

APPLICATION NOTE

Rapid Analysis of Natural Gas Composition and Physical Properties for Gas Appliance and Engine Manufacturers Using the INFICON 3000 Micro GC

INTRODUCTION

Rapid and precise analysis of the chemical composition and physical properties of natural gas is critical for natural gas appliance, boiler, and engine manufacturers. Fuel sources including natural gas, liquified petroleum gas (LPG or liquid propane), or butane/air mixes within predefined specifications are analyzed to determine key performance specifications, such as thermal efficiency. This specification can be obtained by comparing input and output energy content in British Thermal Unit (BTU).

The 3000 Micro GC provides fast and reliable measurement of incoming natural gas BTU value according to ASTM (American Society of Testing and Material), GPA (Gas Processors Association), or ISO (International Standards Organization) calculations, allowing accurate determination of thermal efficiency. The 3000 Micro GC reports gas component data in mole percentage, which is critical for understanding fuel composition. Natural gas streams of pipeline quality may change daily, weekly or monthly. The 3000 Micro GC analysis will ensure these changes are tracked. High quality analytical data is beneficial for product development, performance, environmental compliance, and reporting.

With its accuracy, small size, and speed of analysis, 3000 Micro GC is the ideal BTU analyzer and may be considered an advanced technological upgrade to legacy calorimeters.

EXPERIMENTAL

A natural gas calibration standard was analyzed on a 2-channel 3000 Micro GC containing PLOT U and OV-1 columns with fixed volume injectors. The fixed volume injector provides exceptional precision for both columns. [Table 1](#) displays the component concentrations for the calibration standard.

The calibration standard was introduced to the 3000 Micro GC through a pressure reducer and Genie® filter assembly to regulate the pressure and remove any particulates.

In addition, two gas samples, one containing a high amount of propane and one containing a high amount of butane mixed with air, were analyzed under similar conditions.

RESULTS

[Figure 1](#) and [Figure 2](#) show the labeled chromatograms obtained for the analysis of the natural gas calibration standard, complete in under 300 seconds. Pipeline quality gas typically contains large amounts of methane and small amounts of fixed gases and light hydrocarbons up to C9 plus. The 3000 Micro GC quickly separates and analyzes the fixed gases and hydrocarbons present using a 2-channel Micro GC.

The 3000 Micro GC has excellent retention time and area repeatability. Relative standard deviation (%RSD) values under 0.22% were achieved for compounds up to C8s for 10 consecutive runs. The %RSD value for C9 plus was 1.6%. The retention time and area %RSD values are shown in [Table 2](#).

[Figure 3](#) and [Figure 4](#) show the labeled chromatograms obtained for the analysis of the propane and butane/air gas samples.

CONCLUSION

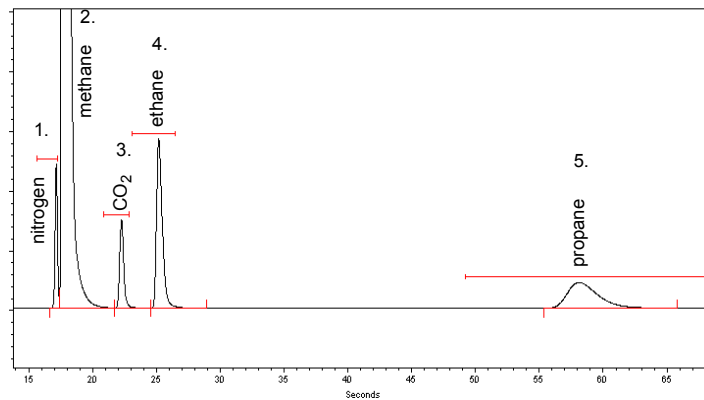
With its speed and precision, the 3000 Micro GC is the ideal instrument to analyze natural gas components to calculate physical properties such as BTU value. Industry compliant natural gas reports can be automatically generated upon completion of a sample run, providing valuable information for gas appliance or engine development.

DATA

Table 1 Natural gas calibration standard information

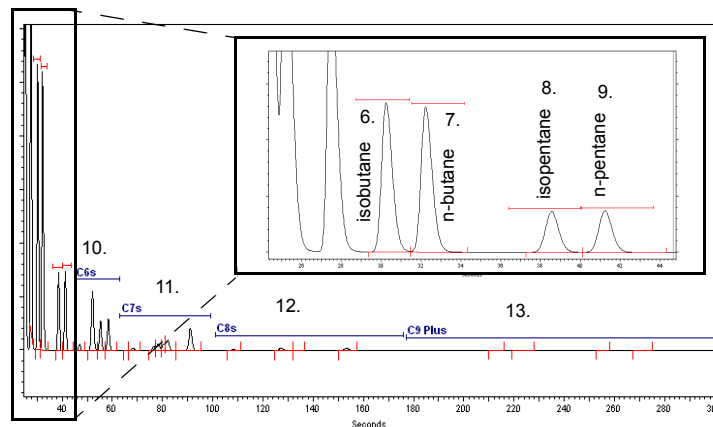
Component	Mole %
nitrogen	1.525
methane	88.671
CO ₂	1.206
ethane	2.994
propane	2.006
isobutane	1.004
n-butane	0.996
isopentane	0.300
n-pentane	0.300
C6s	0.603
C7s	0.320
C8s	0.056
C9 plus	0.019

Figure 1 Chromatogram of the natural gas calibration standard - Channel A



Column: PLOT U, 8 m, Fixed Volume Injector, 0.32 mm ID,
Column Temperature: 80°C, Isothermal; Column Head Pressure: 30 PSI

Figure 2 Chromatogram of the natural gas calibration standard - Channel B



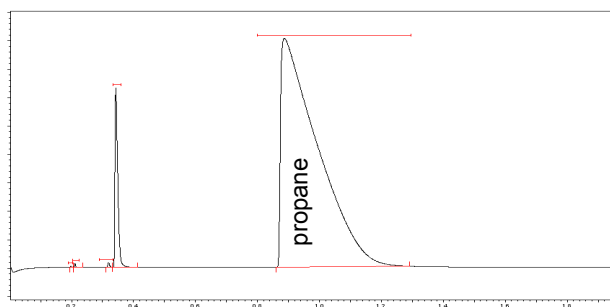
Column: OV-1, 10 m, Fixed Volume Injector, 0.15 mm ID;
Column Temperature: 100°C, Isothermal; Column Head Pressure: 30 PSI

Table 2 Repeatability data for the natural gas calibration standard

Channel	Number of Analyte	Compound	Retention Time (s)	RT %RSD	Area %RSD
A	1	nitrogen	17.16	0.056	0.220
A	2	methane	17.62	0.059	0.044
A	3	CO ₂	22.28	0.046	0.103
A	4	ethane	25.18	0.025	0.087
A	5	propane	58.12	0.018	0.202
B	6	isobutane	30.24	0.035	0.050
B	7	n-butane	32.24	0.000	0.049
B	8	isopentane	38.56	0.025	0.051
B	9	n-pentane	41.24	0.023	0.056
B	10	C6s	45 to 63	*N/A	0.062
B	11	C7s	64 to 99	*N/A	0.114
B	12	C8s	100 to 176	*N/A	0.183
B	13	C9 plus	177 to 300	*N/A	1.604

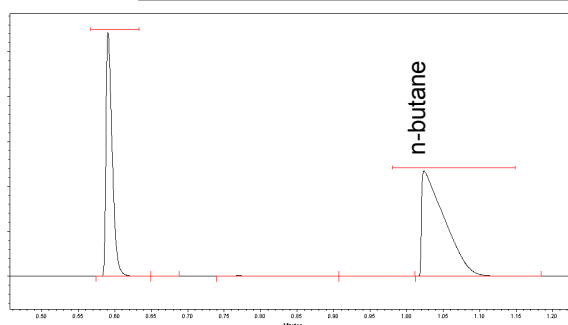
*N/A: Information not available. Compound is a group.

Figure 3 Chromatogram of the propane gas sample - Channel A



Column: PLOT U, 6 m, Fixed Volume Injector, 0.32 mm ID,
Column Temperature: 80°C, Isothermal; Column Head Pressure: 30 PSI

Figure 4 Chromatogram of the the butane/air gas sample - Channel B



Column: OV-1, 14 m, Fixed Volume Injector, 0.15 mm ID;
Column Temperature: 50°C, Isothermal; Column Head Pressure: 35 PSI



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