GLOBAL™ ANALYSER SOLUTIONS G·A·S

Crude Oil Analyser

Simdist-DHA Merge

- Combining DHA and simulated distillation
- More accurate simulated distillation results for crude oil
- Efficient 'all in one' analyser system
- ASTM D7900, D7500, D7169

AN 234WA0219B

GAS offers custom configured GC analysers for many application fields since 40 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 instruments with an optimal return on investment.

The GAS Crude Oil analyser according to ASTM D7900 offers accurate boiling point distribution data for crude oil samples. The analyser provides improved results compared to ASTM D7500 and D7169. Results of DHA front end and high temperature Simdist are combined in one TBP (True Boiling Point) report for highly accurate results.

Figure 1. Combined Simdist DHA analyser for crude oil

Improved HT-Simdist results

Simdist methods ASTM D7169 and D7500 are widely used for characterising crude oils. These methods provide reliable boiling point distribution information, although common issues are (1) interference (quenching) of C_5-C_6 components by carbon disulfide, which is used as a solvent and (2) lack of resolution in de C_5-C_9 range, since a thin film separation column is used. Both issues can be overcome by using Simdist data from DHA (Detailed Hydrocarbon Analyser). DHA provides component details for light hydrocarbons up to C_9 (151 °C), using a high resolution separation column, and offers therefore more precise TBP data. Prevention of accumulation by heavy oil crude components of this column is necessary, and is achieved by injection using PTV (programmable temperature vaporiser) with backflush option (figure 3). Figure 4 shows that the high boiling components are effectively vented, while figure 2 shows the schematic diagram.

Figure 3. InterConnect PTV injection module with back flush option.

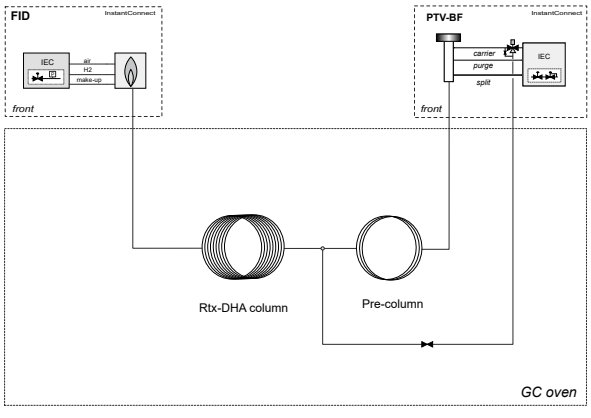


Figure 2. Diagram DHA with PTV-BF

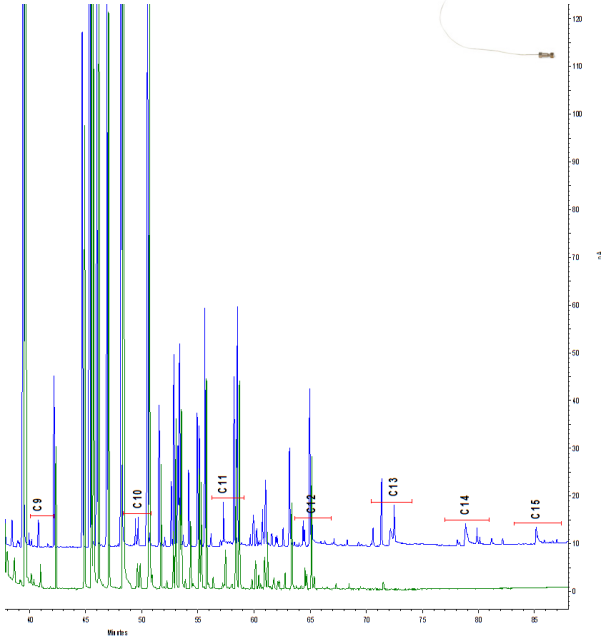


Figure 4. Chromatogram DHA.
Green: back flush used; blue: without back flush).

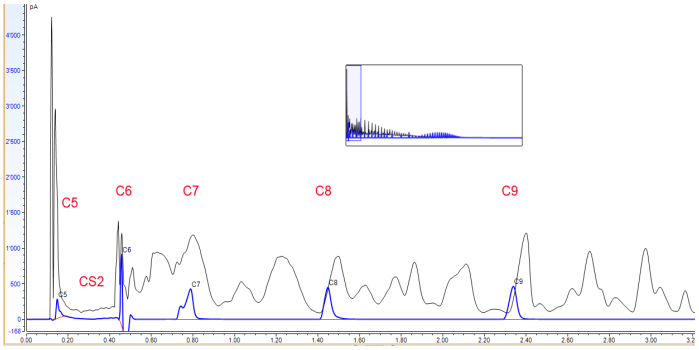


Figure 5. D7169 chromatogram, C_5-C_9 ; quenching by CS_2

%OFF	BP (°C)
0.5	-13.3
5.0	17.8
10.0	44.9
15.0	67.7
20.0	92.7
25.0	104.2
30.0	126.8

Figure 6. D7169 Simdist results

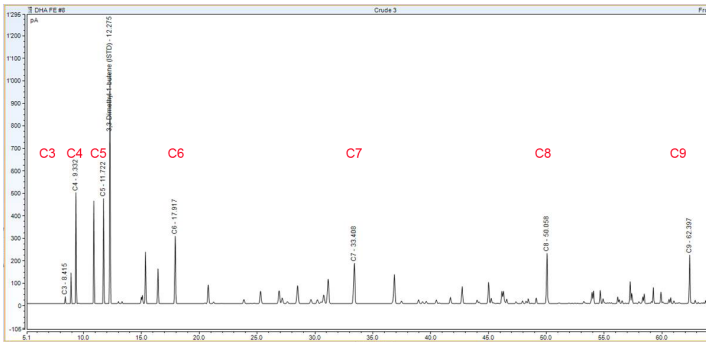


Figure 7. DHA chromatogram C_3-C_9

% OFF	BP (C)
0.5	-37
1.0	-31.5
2.0	-19.5
3.0	-7.5
4.0	14.5
5.0	28
6.0	57
7.0	60
8.0	63
9.0	64.5
10.0	66
11.0	68.5
12.0	80.5
13.0	90
14.0	91.5
15.0	92
16.0	93
17.0	94.5
18.0	97.5
19.0	99.5
20.0	109.5
21.0	115.5
22.0	118
23.0	119.5
24.0	124.5
25.0	125
26.0	131.5
27.0	137
28.0	139
29.0	145

Figure 8. DHA Simdist results

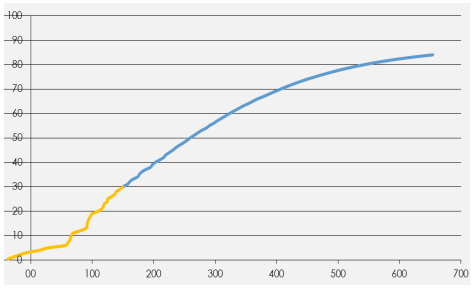


Figure 9. Simdist back end (blue curve) with corrected DHA front end (orange).

Results

In figure 5-8 the chromatograms and boiling point tables are shown of ASTM D7169 and DHA. The DHA chromatogram is not disturbed by solvent CS_2 and the used column offers strongly increased resolution for the light hydrocarbons, with more precise Simdist data as a result. Figure 9 shows D7169 boiling point curve, with DHA front end correction according to ASTM D7900.

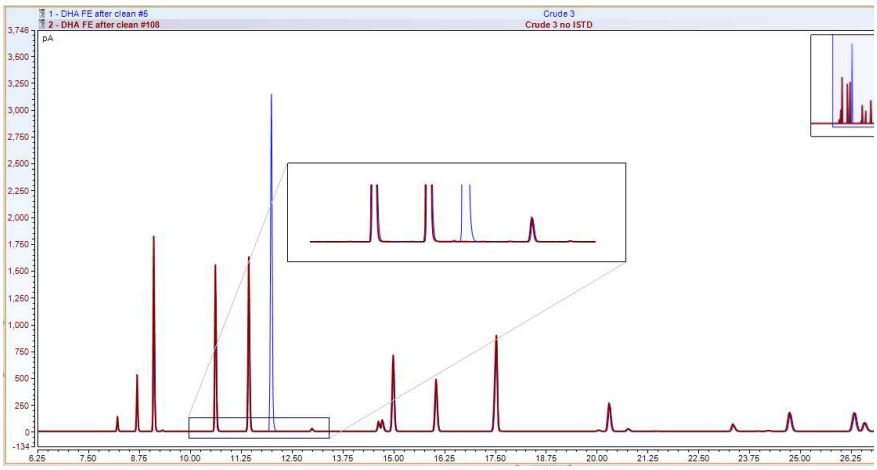


Figure 10. Added internal standard (blue graph) for DHA crude oil recovery calculation

Recovery

The whole crude oil sample does not elute on both analysers, therefore the recovery has to be determined for both methods separately based on internal standards to obtain accurate results. See figures 10 and 11.

Calculation and reporting

Figure 12 (page 4) shows the Simdist merge report. All results are provided by Chromeleon data system using integrated calculation modules for calculation of Simdist, DHA and merging. In this way export of data to external software programs is not needed, which offers very easy user operation, and errors are avoided.

See also the separate GAS application notes on DHA and Simdist for further explanation and examples.

#	FrontDetector	Name	Type	Position	Volume [µL]	Instrument Method	*Solvent Weight [gram]	*Sample Weight [gra
1		Blank	Blank	10	0.50	SIMDIST D7169	1.6000	0.2000
2		HT BP cal	Calibration Standard	11	0.50	SIMDIST D7169	1.6000	0.2000
3		CS2 blank	Blank	10	0.50	SIMDIST D7169	1.0000	0.0000
4		HT Ref	Unknown	12	0.50	SIMDIST D7169	3.3362	0.0364
5		CS2 blank	Blank	10	0.50	SIMDIST D7169	1.0000	0.0000
6		5010	Check Standard	13	0.50	SIMDIST D7169	4.0354	0.0422
7		CS2 blank	Blank	10	0.50	SIMDIST D7169	1.0000	0.0000
8		Crude 3	Unknown	14	0.50	SIMDIST D7169	4.7840	0.1366
9		CS2 blank	Blank	10	0.50	SIMDIST D7169	1.0000	0.0000

Figure 11. Simdist sample sequencing for recovery calculation based on reference standard (5010)

Specifications

Standard methods:	ASTM D7900, D7500, D7169, IP 545, IP 601, EN 115199-3
Configuration:	Thermo Trace GC1300 with PTV and FID for Simdist analysis, Thermo Trace GC1300 with PTV - Backflush and FID for DHA Triplus auto sampler (one sampler covers both GCs)
Application range:	DHA: nafta, reformate, alkylate, crude oil Simdist: crude oil
Data system:	Chromeleon
Calculations:	Customised calculation modules for DHA, Simdist and merging. Calculations are integrated in Chromeleon CDS

See the separate GAS application notes on DHA and Simdist analysers for more information

SimDist calculation pack V1.8

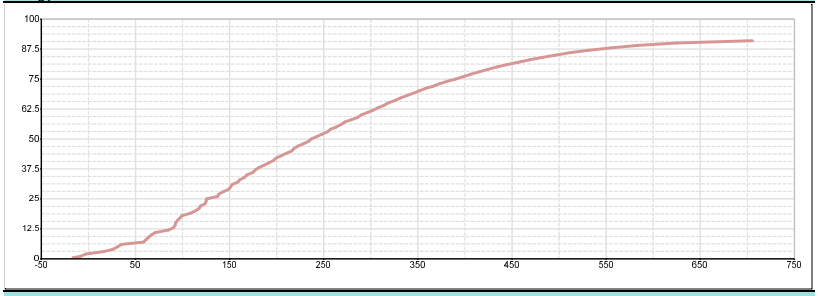
Export Report

Injection Name:	Crude 3
Vial Number:	14
Injection Type:	Unknown
Sequence:	SIMDIST D7169
Instrument Method:	SIMDIST D7169
Processing Method:	Analysis D7169
Injection Date/Time:	18/9/2018
Injection Name:	Crude 3

Used data files		**Merge corrected**	
Blank:	10: CS2 blank (18-9-2018 18:59:47)	**correction:**	**-7.5**
RT Calibration:	Average of 1 injections	**Limit**	**10**
QA / RF Standard:	Average of 1 injections		

General Results			**Integration**	
Total Chromatogram Area	4813.6		**Integration Start:**	0.020 min
Total Corrected Sample Area:	5015.5		**Integration End:**	39.642 min
Recovery	90.8	%		
Initial Boiling Point:	-16.5	°C	**Initial Elution Time:**	0.087 min
Recovery Temperature (@ 90%)	705.3	°C	**Final Elution Time:**	32.170 min

Boiling poin curve



Boiling Point Distribution Table

%OFF	BP (°C)
0.5	-16.5
5	31.0
10	67.0
20	113.5
30	151.1
40	191.4
50	236.6
60	289.9
70	351.4
80	433.8
90	624.5
90.8	705.3

G.A.S. SIMDIST Report V1.8.3/Merge

Figure 12.
Simdist/DHA Merge report

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GAS is an Interscience company