#### Application Note: ANCCSGCTOCAN

## Analysis of Total Organic Carbon by GC/MS

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#### Key Words

- Total Organic Carbon Analysis
- Organic compounds
- Organic pollutants
- TG-5SilMS
- 5% Phenyl



#### Introduction

In environmental analysis Total Organic Carbon (TOC) analysis is extensively used as a screening tool for the determination of carbon content of sediments and water samples both freshwater and marine. If the TOC count is higher than acceptable, the contaminant(s) can be identified and quantified typically using GC-MS or GC-FID.

#### Goal

To demonstrate the suitability and selective performance of the Thermo Scientific TraceGOLD TG-5SilMS for analysis of Total Organic Carbon.

#### **Experimental details**

A standard mix of TOC compounds was prepared using a number of standard mixtures relating to US EPA methods 508, 608, 610, 619, 8080, 8081, 8100, 8140 & 8141, with a total content of 95 components. These were run on a Thermo Scientific 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 TOC 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 Thermo Scientific Xcalibur data handling software.

#### Sample preparation

A 1 ng/µL TOC analysis standard solution was prepared for the analysis

Column	Part Number
TraceGOLD TG-5SiIMS, 30 m $\times$ 0.25 mm $\times$ 0.25 $\mu$ m,	26096-1420
Guard Column 2 m $\times$ 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 230 LT (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	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 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/ $\mu$ L of a TOC standard mix obtained using a TraceGOLD TG-5SilMS column. Table 1 shows the compound constituents of the amalgamated standard mixes.

Many analysts now use Total Organic Carbon (TOC) analysis for the determination of broad spectrum pesticide residue in environmental samples. Whilst TOC analysis is useful for the broad estimation of residual pesticides and other carbonaceous material, it is especially valuable when coupled to mass selective detection. Therefore allowing identification and quantification of specific contaminating materials.

#### Conclusions

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

#### References

1. US EPA methods 508, 608, 610, 619, 8080, 8081, 8100, 8140 & 8141

#### Acknowledgement

Many thanks to the dedicated team at Cromlab S.L., Barcelona, Spain for all of their help providing the data for this application.





#### ORGANOPHOSPHORUS PESTICIDES US EPA 8140, 8141, 8141A TRIAZINES US EPA 619

Parathion Ethyl Trichloronate Chlorfenvinphos Merphos Ametrvn Tetrachlorvinphos Atraton Tokuthion Atrazine Fensulfothion Prometon Ethion Prometryn Sulprofos Propazine Famphur Secbumeton Carbophenothion Simazine Phosmet Simatryn Leptophos Terbutryn Azinphos Methyl Azinphos Ethyl Coumaphos

Deisopropylatrazine Etridazole Deethylatrazine Chloroneb Deethylbutylatrazine Propachlor Trifuluralin HCH-alpha HCB Dicloran Quintozene HCH-beta HCH-gamma Chlorothalonil HCH-delta Heptachlor Terbuthylazine Aldrin Chlorpyrifos DCPA

# CHLORINATED PESTICIDES US EPA 619 US EPA 508, 608, 8080, 8081

Dicofol Isodrin Heptachlor Epoxide Captan Chlordane-gamma Endosulfan I Chlordane-alpha trans-Nonachlor 4,4-DDE Dieldrin Endrin Perthane Endosulfan II Chlorobenzilate cis-Nonachlor 4,4-DDD

### POLYAROMATIC HYDROCARBONS US EPA 610, 8100

Naphthalene Acenaphthylene Acenaphthene Fluorene Phenanthrene Anthracene Fluoranthene Pyrene Benzo(a)anthracene Chrysene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene Indeno(123cd)pyrene Dibenz(ah)anthracene Benzo(ghi)perylene

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Table 1: List of compounds

Dichlorvos (DDVP)

Mevinphos

Demeton-S

Ethoprop

Naled

Sulfotep

Phorate

Dimethoate

Demeton-O

Dioxathion

Terbufos

Diazinon

Disulfoton

Parathion Methyl

Fenchlorphos Malathion

Chlorpyrifos

Fenthion

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