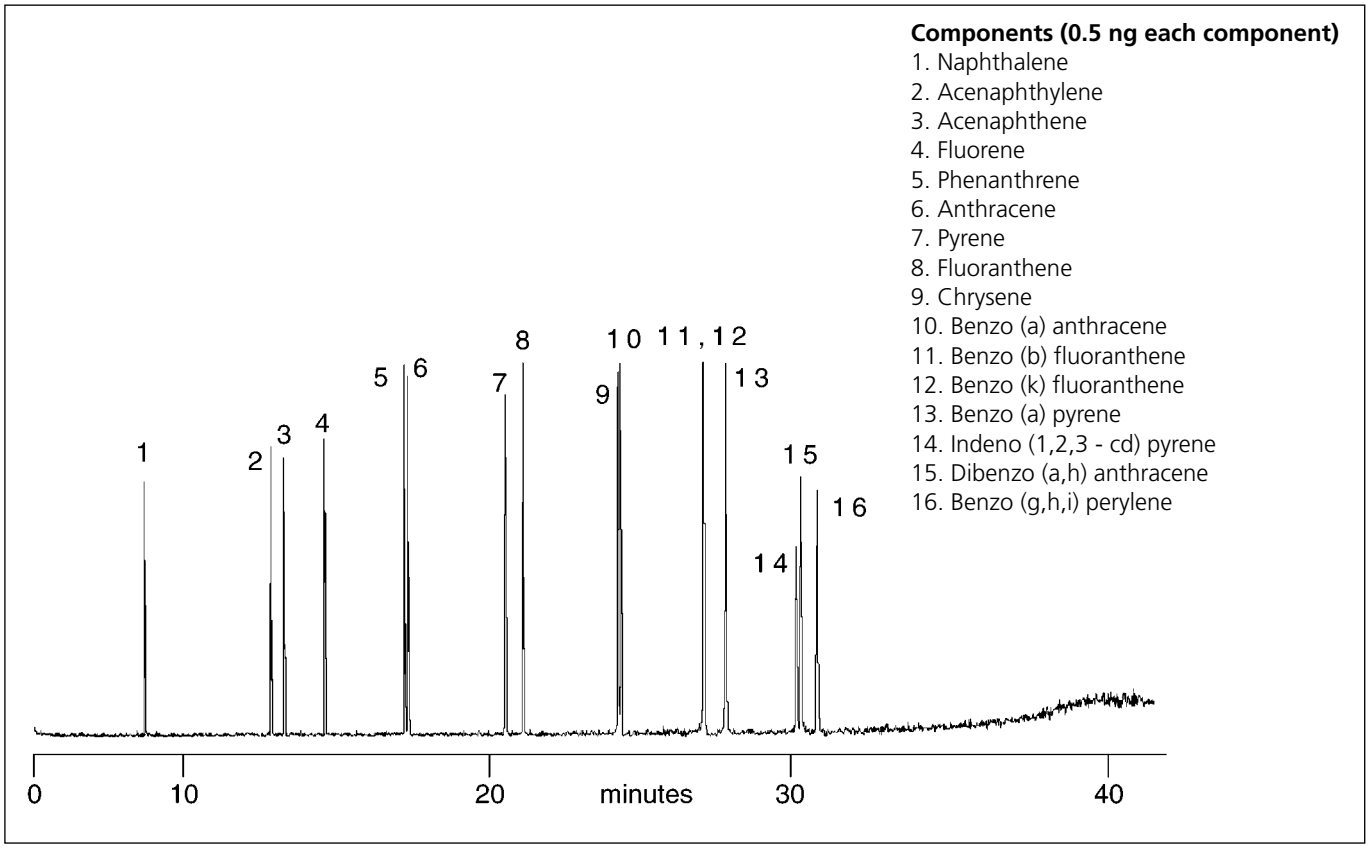
ANALYSIS OF POLYNUCLEAR AROMATIC HYDROCARBONS ON HT5

Column Part No.: 054636

Phase:	HT5, 0.10 µm film
Column:	25 m x 0.22 mm ID
Initial Temp:	50 °C, 2 MIN
Rate:	10 °C/min
Final Temp:	420 °C, 5 min
Detector:	HP5971 MSD
Injection Mode:	Split 50:1
Carrier Gas:	He, 15 psi



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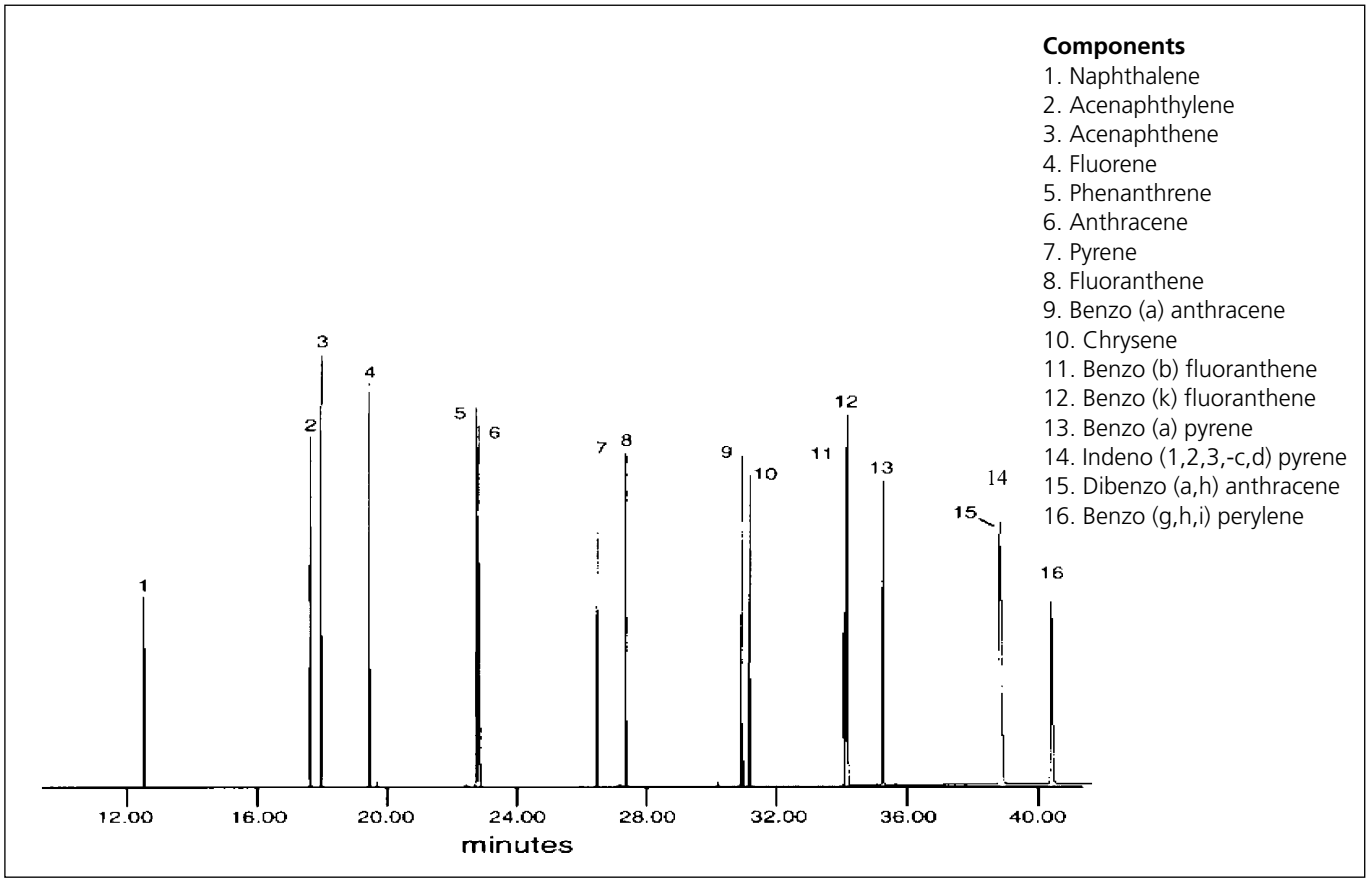
ANALYSIS OF POLYNUCLEAR AROMATIC HYDROCARBONS (PAH) ON BPX50

Column Part No.: 054751

Phase:	BPX50, 0.25 µm film
Column:	30 m x 0.25 mm ID
Initial Temp:	50 °C, 1 min
Rate 1:	8 °C/min
Final Temp:	300 °C, 10 min
Detector:	HP 5973 MSD
Injector Mode:	Split, 40:1, 300 °C
Carrier Gas:	helium, 20 psi



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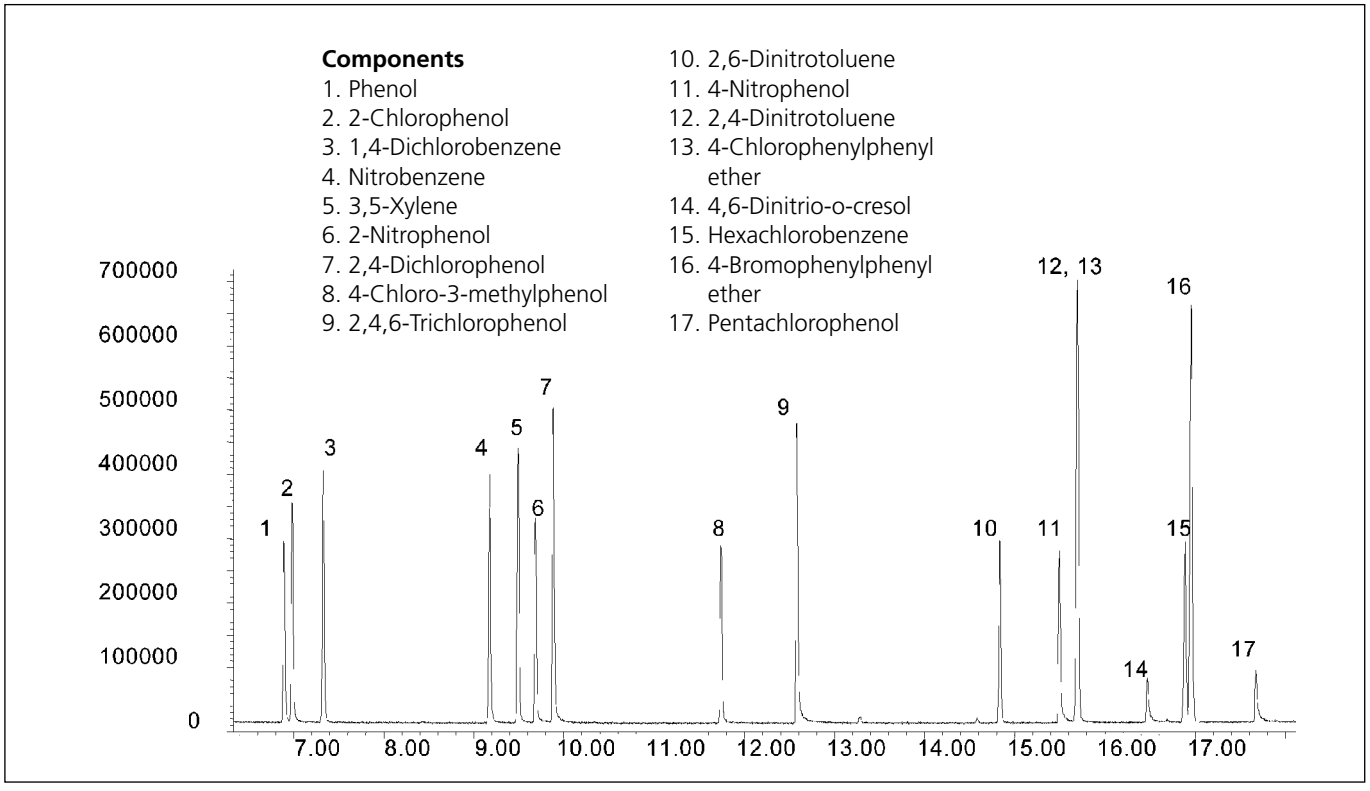
ANALYSIS OF CHLORINATED AND NITROAROMATIC COMPOUNDS ON BPX35

Column Part No.: 054701

Sample:	10 ppm in methanol
Column:	30 m x 0.25 mm ID
Initial Temp:	40 °C, 1 min.
Rate 1:	30 °C/min to 200 °C,
Rate 2:	4 °C/min to 300 °C
Final Temp:	300 °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, 40°C
Injection Mode:	Split
Split Ratio:	100:1
Injection Volume:	1 µL
Injection Temp:	250 °C
Liner Type:	4 mm ID Single Taper Liner
Liner Part No.:	092017
Full Scan/SIM:	Full scan 45 - 450



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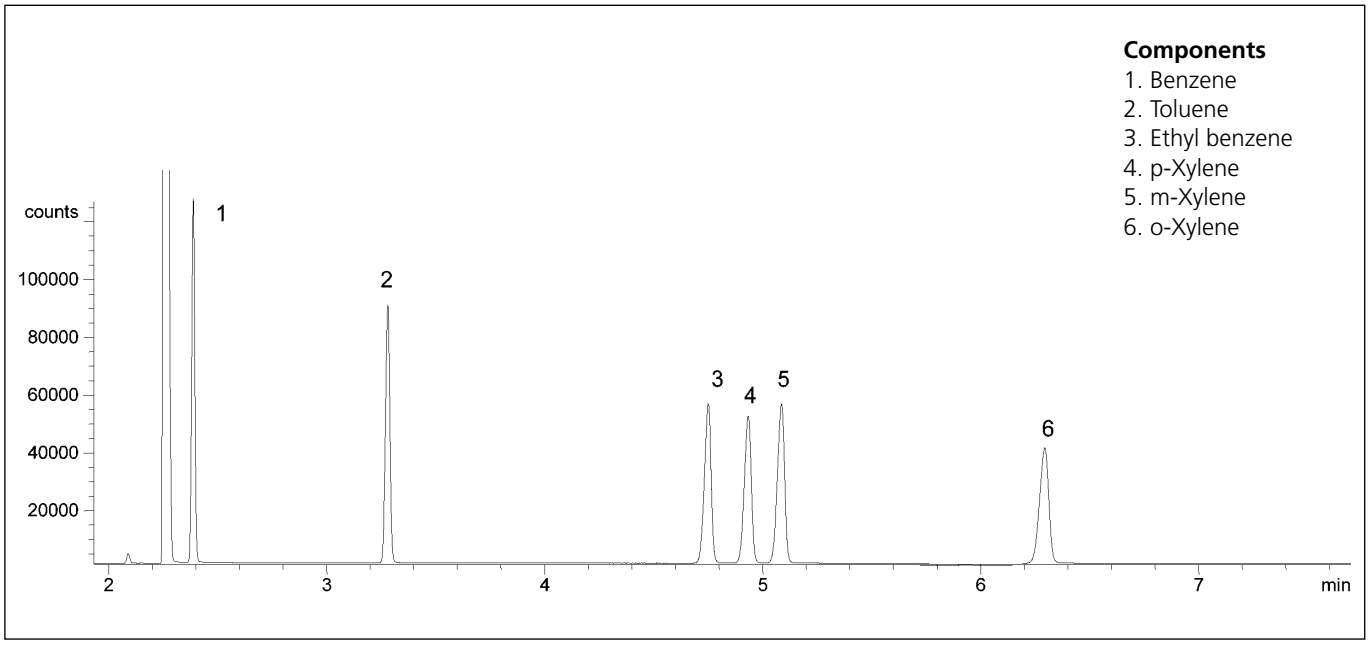
ANALYSIS OF BTEX ON SOLGEL-WAX™

Column Part No.: 054796

Phase:	Solgel Wax 0.25 µm film
BTEX:	300 ppm in methanol
Column:	30 m x 0.25 mm ID
Initial Temp:	60 °C, 10 min
Detector Type:	FID
Carrier Gas:	He, 17.3 psi
Carrier Gas Flow:	1.5 mL/min
Constant Flow:	On
Average Linear Velocity:	35 cm/sec, 60 °C
Injection Mode:	Split
Split Ratio:	100:1
Injection Volume:	0.2 µL
Injection Temp:	250 °C
Liner Type:	4 mm ID Double Taper Line
Liner Part Number:	092018



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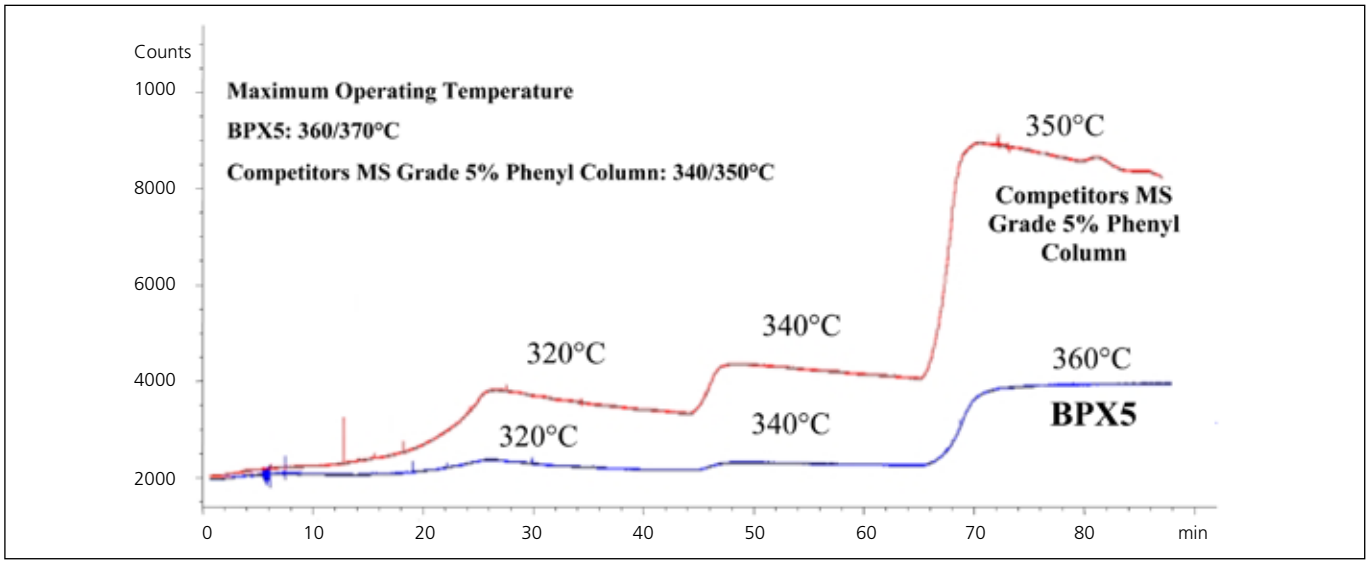
BLEED PROFILE COMPARISON OF BPX5 WITH COMPETITORS MS GRADE 5% PHENYL COLUMN

Column Part No.:	**054101**
Phase:	BPX5, 0.25 µm film
Sample:	NA
Column:	30 m x 0.25 mm ID
Initial Temp:	40 °C, 0 min.
Rate 1:	10 °C/min to 320 °C, 20 min
Rate 2:	10 °C/min to 340 °C, 20 min
Rate 3:	10 °C/min to 360 °C,
Final Temp.:	360 °C, 20 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
Liner Type:	4 mm ID Single Taper Liner
Liner Part Number:	092017
Full Scan / SIM:	Full scan 45-450

Column Part No.:	**NA**
Phase:	Competitors MS grade 5% Phenyl Column, 0.25 µm film
Sample:	NA
Column:	30 m x 0.25 mm ID
Initial Temp:	40 °C, 0 min.
Rate 1:	10 °C/min to 320 °C, 20 min
Rate 2:	10 °C/min to 340 °C, 20 min
Rate 3:	10 °C/min to 350 °C,
Final Temp.:	350 °C, 20 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
Liner Type:	4 mm ID Single Taper Liner
Liner Part Number:	092017
Full Scan / SIM:	Full scan 45-450



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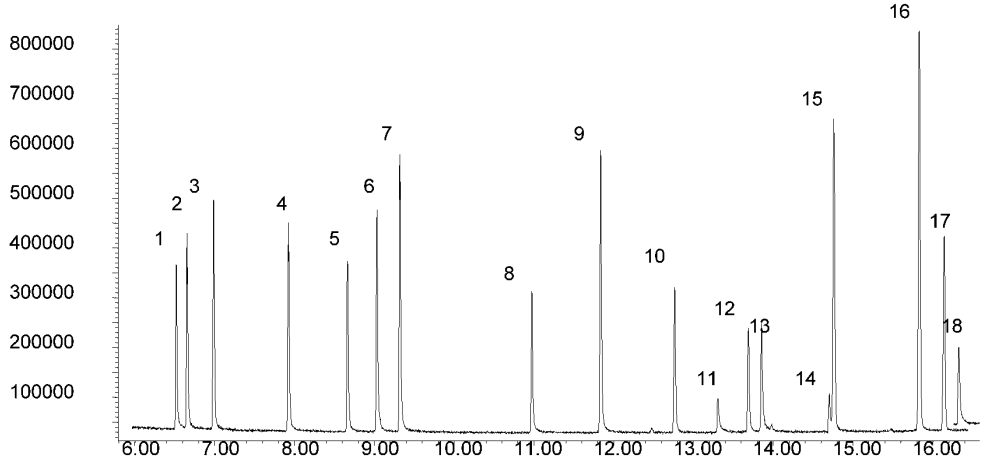
ANALYSIS OF CHLORINATED AND NITROAROMATIC COMPOUNDS ON SOLGEL-1MS™

Column Part No.:	**054462**	Constant Flow:	On
Phase:	SolGel-1ms 0.25 µm film	Average	
Sample:	200 ppm in dichloromethane	Linear Velocity:	35 cm/sec, 40 °C
Column:	30 m x 0.25 mm ID	Injection Mode:	Split
Initial Temp:	40 °C, 1 min.	Split Ratio:	100 : 1
Rate 1:	10 °C/min to 300 °C	Injection Volume:	0.5 µL
Final Temp:	300 °C, 2 min.	Injection Tem:	250 °C
Detector Type:	MSD	Liner Type:	4 mm ID Single Taper Liner
Carrier Gas:	He, 25.7 psi	Liner Part No.:	092017
Carrier Gas Flow:	1.8 mL/min.	Full Scan / SIM:	Full scan 45-450



Components

1. Phenol
2. o-Chlorophenol
3. p-Dichlorobenzene
4. Nitrobenzene
5. o-Nitrophenol
6. 2,4-Xylenol
7. 2,4-Dichlorophenol
8. 4-Chloro-3-methylphenol
9. 2,4,6-Trichlorophenol
10. 2,6-Dinitrotoluene
11. 2,4-Dinitrophenol
12. 2,4-Dinitrotoluene
13. 4-Nitrophenol
14. 4,6-Dinitro-o-cresol
15. 4-Chlorophenyl phenyl ether
16. 4-Bromophenyl phenyl ether
17. Hexachlorobenzene
18. Pentachlorophenol

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APPLICATION NOTE

The Separation of Aromatics from Olefins in Petroleum Samples using *forte* BPX90

Dr Paul Wynne, SGE Analytical Science

Introduction

Regardless of the method used for sample preparation, the separation of aromatic and aliphatic components during the analysis of petroleum and related products remains an important application for gas chromatography. SGE's BPX90 GC capillary column is a highly polar phase that offers unique selectivity and the opportunity to speciate petroleum based products on the basis of degree of unsaturation.

While the aromatic content of petroleum products is important to their function, the aromatic components are of particular concern because they pose a toxicological threat and so are legitimate targets in many gas chromatographic applications. Successful speciation of aromatic and saturate groups is made difficult because of the need to use columns with sufficient polarity that separation is not based only on boiling point (vapor pressure) but that also have sufficient thermal stability to allow the elution of higher boiling hydrocarbons.

Experimental Conditions

A petroleum sample for analysis was obtained for analysis from a domestic automotive fuel supply. Gas chromatography-mass spectrometry analysis was performed using an Agilent 6890 GC - 5973 MSD (Palo Alta, CA, USA) fitted with a BPX90 capillary column (30 m x 0.25 mm ID, film thickness 250 micron, P/N 054580), a No-Vent II (SGE International) and an ETP 14616 electron multiplier (Sydney, Australia). The column temperature settings were 40°C for 5 min then the GC oven was heated at 30°C/min to 230°C with a final holding time of 5 minutes. Injector and detector temperatures were at 240°C and 230°C, respectively. Cold-needle injection of 0.3°µl of sample was split at the rate of 60:1 with a nominal pressure pulse of 25.7 psi to give a helium flowrate of 1.8 ml/min in constant flowrate mode. Electron Impact (EI)-MS was conducted under standard conditions using an unskewed automatic tune over the range of 45 to 450 Da with a data acquisition rate of 2 s/scan.

Results

Analysis of the petroleum sample on BPX90 allowed the elution of hydrocarbons up to C10 before benzene and other aromatics (see Figure 1). Mechanistically, the BPX90 has negligible non-polar characteristics and so saturates are eluted on the basis of their vapor pressure only. The comparatively strong retention of the aromatics is evidence of a very strong π-bonding phase that is generally useful for the speciation of compounds containing isolated double and triple bonds. Unlike the PEG phases in which the n-bonding moieties are fixed to the phase backbone, the BPX90 has mobile isolated π-bonding functional groups that do not provide complete resolution of the meta- and para-xylenes. However, this characteristic of the phase separation on the basis of π-density in sterically hindered fused ring systems that are not well resolved on alternative phases.

Conclusion

The BPX90 column is effective at separating aliphatic and aromatic components in petroleum based products. A maximum operating temperature of 280°C and the selectivity of the phase towards aromatic species is attributable to the very high π-bonding capacity of the phase that allows retention of suitable analytes in the absence of a significant non-polar capacity.

The very high selectivity towards higher aromatics (naphthalenes and higher) also provide a phase with exquisite resolution that is also completely orthogonal to non-polar phases for 2-dimentional GC applications.

APPLICATION NOTE

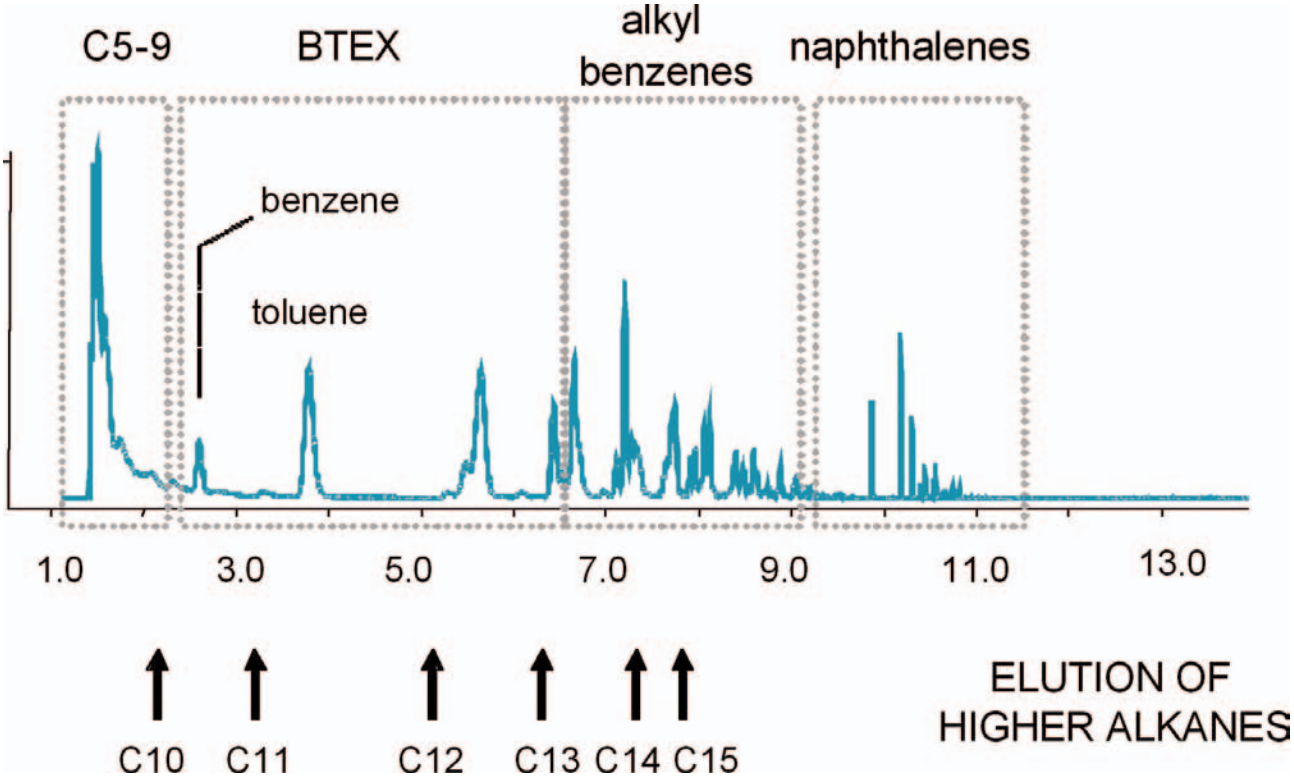

Figure 1: The separation of a petroleum sample using a BPX90 column (30m x 0.25mm, 250 micron film) showing the resolution of aromatic families and the separation from more abundant alkanes.

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