

# Analysis of Organophosphorus Compounds by GC/MS

Paul Wheeler, Rob Bunn, Tony Edge, Thermo Fisher Scientific, Runcorn, Cheshire, UK

## Key Words

- US EPA Method 8141B
- Organophosphorus compounds
- Organic pollutants TG-5SiIMS
- 5% Phenyl

## Introduction

US EPA 8141B is an analytical method used for the determination of organophosphorus compounds using appropriate extraction techniques from aqueous and solid samples using gas chromatographic separation.

US EPA method 8141B is usually performed using NPD or FPD detection but adequate sensitivity can also be achieved using mass selective detection. This analysis will fulfil the analysis parameters for the organophosphorus pesticides listed and was performed using a Thermo Scientific TRACE GC in splitless injection mode coupled to a Thermo Scientific Ion Trap Mass Spectrometer. The Thermo Scientific TraceGOLD TG-5SiIMS column fulfils the requirement of the US EPA method 8141B providing excellent performance for the analysis of the listed organophosphorus pesticides.

## Goal

To demonstrate the suitability and selective performance of the TraceGOLD™ TG-5SiIMS for analysis when using US EPA method 8141B.

## Experimental details

A standard mix of organophosphorus pesticides representative of those listed in the US EPA method 8141B were run on a TRACE™ GC fitted with a TriPlus autosampler. An ion trap mass spectrometer was used in a segmented mode to allow precise control of ion groups for improved ion statistics and ratios. The column used for analysis of the organophosphorus pesticides standard mixture, was a low polarity silarylene phase with selectivity similar to a 5% diphenyl/95% dimethyl polysiloxane phase. The data was acquired and processed using the Thermo Scientific Xcalibur data handling software.

### Sample preparation

A pre-mixed 1ng/μL organophosphorus pesticides standard solution 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 US EPA method 8141B covers the determination of organophosphorus pesticides and requires a column with the selectivity to separate the listed compounds. The most common problem for the analyst using this method is that of co-elution with untargeted organophosphorus compounds offering the principal interferences. The detection system chosen must be sensitive to phosphorus bearing organic compounds and in this case a mass selective detector was used. The separation and identification of the organophosphorus pesticides using the TraceGOLD TG-5SilMS on a GC/MS system fulfils this requirement. The stationary phase of the TraceGOLD TG-5SilMS provides excellent performance due to minimal interaction of active compounds with active sites on the column, minimising peak tailing and optimising resolution.

Figure 1 shows the TIC chromatogram for 1 ng/μL of organophosphorus pesticides obtained using a TraceGOLD TG-5SilMS column. Table 1 shows the peak

identification of the organophosphorus pesticides according to the retention times on TraceGOLD TG-5SilMS column.

## Conclusions

The TraceGOLD TG-5SilMS column demonstrated excellent performance for the analysis of organophosphorus compounds with excellent peak shape and resolution. The chromatogram illustrates the superior performance of the TraceGOLD TG-5SilMS for this analysis.

## References

1. AUS EPA 8141B

## Acknowledgement

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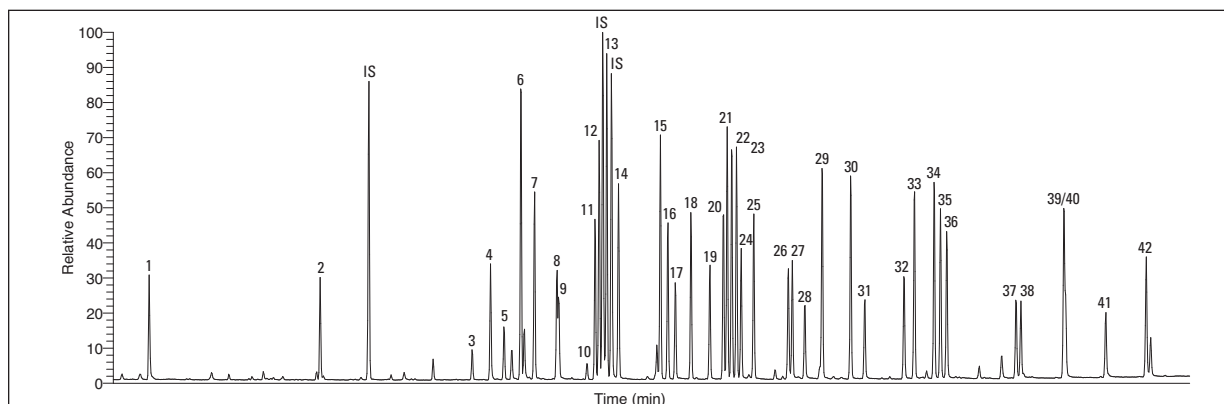


Figure 1: TIC chromatogram of 1 ng/μL of an organophosphorus compound standard mix separated on a TG-5SilMS column

Compound Name	Peak No.	Compound Name	Peak No.	Compound Name	Peak No.
Dichlorvos	1	Internal Standard	IS	Crotoxyphos	28
Mevinphos	2	Disulfoton	14	Tetrachlorvinphos	29
Internal Standard	IS	Dichlofenthion	15	Tokuthion	39
Demeton-S	3	Chlorpyrifos-metil	16	Tribuphos(DEF)	31
Ethoprop	4	Parathion-metil	17	Fensulfothion	32
Naled	5	Fenclorphos	18	Ethion	33
Sulfotep	6	Fenitrothion	19	Sulprophos	34
Phorate	7	Malathion	20	Famphur	35
Dimethoate	8	Aspon	21	Carbofenothion	36
Demeton-O	9	Chlorpyrifos-etil	22	Phosmet	37
Dioxation	10	Fenthion	23	EPN	38
Terbuphos	11	Parathion-etil	24	Leptophos	39
Fonofos	12	Trichloronate	25	Azinphos-metil	40
Internal Standard	IS	Chlorfenvinphos	26	Azinphos-etil	41
Diazinon	13	Merphos	27	Coumaphos	42

Table 1: List of Organophosphorus compounds according to retention

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