

Fast Analysis of Polycyclic Aromatic Hydrocarbons (PAHs) for Food and Environmental Samples



Faizy Ahmed, Maureen J Joseph, and John W Henderson Jr.
Agilent Technologies, 2850 Centerville Rd., Wilmington DE 19808 USA

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Baltimore, MD

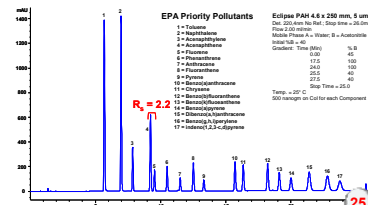
Abstract

The measurement of PAHs represents an important assay in environmental and food analysis. Methods continue to change for both types of analyses. Different PAHs are analyzed for food than for water and soil samples. Regardless of whether the analysis is for food or for water/soil there is a desire to speed up these analyses while maintaining high resolution. For food analyses a screening method for 6 PAHs is important to knowing whether a complete analysis needs to be done. Completing this screening quickly determines how detailed an analysis must follow. With a new sub-2-micron PAH column this screening can be done in less than 2 minutes and the follow-up analysis done in 12 minutes. For environmental separations, regulations require more and more PAHs to be monitored. Sub-2-micron columns can be used to complete faster analyses – down to 5 minutes for 16 PAHs – or to add resolution to more complicated analyses – 24 PAHs in 13 minutes.

This presentation shows examples mentioned for food and environmental analyses as well as compare the results with 3.5 and 5 micron particle size columns.

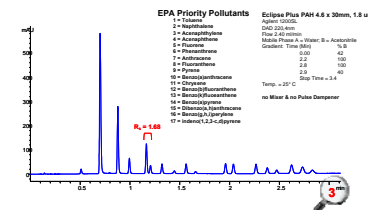
Conventional Methods: "Slow"

Eclipse Plus PAH 4.6 x 250 mm, 5 µm – Typical analysis time for 250 mm column, but Resolution ≥ 2.0 for all peaks



RRHT Methods: "Fast" Analysis

Eclipse Plus PAH 4.6 x 30 mm, 1.8 µm – Fast analysis time, but Resolution ≥ 1.9 for all peaks



Column Dimension Choices for Time, Resolution

Column Description	Size	Part Number	Analysis Time	Rs
1 Analytical	4.6 x 250mm, 5µm	95990-918	25 min	2.0
2 Analytical	4.6 x 150mm, 3µm	95993-918	20 min	2.0
3 Analytical	4.6 x 100mm, 3µm	95994-918	15 min	2.0
4 Rapid Resolution	4.6 x 150mm, 3.5µm	95983-918	19 min	2.6
5 Rapid Resolution	4.6 x 100mm, 3.5µm	95981-918	14 min	2.4
6 Rapid Resolution	4.6 x 50mm, 3.5µm	95943-918	11 min	2.6
7 Rapid Resolution HT	4.6 x 100mm, 1.8µm	95984-918	16 min	3.6
8 Rapid Resolution HT	4.6 x 50mm, 1.8µm	95941-918	9 min	2.9
9 Rapid Resolution HT	4.6 x 30mm, 1.8µm	95931-918	2 min	1.7
10 Solvent Saver	3.0 x 250mm, 5µm	95990-918	27 min	2.1
11 Narrow Bore	2.1 x 250mm, 5µm	95979-918	21 min	2.6
12 Narrow Bore	2.1 x 150mm, 5µm	95973-918	25 min	2.5
13 Narrow Bore RR	2.1 x 100mm, 3.5µm	95973-918	16 min	2.2
14 Narrow Bore RRHT	2.1 x 100mm, 1.8µm	95974-918	16 min	3.6
15 Narrow Bore RRHT	2.1 x 50mm, 1.8µm	95974-918	7 min	2.1
16 Guard Cartridges, 4pk	4.6 x 12.5, 5µm	92990-939	n/a	n/a
17 Guard Cartridges, 4pk	2.1 x 12.5, 5µm	92125-939	n/a	n/a

> Max resolution with 100mm, 1.8µm – but would have max pressure as well – above 400 bar.
> For max resolution below 400 bar – choose 4.6 x 150mm, 3.5µm
> For shortest time choose 4.6 x 30mm, 1.8µm – pressure below 400 bar
> For screening choose 4.6 x 30mm, 1.8µm – pressure only 150 bar and 2 minutes
> Choose 3.0 mm ID columns for 50% solvent savings and reduced costs.

Sub-Two Micron Essentials

Sub 2-micron particles deliver efficiency and productivity

This is the basic premise from which we operate.

$$R_s = \frac{\sqrt{N}}{4} \cdot (\alpha - 1) \cdot \frac{k'}{k' + 1}$$

To Maintain R_s :
e.g.: $L/2 \rightarrow \sqrt{L}/2$

Column Length = \downarrow N
Particle Size = \uparrow N

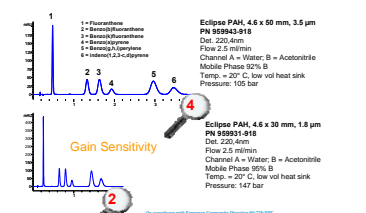
Sub 2-Micron Columns Provide the Efficiency of Longer Columns for More Productivity

Column Length (mm)	Resolving Power (N _{0.5})	Resolving Power (N _{1.5})	Resolving Power (N _{1.8})	Typical Pressure Bar (1.8 µm)	Analysis Time*
150	12,500	21,000	32,500	550	
100	8,500	14,000	24,000	420	-33%
75	6000	10,500	17,000	320	-50%
50	4,200	7,000	12,000	210	-67%
30	N.A.	4,200	6,500	126	-80%
15	N.A.	2,100	2,500	55	-90%

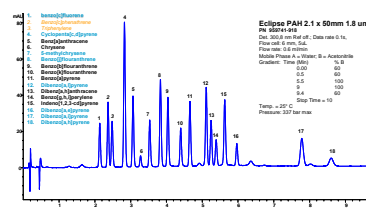
* Reduction in analysis time compared to 150 mm column at 150 mm columnar flow
* pressure determined with 90:10 MeOH/water, 1ml/min, 4.5mm ID

Fast Analysis- Food PAHs

Rapid Resolution PAH Screening Columns for Drinking Water

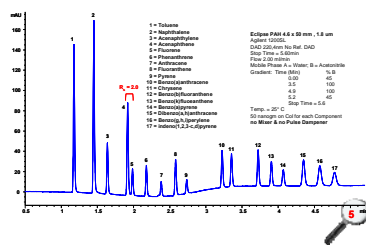


European Union's SCF and JECFA "15+1" with two additional PAHs

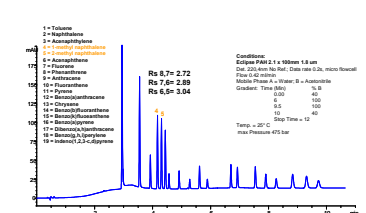


Fast Analysis-Environmental PAHs

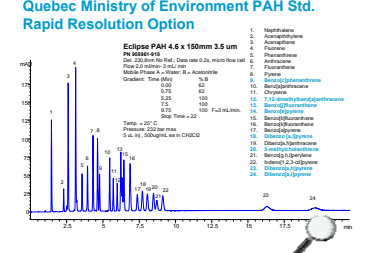
EPA Priority Pollutants



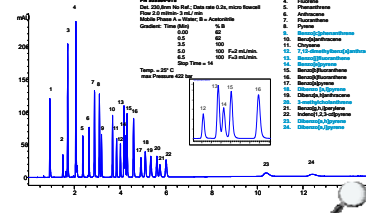
PAH Analysis for Florida Administrative Code 17.700



Quebec Ministry of Environment PAH Std. Rapid Resolution Option

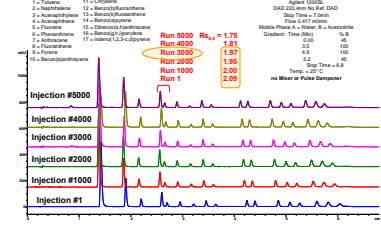


Quebec Ministry of Environment PAH Std. Rapid Resolution HT Option

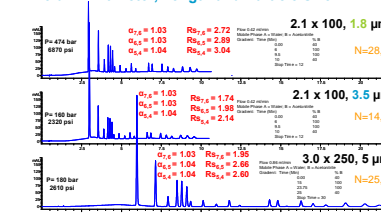


Column Performance

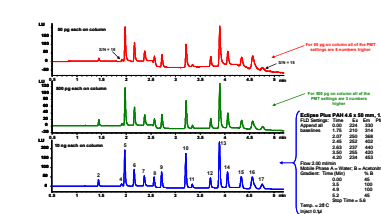
Column Life of Eclipse Plus PAH 2.1 x50 mm, 1.8 µm



Eclipse Plus PAH Column Scalability across Column Diameter, Length and Particle Size



Eclipse Plus PAH Sensitivity of FLD detection $s/N \geq 10$



Conclusion

- Selectivity of Eclipse PAH columns generated high resolution methods for the 16 EPA priority pollutants, the critical pair having $R_s \geq 1.9$ or greater.
- Eclipse PAH columns have long life, and are scalable across column geometries (diameters, lengths and particle sizes), indicating batch to batch reproducibility and robustness
- Eclipse PAH columns are available as RRHT (1.8 µm) and Rapid Resolution (3.5µm) columns for maximum productivity (highest resolution / shortest run times) and conventional 5 µm sizes for high resolution routine or replacement methods
- Eclipse PAH columns with simple water / acetonitrile gradients can separate a wide variety of PAH mixtures- not just the 16 EPA priority pollutants