Global Analyser Solutions

Verified Hydrocarbon Analysis using VUV

VUV ANALYTICS

- ASTM D8369
- Highly improved DHA using VUV spectra
- Accurate and reliable identification
- Replaces multiple existing traditional DHA methods with one easy-to-use application

Get ready for ***tomorrow's analytics***

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Global Analyser Solutions

GAS offers custom configured GC analysers for many application fields for over 50 years. GAS analysers are designed to meet many standardised methods from GPA, ASTM, UOP, ISO, EN and others. The efficient configurations are based on proven GC technology, resulting in robust, highly productive instruments with an optimal return on investment.

ASTM D 8369 describes the determination of individual compounds and compound classes by percent mass or percent volume with a final boiling up to 225 °C. Typical products encountered in petroleum refining or biofuel operations, such as blend stocks; naphthas, reformates, alkylates, FCC gasoline, liquefied petroleum gas (LPG), alcohols and ethers can be analysed. Spark-ignition engine fuels including those with commonly blended oxygenates are also analysed.

The power of VUV spectra

Hydrocarbon analysis that previously required complex chromatographic separation can be simplified and shortened due to the ability to deconvolve overlapping spectral responses (figure 1). VUV absorbance spectra are typically highly structured and distinct for individual compounds, yet exhibit the intrinsic property of having similar features when measuring related compound classes, see figure 2. GC-VUV absorbance data is inherently three dimensional (time, absorbance, wavelength) and specific to the compound chemical structure.

VHA: Verified DHA

The VUV VHA component database contains up to 700 individual components; around 350 species are already spectrally verified and speciated, while another 350 can be selected and added by the user. Oxygenates methanol, ethanol, butanols, methyl t-butyl ether (MTBE), ethyl t-butyl ether (ETBE) and t-amyl methyl ether (TAME) are included as well. All other compounds are identified by carbon number based on retention index and by class type based on spectral response. The resulting verified hydrocarbon analysis therefore identifies, classifies, and reports 100 % of the spectral responses.

Compared to FID (DHA), the GC-VUV offers a more robust, more accurate, less labor-intensive and faster alternative to traditional DHA.

Straightforward instrument

GC-VUV uses easy instrumentation: Thermo Trace GC 1600 gas chromatograph, a single capillary column and VUV-VGA detector (figure 6). No traps, pre-column tuning or calibration requirements are needed. Method setup is easy, operational costs are lows and time-consuming manual data review is no longer required.

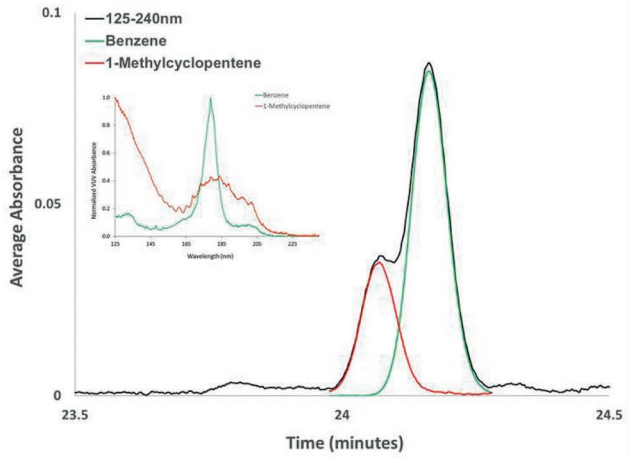

Figure 1
Example GC-VUV chromatogram of gasoline. Benzene and 1-methylcyclopentene are not well separated (black). Relative proportion of both components is displayed after deconvolution by VUV software (red/green).

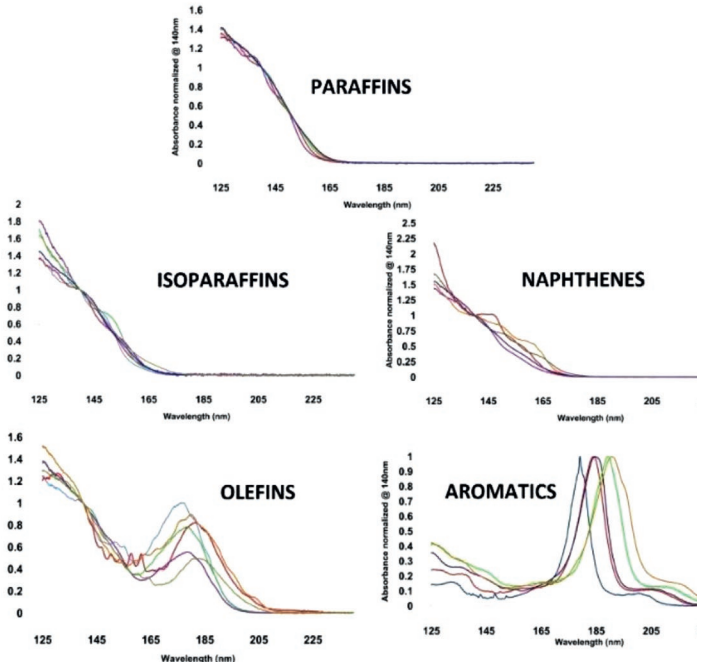

Figure 2
Distinct spectra for PIONA component classes. VUV spectra are highly stable and independent of instrument settings. Reliable identification is also offered for paraffins and iso-paraffins, which apparently have small spectral differences

Results

VHA offers DHA-level speciation with greater accuracy and less resources in a significantly shorter time. VHA uses a shorter separation column compared to classical DHA (60m instead of 100m), but offers better and more reliable component resolution thanks to the spectral information. The runtime is reduced from 3 hours to 45 minutes in this way. Figure 5 shows the resulting chromatogram with spectral filters for aromatics and saturates applied by VUV-Analyze™ software.

Figure 4 displays a part of the individual components report; the total report includes up to 700 compounds. The PIONA group type/carbon number breakdown report is shown in figure 3.

Mass %

C#	P	I	O	N	A	Oxy	Total
C1							
C2						11.6702	11.6702
C3							
C4	1.3354	0.0894	0.0642				1.4890
C5	3.0684	6.5351	3.1798	0.3239			13.1072
C6	2.2775	6.8407	2.6831	1.9381	0.8511		14.5905
C7	1.2879	5.5580	0.9570	1.9848	4.0231		13.8108
C8	0.2602	17.9417	0.6399	1.9301	5.8566		26.6286
C9	0.2909	3.6293	0.1052	0.4961	6.2967		10.8181
C10	0.2493	1.0226	0.0803	0.2538	2.8931		4.4990
C11	0.0974	0.9111	0.0086	0.2749	1.5964		2.8885
C12	0.0571	0.1328	0.0166	0.0064	0.2074		0.4202
C13	0.0173	0.0232			0.0343		0.0749
C14		0.0030					0.0030
C15							
Total	8.9416	42.6868	7.7347	7.2080	21.7587	11.6702	100.0000

Figure 3
VHA report in mass %. Mole % and volume % are also available.

Speciated Results 1 of 4

Report Name	Category	Retention Time (min)	Mass %	Volume %	Mole %	C#
Isobutane	Isoparaffin	4.1866	0.0894	0.1172	0.1330	4
Butane	Paraffin	4.4466	1.3354	1.6865	1.9873	4
trans-2-Butene	Olefin	4.5466	0.0271	0.0328	0.0418	4
cis-2-Butene	Olefin	4.6966	0.0298	0.0351	0.0460	4
Ethanol	Alcohol	5.0266	11.6702	10.8115	21.9114	2
3-Methyl-1-butene	Olefin	5.0866	0.0628	0.0732	0.0774	5
Isopentane	Isoparaffin	5.3566	6.5263	7.6991	7.8240	5
1-Pentene	Olefin	5.5966	0.1818	0.2075	0.2243	5
2-Methyl-1-butene	Olefin	5.7166	0.4465	0.5018	0.5507	5
n-Pentane	Paraffin	5.7966	3.0684	3.5817	3.6786	5
trans-2-Pentene	Olefin	5.9466	0.8403	0.9476	1.0364	5

Figure 4
Part of VHA individual components report. In total up to 700 components including oxygenates are reported. Custom components can be added by the user.

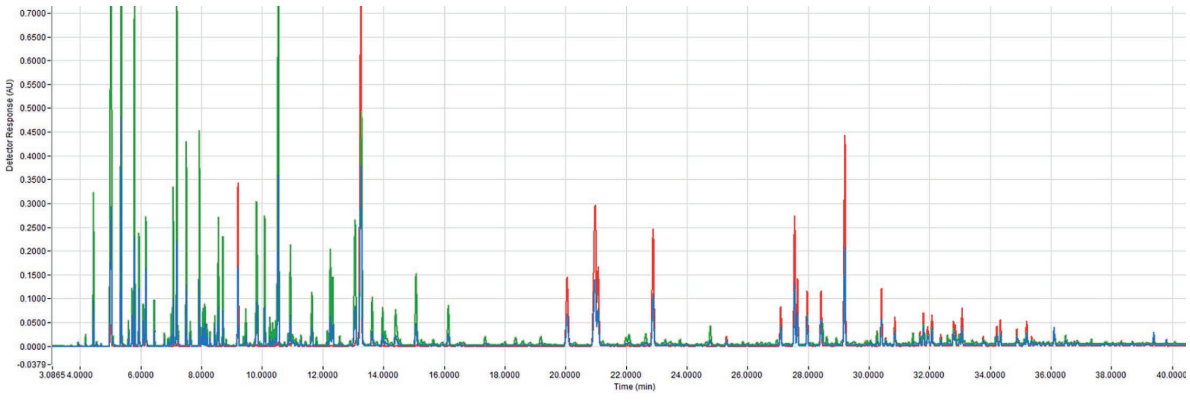

Figure 5
VHA example chromatogram by VUV-Analyze™ engine, showing spectral filters 170-200 nm (red, aromatics) and 125-160 nm (yellow, saturates). The blue graph represents the total signal. The runtime is 45 minutes.

Specification

ASTM D8369

Standardised method:	ASTM D8369
Application:	Detailed Hydrocarbon Analysis with individual component and PIONA group reporting
Component database:	Up to 700 individual components: 350 species are already spectrally verified and speciated, while another 350 can be selected and added by the user.
Analysis Time:	45 minutes
Column type:	Restek Rtx-1, 60m*0.25mm, df=0.25u
GC oven temperature program :	5 °C (4 min) - 18 °C/min - 50 (14 min) - 5.5 °C/min - 200 °C (1 min)

Figure 6 VUV Analytics VGA-100 + Thermo Trace GC 1600