



Low Level Oxygenates Analyzer

- Trace Analysis of Oxygenates
in Hydrocarbon Matrices



The determination of sub to high ppm levels of ethers, alcohols, aldehydes and ketones in different hydrocarbon matrices is a recurring challenge in the petroleum refining and petrochemical industry. The Scion Low Level Oxygenates Analyzer is an easy to use 'turnkey' solution to meet this analysis challenge.

Key Benefits include:

- **Factory optimized to ensure excellent analysis results**

The system is configured, optimized and tested at the factory to analyze oxygenated components at concentrations as low as 100 ppb in streams with a final boiling point of up to 250 °C and no interference from the hydrocarbon matrix. An optimized system for the analysis of oxygenates at trace level.

- **A powerful GC solution, yet extremely easy to operate**

The Scion GC and compassCDS Chromatography Data Handling Software, is a very powerful combination and is key to the system's ability to generate reliable results. The system can be used successfully without a high level of operator skill.

- **A flexible, economical analysis solution**

The analysis system is configured to accommodate gas, liquid and liquified petroleum gas (LPG) streams. Configured with both a gas sampling valve and a liquid sampling valve, all three samples can be injected without the need to change the system configuration.

- **A cost effective, time-saving solution**

All Scion GC analyzers not only include proven GC hardware and software but are also pre-loaded with analysis methods and documentation specific to the method required. All operational procedures are fully documented.

- **A comprehensive, single vendor solution**

The hardware, software, application optimization, documentation, installation and support services are all provided by Scion, allowing analysis to be carried out quickly and efficiently by one dependable supplier.



Figure 1: The analyzer incorporates the Scion GC

● Low Level Oxygenates Analyzer

Oxygenated compounds can be present in hydrocarbon streams for a variety of reasons. For example, methanol is added to crude oil to reduce the formation of hydrates during transportation and storage. Unfortunately, the presence of methanol in downstream operations is highly problematic.

Clean-up processes like hydro-treating are used in an attempt to remove oxygenated compounds. But even at trace levels (sub ppm), oxygenates quickly degrade or destroy expensive process catalysts, (e.g. polymer production).

Most of the standard methods for the analysis of oxygenated compounds in use today (ASTM D4815, D5599, EN 13132, DIN 1601 and DIN 51413-7) are not suitable for the analysis of oxygenates at sub ppm levels. The Low Level Oxygenates Analyzer according to ASTM D7423 has been developed to meet this low level detection requirement.

Analyzer Overview

The Low Level Oxygenates Analyzer is designed and optimized to quantify ppm and sub ppm levels of ethers (e.g. DME, MTBE, ETBE, DIPE), alcohols (e.g. methanol, ethanol, propanol), ketones (e.g. acetone, MEK) and aldehydes in various hydrocarbon matrices. In general, all oxygenated components with a boiling point of up to 100 °C can be analyzed. The sample can be a gas, LPG or liquid under ambient conditions with a final boiling point up to 250 °C.

The system is comprised of a Scion 456 GC configured with gas and liquid sampling valves, two high performance capillary analysis columns, digitally controlled pneumatics including a 'fluidic' switch and Flame Ionization Detector (FID). An optional 'pressure station' can be added to eliminate the possibility of losing sample due to evaporation when analyzing LPG.

The GC is controlled via the Compass-CDS Chromatography Data Handling Software,

which acquires data, processes it and generates analyses reports. The gas or liquid sample is injected via a gas or liquid sampling valve onto the first of two columns (BR-1). A fluidic switch is positioned between the two columns. The 'lighter' fraction (containing the oxygenates) is separated from the rest of the stream components on the BR-1 column.

The 'heavier' components are then back-flushed to vent. The fraction containing the 'lighter' components is transferred onto the second column (LOWOX) using the fluidic switch. The LOWOX column is used to separate the individual oxygenated components from the bulk hydrocarbons. The LOWOX column was specially developed in the 1990s for the trace analysis of oxygenates in hydrocarbon streams. It offers unequalled selectivity for oxygenated compounds.

Due to its high selectivity, large amounts of sample can be introduced onto the LOWOX column which, through the use of the sensitive FID, enables the system to achieve the required low detection levels for oxygenated compounds.

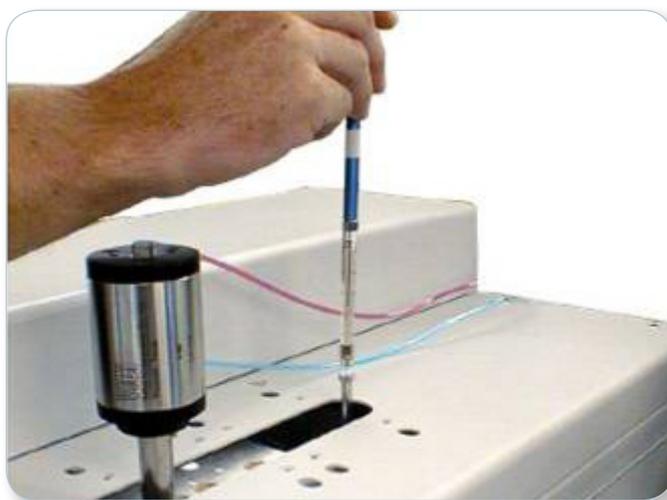


Figure 2: The analyzer includes both gas and liquid sample valves for maximum flexibility.

● Analysis of Oxygenates at sub-ppm Levels

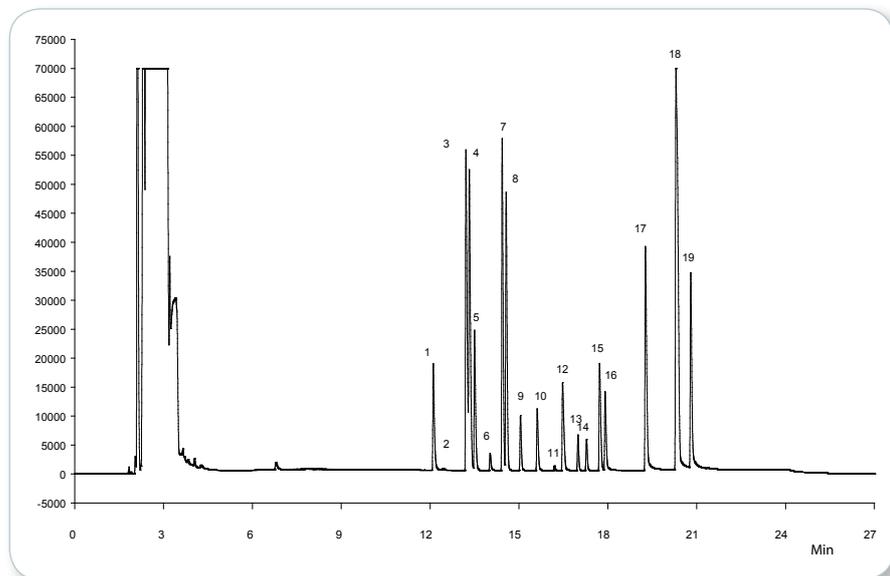


Figure 3: A typical chromatogram showing a wide range analysis of a liquid sample stream

Calibration is performed using several concentrations of a multi-component standard mixture with varying known/measured amounts of each oxygenated compound.

The system automatically generates a calibration curve for each analyte. The samples are analyzed, each of the oxygenates are automatically quantified and a report of the results is printed at the end of each analysis cycle. (Typical performance results are depicted in Table 1.)

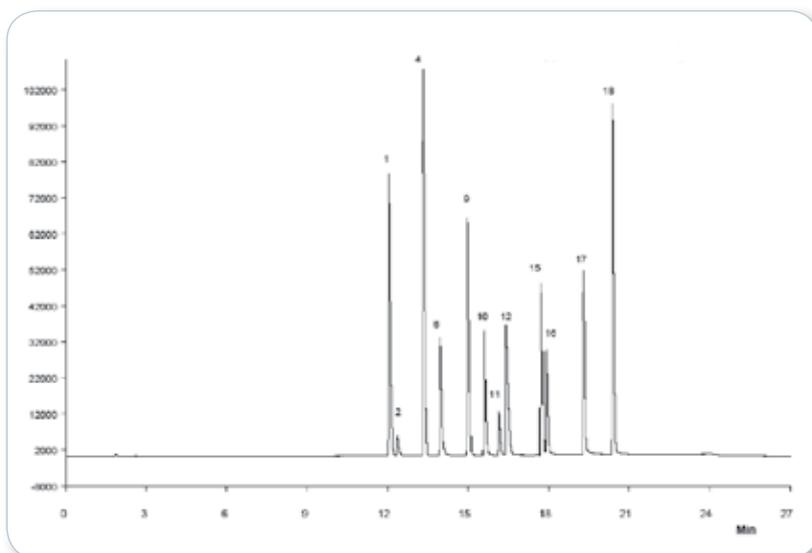


Figure 4: Typical chromatogram showing a MTBE range analysis of a gas stream.

Peak Identification

- | | |
|-----------------------------|-------------------------|
| 1. Diethylether | 11. Methanol |
| 2. Acetaldehyde | 12. Acetone |
| 3. Ethyl tert. Butyl ether | 13. Isovaleraldehyde |
| 4. Methyl pert. Butyl ether | 14. Valeraldehyde |
| 5. Diisopropylether | 15. 2-Butanone |
| 6. Propanal | 16. Ethanol |
| 7. Tert. amyl methyl ether | 17. 1-Propanol |
| 8. Propylether | 18. Tert. butanol |
| 9. Isobutyraldehyde | 19. 2-Methyl 1-propanol |
| 10. Butyraldehyde | 19.1-Butanol |

● Typical Performance

Table 1. Typical repeatability in the analysis of oxygenates in a gas stream

	ETBE	MTBE	Methanol	Aceton	MEK	Ethanol	1-Propanol
Run 1	579554	490771	59388	224339	338840	129250	224083
Run 2	578838	491908	59310	224407	339195	129779	225111
Run 3	585890	481217	60135	225063	340116	131457	227596
Run 4	579313	491673	59663	224583	339338	130075	225695
Run 5	578500	492449	59897	224743	339606	131011	227058
Run 6	577796	493989	59766	224583	339482	130628	226651
Run 7	579844	490743	59879	224593	339622	130645	226309
Run 8	580253	487207	59800	224570	339470	130874	226918
Run 9	580592	484805	59856	224539	339556	130808	226284
Run 10	578693	487272	59946	224530	339893	131131	226630
N	10	10	10	10	10	10	10
Mean	579927	489203	59764	224595	339512	130566	226234
Std. Dev.	2142.60	3775.30	238.60	187.10	334.20	637.80	975.60
RSD %	0.37	0.77	0.40	0.08	0.10	0.49	0.43

Table 2. Typical analyzer performance.

Minimum Detection Level	100 ppb/Weight
System Linearity	100 ppb to 500 ppm
Typical RSD %	For gas streams; < 2 % for MTBE, methanol and ethanol. For liquid streams; < 2.5 % for MTBE, methanol and ethanol.

Scion-Certified Consumables for Your SCION GC Series

Scion GC columns span a broad range of column diameters, stationary phases, and capillary column materials: Fused Silica (FS) and Inert Steel (IS). Ideal for either routine or research type analyses. Scion GC column offerings bridge across many important applications and include a number of offerings such as:

- Standard WCOT (Wall Coated Open Tubular)
- Solid Stationary Phase PLOT (Porous Layer Open Tubular)
- Inert Steel Micro-Packed and Packed



Super Clean™ Gas Filters

Scion Gas Purification Systems have the range to satisfy your needs from individual to combination filters, from Ultra purity combined with Ultra capacity, to all in one solution kits. Innovative features designed into the product yield extensive benefits to the user.

- Ultra-high capacity for long life, less change and improved productivity
- High-purity output ensures 99.9999% Pure Gas
- "Quick connect" fittings for easy, leak-tight filter changes
- Glass internals prevent diffusion; plastic externally for safety
- Easy-to-read indicators for planned maintenance and improved up-time



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