

## GC Analyses of Polynuclear Aromatic Hydrocarbons

Polynuclear aromatic hydrocarbons (PAHs) can be separated by packed column or capillary column gas chromatography. An SPB-5 bonded phase fused silica capillary column separates the 16 PAHs considered priority pollutants in wastewater by the US EPA. SP-301, a liquid crystal stationary phase in packed GC columns, resolves benzo(e)pyrene and benzo(a)pyrene. This publication discusses conditions, limitations, and standards appropriate to each analysis.

### Key Words:

- polynuclear aromatic hydrocarbons • capillary GC
- packed column GC

### Analysis by Capillary GC

Analysts using gas chromatography to monitor the 16 priority pollutant PAHs in wastewater, according to US Environmental Protection Agency (EPA) Method 610, may use either a capillary column or a packed column (1). Packed columns only partially resolve benzo(a)anthracene and chrysene, and result in the coelution of benzo(b)fluoranthene with benzo(k)fluoranthene and dibenzo(a,h)anthracene with indeno(1,2,3-cd)pyrene.

Using GC or GC/MS for PAH analyses often results in unacceptable detection limits. However, a 30 meter, 0.25mm ID SPB™-5 bonded phase capillary column improves the resolution of the 16 compounds, yielding sharp, symmetrical peaks (Figure A). (For trace level or GC/MS analyses, use splitless injections.)

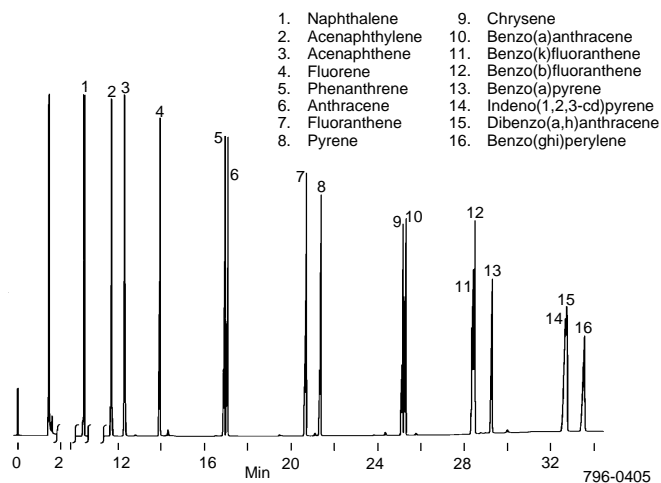
The highly stable crosslinked phase also gives SPB-5 columns a long and useful life at the high temperatures needed for PAH analyses. This column also is available in 0.53mm and 0.75mm internal diameters (Figure B). These wide bore columns can be easily installed in a packed column system.

### Analysis by Packed Column GC

A number of PAHs also can be separated on a liquid crystal stationary phase, such as Supelco's 1.5% SP™-301 on 100/120 mesh SUPELCOPORT™ support (Figure C). A glass column outperforms a stainless steel column, which provides poor resolution and asymmetric peaks.

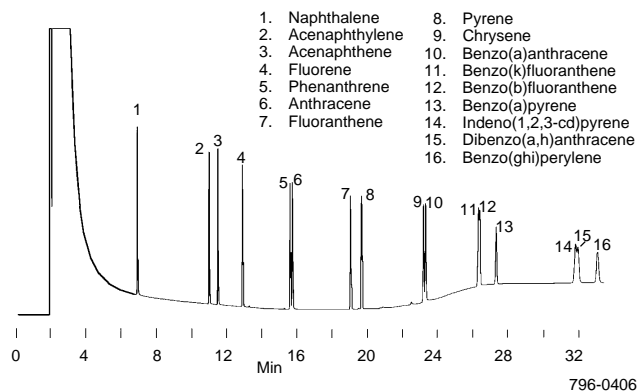
**Figure A. Symmetrical PAH Peaks Using a Fused Silica Capillary Column**

Column: SPB-5 capillary, 30m x 0.25mm ID, 0.25µm film  
 Cat. No.: 24034  
 Oven: 100°C (4 min) to 310°C at 8°C/min, hold  
 Carrier: helium, 20cm/sec, 310°C  
 Det.: FID  
 Inj.: PAHs in 0.4µL methylene chloride, approx. 4.0ng each component on-column, split 100:1



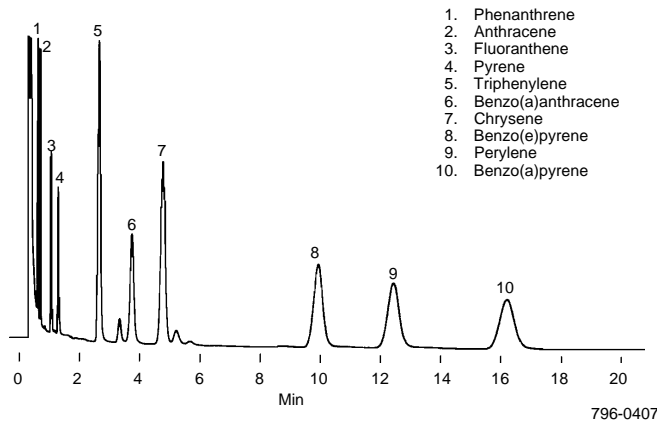
**Figure B. PAHs Using a Wide Bore Capillary Column**

Column: SPB-5 capillary, 60m x 0.75mm ID, 1.0µm film  
 Cat. No.: 23721  
 Oven: 100°C (1 min) to 300°C at 8°C/min, hold 15 min  
 Carrier: helium, 1mL/min  
 Det.: FID  
 Inj.: 1.0µL benzene containing 40ng each component



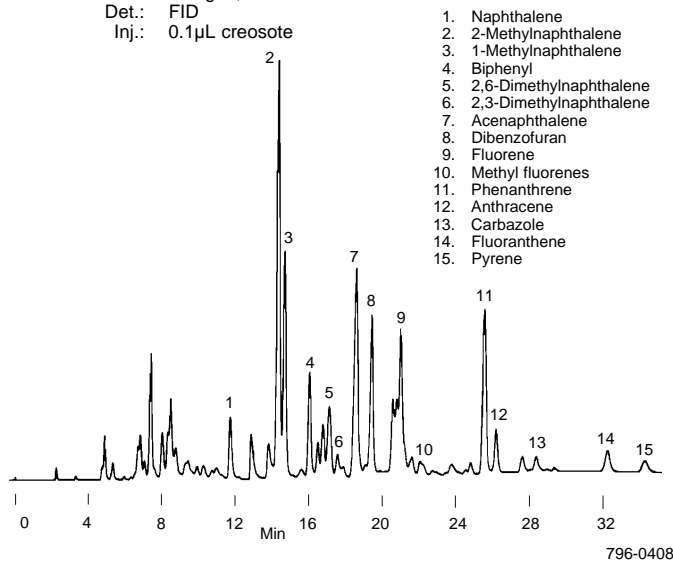
## Figure C. PAHs Using a Liquid Crystal Phase GC Column

Packing: **1.5% SP-301 on 100/120 SUPELCOPORT**  
 Column: 6' x 2mm ID glass  
 Oven: 270°C  
 Carrier: nitrogen, 20mL/min  
 Det.: FID, 270°C  
 Inj.: 0.5µL of Cat. No. 4-9155 (0.25µg/mL each component), 260°C



## Figure D. Creosote Using a Liquid Crystal/Silicone Mixed Phase Column

Packing: **1.5% SP-2100/1% BMBT on 100/120 SUPELCOPORT**  
 Column: 10' x 1/8" stainless steel  
 Oven: 85°C to 225°C at 6°C/min  
 Carrier: nitrogen, 20mL/min  
 Det.: FID  
 Inj.: 0.1µL creosote



Liquid crystal/silicone stationary phases can enhance the separation of PAHs from other hydrocarbons. A mixed phase, 5% SP-2100/1% BMBT on 100/120 SUPELCOPORT, is used to determine phenanthrene, anthracene, and carbazole levels in creosote (Figure D). A stainless steel column is adequate for this analysis.

## PAH Standards

TCL Polynuclear Aromatic Hydrocarbons Mix (Cat. No. 4-8905) is designed for capillary GC/MS analysis of semivolatile priority pollutants. TCL standards are specifically formulated for Superfund protocols issued by the US EPA.

EPA 610 Polynuclear Aromatic Hydrocarbons Mixture (Cat. No. 4-8743) contains the 16 priority pollutant PAHs in methanol:methylene chloride (50:50). The concentrations are varied to provide reasonably uniform peak heights with fluorescence detection, the detection means recommended for HPLC analyses in EPA Method 610.

Other standards include PAH Kit 610-S (Cat. No. 4-8755), which consists of individual solutions of each of the 16 priority pollutants, and PAH Kit 610-N (Cat. No. 4-7351) which consists of individually packaged neat compounds.

## Ordering Information:

### SPB-5 Bonded Phase Capillary Columns

With fittings for 1/16" OD stainless steel tubing.

30m x 0.25mm ID, 0.25µm film	<b>24034</b>
30m x 0.32mm ID, 0.25µm film	<b>24048</b>
15m x 0.53mm ID, 0.50µm film	<b>25316</b>
30m x 0.53mm ID, 0.50µm film	<b>25317</b>
60m x 0.75mm ID, 1.0µm film	<b>23721</b>

### Custom-Made Packed GC Columns

We will fill stainless steel columns with these liquid crystal phase packings. However, we strongly recommend glass columns.

6' x 2mm ID glass column, 1.5% or 2.5% SP-301 on 100/120 SUPELCOPORT	<b>custom</b>
10' x 2mm ID glass column, 5% SP-2100/1% BMBT on 100/120 SUPELCOPORT	<b>custom</b>
10' x 1/8" OD stainless steel column, 5% SP-2100/1% BMBT on 100/120 SUPELCOPORT	<b>custom</b>

For coiling information, prices, and information about columns with other lengths or diameters, refer to the Custom Made Columns Table in our latest catalog.

### Reference

1. Federal Register, **44**: 233 (Dec. 3, 1979).  
Reference not available from Supelco.

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Fused silica columns manufactured under HP US Pat. No. 4,293,415.

Contact our Technical Service Department (phone 800-359-3041 or 814-359-3041, FAX 814-359-5468) for expert answers to your questions.

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For more information, or current prices, contact your nearest Supelco subsidiary listed below. To obtain further contact information, visit our website ([www.sigma-aldrich.com](http://www.sigma-aldrich.com)), see the Supelco catalog, or contact Supelco, Bellefonte, PA 16823-0048 USA.

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