Global Analyser Solutions

Biogas analyser

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

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

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.

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

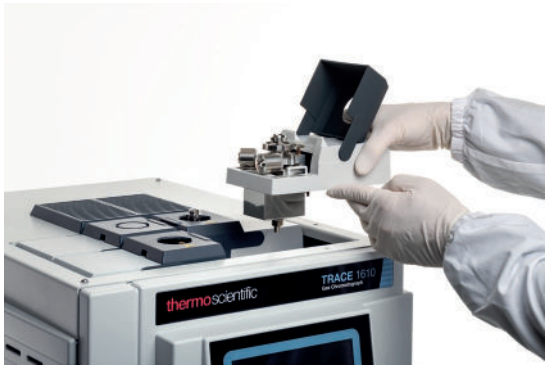

Figure 2 Modular injector/detector technology

Biogas analyser configurations

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

Main components

Figure 3 shows the analysis of biogas using a single TCD detector. Components of interest like methane, carbon dioxide, light hydrocarbons, hydrogen sulphide and permanent gases are effectively analysed using helium as carrier gas. Hydrogen is also measured , although an additional channel with nitrogen or argon carrier gas is preferred for better sensitivity and linearity. The instrument is equipped with an independently heated valve oven (figure 1) with robust diaphragm valves for extended lifetime. Figure 4 shows the excellent quantitative results. The modular injectors and detectors can be easily exchanged by the user in minutes, and offer high flexibility and low maintenance costs.

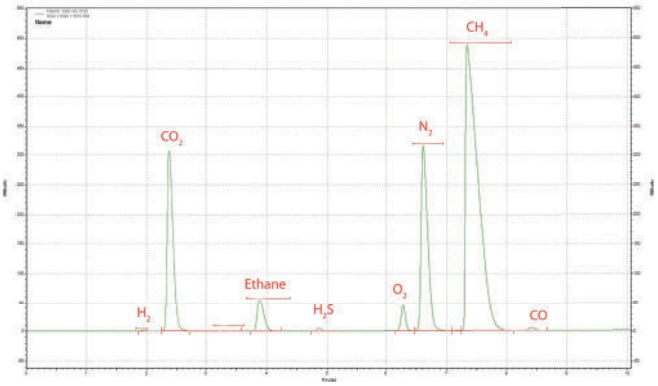

Figure 3 Biogas analyser TCD chromatogram

TRACE 1300 GC-FID Sample ID	Methane Area	Ethane Area	Propane Area
Reprotest NGA 111	20139243	1739944	640911
Reprotest NGA 112	20086079	1734190	638439
Reprotest NGA 113	20044487	1731425	637100
Reprotest NGA 114	20036999	1732525	637037
Reprotest NGA 115	20018051	1730020	636031
Reprotest NGA 116	20091384	1733729	637696
Reprotest NGA 117	20025051	1729626	636297
Reprotest NGA 118	20075026	1735624	637279
Reprotest NGA 119	19994570	1727838	636393
Reprotest NGA 120	20012133	1728947	635546
Reprotest NGA 121	20010572	1728331	635273
Reprotest NGA 122	20031270	1730848	635984
Reprotest NGA 123	19971068	1723629	634951
Reprotest NGA 124	20019514	1728056	634989
Reprotest NGA 125	20002092	1728560	635194
Reprotest NGA 126	19945816	1722529	632508
Reprotest NGA 127	19970722	1723681	633248
Reprotest NGA 128	20044032	1728287	636239
Reprotest NGA 129	20023385	1729286	635917
Reprotest NGA 130	19997280	1721256	634269
Min:	19997280	1721256	632508
Max:	20139243	1739944	640911
Mean:	20019430	1729295	636074
Std Dev:	51251	4519	1835
%RSD:	0.26	0.26	0.29

TRACE 1300 GC-TCD Sample ID	CO2 Area	Ethane Area	Nitrogen Area	Methane Area
Reprotest NGA 111	2226454	5898363	5345964	90567939
Reprotest NGA 112	2217693	5902294	5348925	90445635
Reprotest NGA 113	2215965	5903676	5348602	90526422
Reprotest NGA 114	2227435	5904121	5345891	90517862
Reprotest NGA 115	2213580	5897482	5345900	90501697
Reprotest NGA 116	2217296	5901468	5349411	90468306
Reprotest NGA 117	2222737	5903879	5349658	90549145
Reprotest NGA 118	2219658	5905502	5350448	90595649
Reprotest NGA 119	2223410	5902305	5351021	90504111
Reprotest NGA 120	2217703	5904059	5353904	90630117
Reprotest NGA 121	2225462	5898589	5345321	90599110
Reprotest NGA 122	2219024	5902849	5351845	90574361
Reprotest NGA 123	2224970	5902603	5350288	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	2224665	5903110	5350234	90640979
Reprotest NGA 128	2219309	5904607	5352404	90670039
Reprotest NGA 129	2216183	5913463	5352165	90560226
Reprotest NGA 130	2221801	5909808	5346745	90580078
Min:	2213580	5897482	5345964	90445635
Max:	2232354	5913463	5353904	90670039
Mean:	2221734	5903698	5348926	90562235
Std Dev:	4782	3839	2770	59859
%RSD:	0.22	0.07	0.05	0.07

Figure 4 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 5 shows hydrocarbon analysis using Flame Ionisation Detector, for analysing sub-ppm to % levels.

Figure 6 is an example of the analysis of low ppb level sulphur components using Quadrupole MS. The colours represent different masses used for quantification. Figure 7 shows trace level sulphur components using Pulsed Flame Photometric Detector.

Low level ppb siloxanes analysis are analysed in figure 8 (ISQ Mass Spectrometer). Figure 9 and 10 demonstrate measurement of ammonia using TCD (1000 ppm standard, LOD <50ppm) and Pulsed Discharge Detector (2,2 ppm, LOD: ppb range).

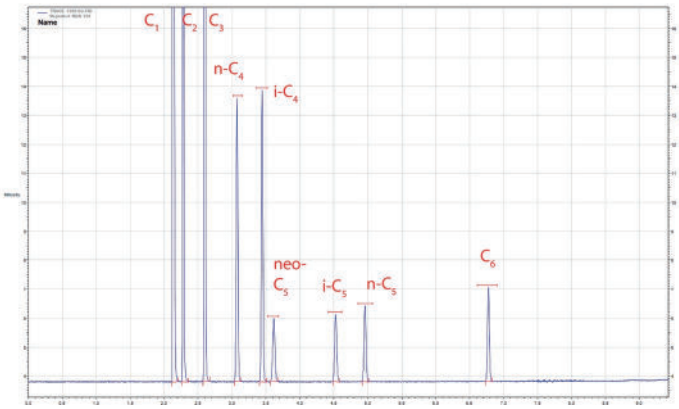

Figure 5 Chromatogram hydrocarbon analysis using FID.

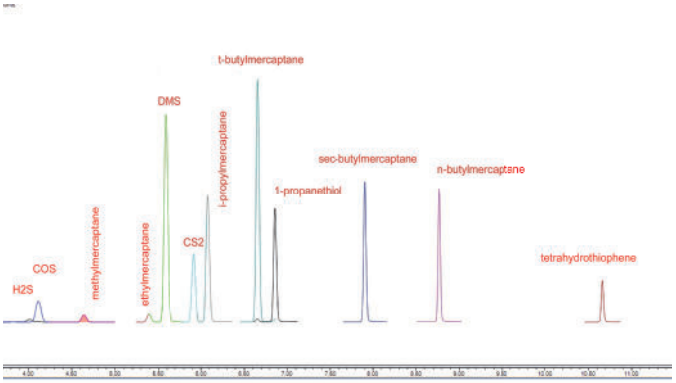

Figure 6 Sulphur component analysis by GC-Quadrupole-MS. LOD= 5 ppb

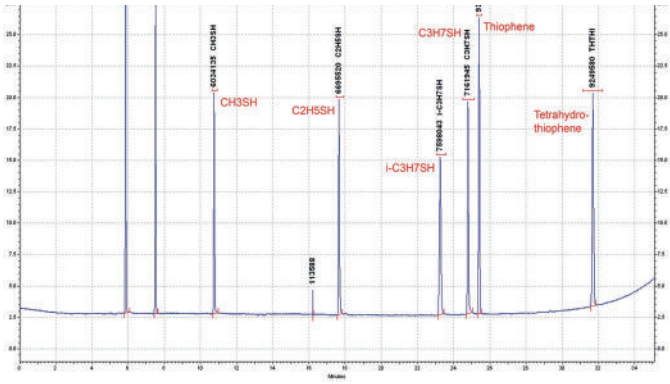

Figure 7 Sulphur component analysis using PFPD. LOD= 25 ppb.

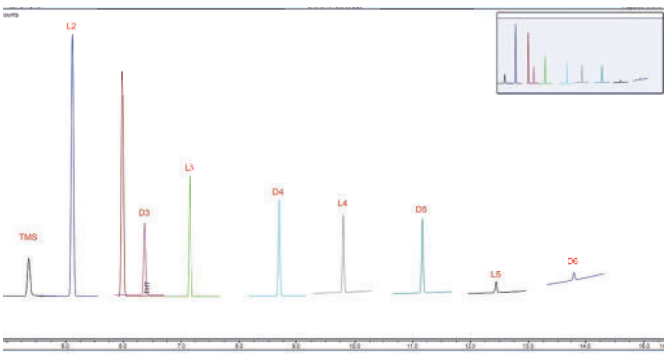

Figure 8 Siloxanes using GC-ISQ. The colours represent different quantification masses. LOD=5 ppb..

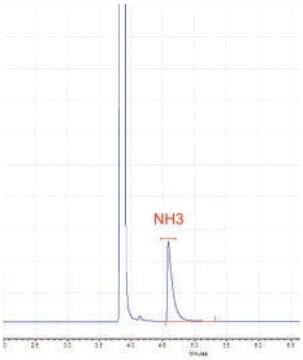

Figure 9 1000 ppm NH_3 using TCD (LOD < 50 ppm)

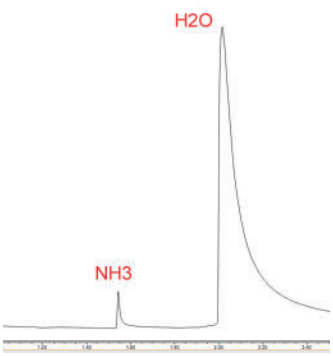

Figure 10 2,2 ppm NH_3 using PDD (LOD < 1 ppm)

Figure 11
Comprehensive biogas analyser equipped with TCD, FID and ISQ Quadrupole MS

Specification

Standardised methods:	GPA 2261, 2177, 2186, 2286; ISO 6974, 6975, 1976; ASTM D1945, D1946, D6228
Configuration:	1-4 channel instrument based on Thermo TRACE GC 1600 Also available: Biogas analyser based on CompactGC$^{4.0}$ (fig. 12; see application note)
Optional:	- Additional channels for hydrogen, heavier hydrocarbons, sulphur, terpenes, siloxanes, ammonia and others, using FID, (P)FPD, Mass Spectrometer (fig. 11), 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 and hydrocarbons using TCD: < 0.001% - Sulphur components using FPD: < 200 ppb - Sulphur components using PFPD: < 25 ppb - Hydrocarbons using FID: < 1 ppm - Sulphur components, siloxanes, terpenes using GCMS-AEI (Advanced Electron Ionisation): < 1 ppb - Ammonia using PDD: < 100 ppb
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 4)
Data systems:	Chromeleon, OpenLab
Calculations:	Calorific value (sup. and inf.), mean molecular weight, compression factor, relative density, Wobbe index, BTU. Custom calculations on request.

Figure 12 Biogas/Natural gas analyser based on CompactGC$^{4.0}$, with small footprint and fast analysis time (application note available).