GLOBAL™ ANALYSER SOLUTIONS G·A·S

Biogas Analyser

- ASTM D1945, D1946, D6228, ISO 6974, 6975, 6976, GPA 2261, 2177, 2186, 2286
- Optional: siloxanes, terpenes, sulphur components, ammonia
- Robust, flexible

AN 228WA0320B

GAS offers custom configured GC analysers for many application fields for over 45 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.

Biogas is produced through biological processes, and its role is growing in sustainable energy production. Depending on production source, a wide range of components can be present. The main components are methane and carbon dioxide, and often hydrocarbons, permanent gases sulphur components, terpenes, siloxanes and ammonia are analysed as well. GAS offers several solutions for analysing these components.

Figure 1. Biogas analyser with external valve oven and modular injector/detector technology

Biogas analyser configurations

Biogas analysers are available in many different configurations, from single valve/detector instruments to comprehensive multi-channel analysers. The system depends on components of interest and required accuracy and analysis time. Our analysers comply with standardised methods for Natural Gas analysis like GPA (2261, 2177, 2186, 2286), ISO (6974, 6975), ASTM (D1945 and D1946, D6228)
and others.

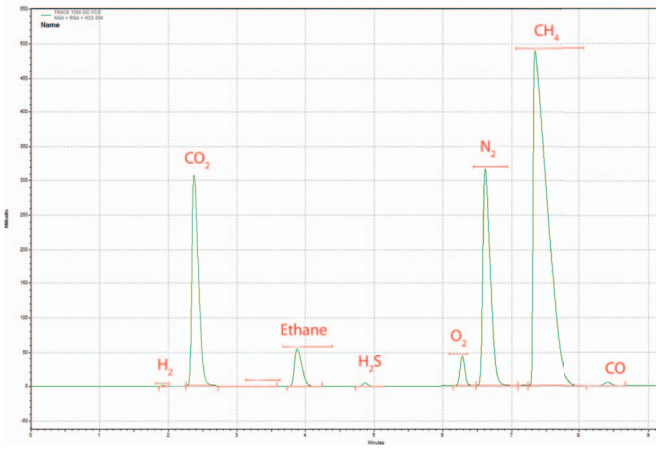

Figure 2. Biogas analyser TCD chromatogram

Main components

Figure 2 shows the analysis of Biogas using a single TCD detector. Components of interest like methane, carbon dioxide, light hydrocarbons, hydrogen sulfide and permanent gases are effectively analysed using helium as carrier gas. Hydrogen is measured as well, although an additional channel with optimal carrier gas (N_2, Ar) is preferred for this component. The instrument is equipped with an independently heated valve oven (figure 1) with robust diaphragm valves for extended lifetime. Figure 3 shows the excellent quantitative results. Modular injectors and detectors offer high flexibility and low maintenance costs.

TRACE 1300 GC-TCD Sample ID	CO2 Area	Ethane Area	Nitrogen Area	Methane Area
Reprotest NGA 111	2226454	5898353	5345064	90507939
Reprotest NGA 112	2217093	5902294	5346925	90445635
Reprotest NGA 113	2215985	5903676	5346602	90526422
Reprotest NGA 114	2227435	5904121	5345091	90517862
Reprotest NGA 115	2213580	5897482	5346060	90501697
Reprotest NGA 116	2217296	5901460	5349411	90488306
Reprotest NGA 117	2222737	5903879	5349656	90549145
Reprotest NGA 118	2219658	5908502	5350448	90595649
Reprotest NGA 119	2223410	5902305	5351021	90504111
Reprotest NGA 120	2217703	5904050	5353904	90638117
Reprotest NGA 121	2225062	5898589	5345321	90599110
Reprotest NGA 122	2219024	5902849	5351045	90574361
Reprotest NGA 123	2224970	5902603	5350286	90568154
Reprotest NGA 124	2226904	5901536	5349733	90598430
Reprotest NGA 125	2223668	5904325	5345351	90531033
Reprotest NGA 126	2232354	5907475	5351045	90639410
Reprotest NGA 127	2224065	5903110	5350234	90640979
Reprotest NGA 128	2219309	5904037	5352404	90670039
Reprotest NGA 129	2216183	5913463	5352165	90560228
Reprotest NGA 130	2221801	5909808	5346745	90588078
Min:	2213580	5897482	5345064	90445635
Max:	2232354	5913463	5353904	90670039
Mean:	2221734	5903696	5348926	90562235
Std Dev:	4782	3839	2770	59659
%RSD:	0.22	0.07	0.05	0.07

Figure 3. TCD channel repeatability

Extended analysis:
Terpenes, siloxanes, sulphur components, ammonia

Since a broad range of feedstocks is used, biogas production can result in various additional components like terpenes, siloxanes, sulphur components, ammonia, heavier hydrocarbons and others. The concentration levels depend on type of feedstock, production process and operating conditions. Optional analysis channels are therefore offered with appropriate detectors.

Figure 4 shows hydrocarbon analysis using Flame Ionisation Detector, for analysing sub-ppm to % levels.

Figure 5 is an example of the analysis of low ppb level sulphur components using Quadrupole MS. The colours represent different masses used for quantification. Figure 6 shows trace level sulphur components using Pulsed Flame Photometric Detector.

Low level ppb siloxanes analysis are analysed in figure 7 (ISQ Mass Spectrometer). Figure 8 and 9 demonstrate measurement of ammonia using TCD (1000 ppm standard, LOD <50ppm) and Pulsed Discharge Detector (2,2 ppm, LOD: ppb range).

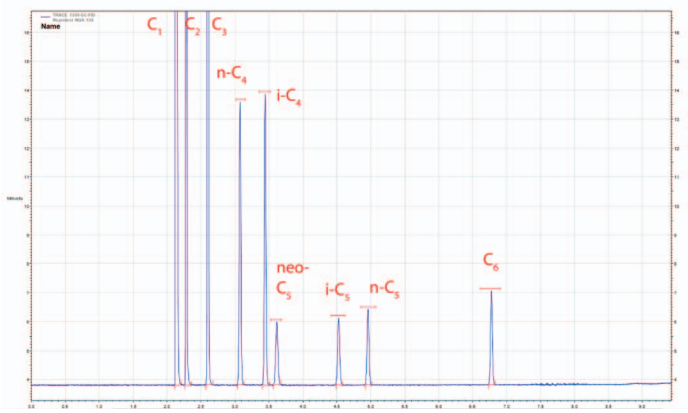

Figure 4. Chromatogram hydrocarbon analysis using FID.

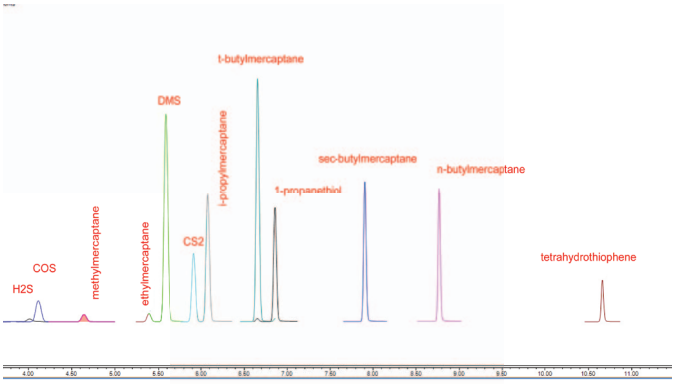

Figure 5. Sulphur component analysis by GC-Quadrupole-MS. LOD= 5 ppb

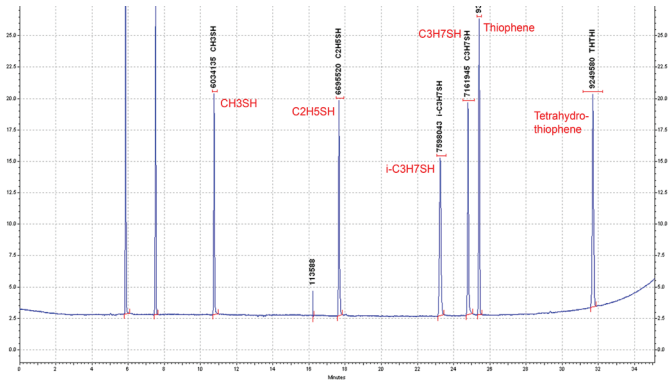

Figure 6. Sulphur component analysis using PFPD. LOD= 25 ppb.

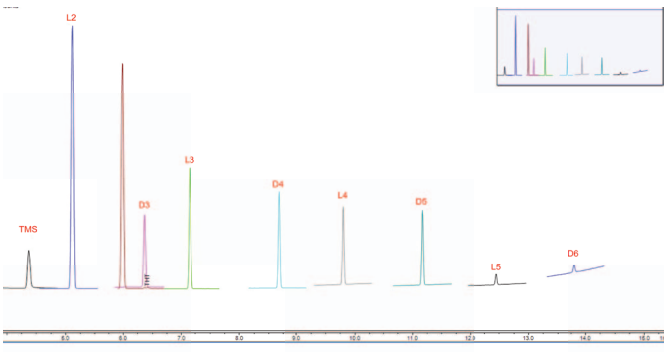

Figure 7. Siloxanes using GC-ISQ. The colours represent different quantification masses. LOD=5 ppb..

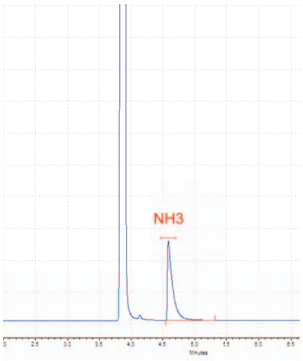

Figure 8. 1000 ppm NH_3 using TCD (LOD < 50 ppm)

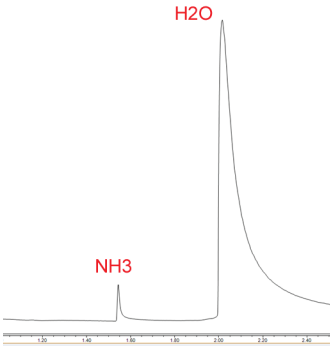

Figure 9. 2,2 ppm NH_3 using PDD (LOD < 1 ppm)

Figure 10.
Comprehensive biogas analyser equiped with TCD, FID, ISQ Quadrupole MS and stream selector.

Specifications

Standardised methods:	GPA 2261, 2177, 2186, 2286; ISO 6974, 6975; ASTM D1945, D1946, D6228
Configuration:	1-4 channel instrument based on Thermo TRACE GC 1300. Also available: Biogas analyser based on CompactGC$^{4.0}$ (application note available).
Optional:	- Additional channels for hydrogen, heavier hydrocarbons, sulphur, terpenes, siloxanes, ammonia and others, using FID, (P)FPD, Mass Spectrometer, PDD. - Stop flow valve, back pressure regulator - Stream selector
Sample tubing:	Sulfinert® tubing for inert sample path (sulphur and other polar components).
Application:	Custom configured analyser for the analysis of gaseous biogas and natural gas samples, containing hydrocarbons, permanent gases, sulphur components, siloxanes, terpenes, ammonia and other components.
Sample requirements:	See our pre-installation guide for additional requirements.
Analysis time:	2-20 minutes, depending on configuration and analysed components.
Minimum detectability:	Dependent on configuration, detector and sample composition. Examples: - Permanent gases, hydrocarbons, sulphur, ammonia using TCD: < 0.005% . - Sulphur components using FPD: < 200 ppb. - Sulphur components using PFPD: < 25 ppb. - Hydrocarbons using FID: < 1 ppm. - Sulphur components, siloxanes, terpenes using Quadrupole MS: < 5 ppb. - Ammonia using PDD: < 1 ppm; ppb range (depending on sample composition).
Dynamic Range:	TCD: 4 decades; FID: 7 decades.
Accuracy:	Depending on external calibration and repeatability.
Repeatability:	Depending on analysis channel. < 0.1 % RSD for CH_4 (example: see figure 3).
Data systems:	Chromeleon, OpenLab
Calculations:	Calorific value (sup. and inf.), mean molecular weight, compression factor, relative density, density, Wobbe index, BTU, and others on request.

Figure 11. Biogas/Natural gas analyser based on CompactGC$^{4.0}$, with small footprint and fast analysis time (application note available).

GLOBAL™ ANALYSER SOLUTIONS G·A·S MADE IN HOLLAND

GAS is an Interscience company