

# Analysis of Polynuclear Aromatic Hydrocarbons (PAHs) in Wastewater by GC/MS

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## Key Words

- US EPA 610
- US EPA 8100
- Polynuclear aromatic hydrocarbons
- PAH's
- waste water
- TG-5SiIMS
- 5% Phenyl

## Introduction

US EPA method 610 is an analytical GC/MS method used for determining a range of polynuclear aromatic hydrocarbons (PAHs) in municipal and industrial wastewater. This method was developed by the US Environmental Protection Agency to monitor industrial and municipal discharges under 40 CFR 136.1.

EPA method 610 was performed using a splitless injection mode on a Thermo Scientific TRACE GC coupled to a Thermo Scientific Ion Trap mass spectrometer.

The Thermo Scientific TraceGOLD TG-5SiIMS column provides excellent performance for the analysis of PAHs, in accordance with EPA method 610. It can also be used for the analysis of PAHs for EPA method 8100.

## Goal

To demonstrate the suitability and performance of TraceGOLD™ TG-5SiIMS for the analysis of EPA method 610; PAHs in wastewater.

## Experimental details

The PAHs stated in the EPA method 610 were run on a TRACE™ GC fitted with a TriPlus autosampler. The Ion trap mass spectrometer was used in a segmented mode to allow precise control of groups of ions for improved ion statistics and ion ratios. The column used for analysis of the series of PAHs was a low polarity silarylene phase, with selectivity comparable to a 5% diphenyl/95% dimethyl polysiloxane phase. The data was acquired and processed using Thermo Scientific Xcalibur data handling software.

## Sample preparation

A pre-mixed 1 ng/μL of PAHs standard solution prepared in dichloromethane and benzene was used for the analysis.

Column	Part Number
TraceGOLD TG-5SiIMS, 30 m × 0.25 mm × 0.25 μm,	26096-1420
Guard Column 2 m × 0.32 mm	260RG497
Press-Fit Union	64000-001



## Thermo Scientific TriPlus Autosampler

Sample volume	1 μL
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## TRACE GC Ultra

Oven Program	60 °C (5 min), 8 °C/min, 300 °C (10 min)
Equilibration Time	0.5 min
Injector	275 °C, Splitless (1 min)
Split Flow	30 mL/min
Column Flow	Helium, 1.5 mL/min (constant flow)
Transfer Line Temperature	300 °C

## Thermo Scientific Ion Trap MS

MS Type	ITD 230LT (250 L turbo pump)
MS Source Temperature	225 °C
MS Source Current	250 μA
Electron Energy	70 eV
Filament Delay	5 min
MS Acquisition Mode	El+, 45-450 amu Segmented Scan

## Consumables

Consumables	Part Number
BTO 17 mm septa	31303211
3 mm ID Focus Liner, 105 mm long	45350032
Liner graphite seal	29033406
10 μL, 80 mm Syringe	36502019
Graphite ferrules to fit 0.32 mm id columns	29053487
Graphite/vespel 0.25 mm ID ferrules for GC/MS interface	29033496
2 mL clear vial and Si/PTFE seal	60180-599

## Results

The requirements for the EPA method 610 were achieved with separation of all of the sixteen PAHs using the TraceGOLD TG-5SiMS on a GC/MS system. The stationary phase in the TraceGOLD TG-5SiMS provides excellent performance due to minimal interaction of active compounds with active sites on the column, therefore no significant peak tailing was observed. The excellent separation achieved using this column makes it applicable to the analysis of EPA method 8100. Figure 1 shows the TIC chromatogram for a 1 ng/μL of PAHs in a mixture of dichloromethane and benzene obtained using a TraceGOLD TG-5SiMS column. Table 1 shows the peak identification of compounds according to the retention times on a TraceGOLD TG-5SiMS.

## Conclusions

The TraceGOLD TG-5SiMS column demonstrated excellent performance for the analysis of PAHs displaying

excellent selectivity. The chromatogram illustrates the superior performance of the TraceGOLD TG-5SiMS for the analysis of PAHs in accordance with EPA methods 610 and 8100.

## References

1. EPA method 610:  
[www.epa.gov/waterscience/methods/method/organics/610.pdf](http://www.epa.gov/waterscience/methods/method/organics/610.pdf)
2. EPA method 8100:  
[www.epa.gov/osw/hazard/testmethods/sw846/pdfs/8100.pdf](http://www.epa.gov/osw/hazard/testmethods/sw846/pdfs/8100.pdf)

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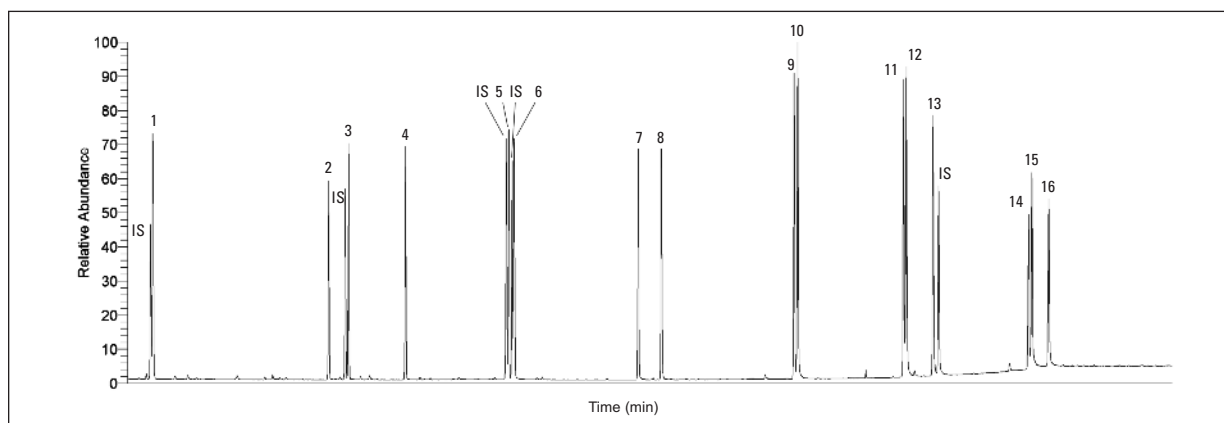


Figure 1: TIC chromatogram of 1 ng/μL of PAHs separated on a TG-5SiMS column

PAHs	Peak No.	PAH	Peak No.
Internal Standard	IS	Pyrene	8
Naphthalene	1	Benz(a)anthracene	9
Acenaphthylene	2	Chrysene	10
Internal Standard	IS	Benzo(b)fluoranthene	11
Acenaphthene	3	Benzo(k)fluoranthene	12
Fluorene	4	Benzo(a)pyrene	13
Internal Standard	IS	Internal Standard	IS
Phenanthrene	5	Indeno(1,2,3-cd)pyrene	14
Internal Standard	IS	Dibenz(a,h)anthracene	15
Anthracene	6	Benzo(g,h,i)perylene	16
Fluoranthene	7		

Table 1: List of Polynuclear Aromatic Hydrocarbons (PAHs) compounds according to retention times

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