

APPLICATION NOTE

Rapid Analysis of Natural Gas Composition and Physical Properties 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 producers, gatherers, gas distribution companies, electrical utilities, and independent testing laboratories. The 3000 Micro GC measures the individual components in natural gas, such as methane, and provides detailed reports of physical properties—including composition, heating value, and specific gravity (or relative density), up to ten times faster than a conventional GC system. The portable 3000 Micro GC is applicable to natural gas samples from wellhead to pipeline-quality gas either on-site or in a laboratory setting.

Due to variations in natural gas composition, it is necessary to monitor the physical properties of the gas. These values determine the commercial value of the natural gas either purchased or sold, notably in custody transfer situations. Small differences in the calculated values can have a significant financial impact. The 3000 Micro GC software automatically calculates critical physical properties after each sample analysis and generates a standard report using industry specific methods from either the GPA (Gas Processors Association) 2172, the ASTM (American Society of Testing and Materials) D3588 or the ISO (International Standards Organization) 6976.

EXPERIMENTAL

A natural gas calibration standard was analyzed on a two-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.

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 two-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](#).

Some natural gas measurements require oxygen and nitrogen composition analysis. This requirement can be met with the addition of a Molsieve column. [Figure 3](#) shows a labeled chromatogram obtained from analyzing a sample of natural gas containing oxygen and nitrogen on the Molsieve column.

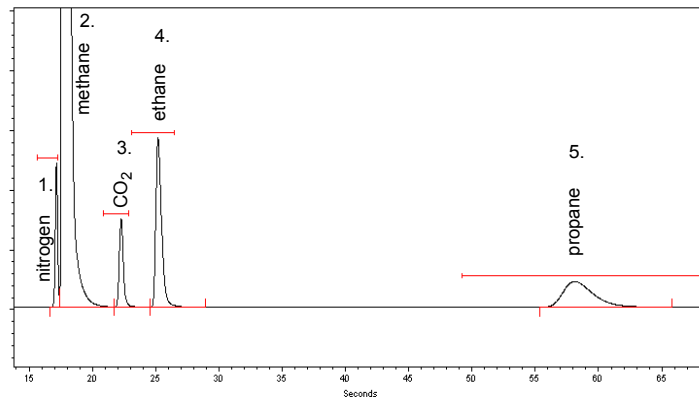
CONCLUSION

With its speed and precision, the 3000 Micro GC is the ideal instrument to analyze natural gas components to calculate physical properties such as heating value and relative density. Industry compliant natural gas reports can be automatically generated upon completion of a sample run, providing valuable information for custody transfer situations.

Table 1 Natural gas calibration standard information

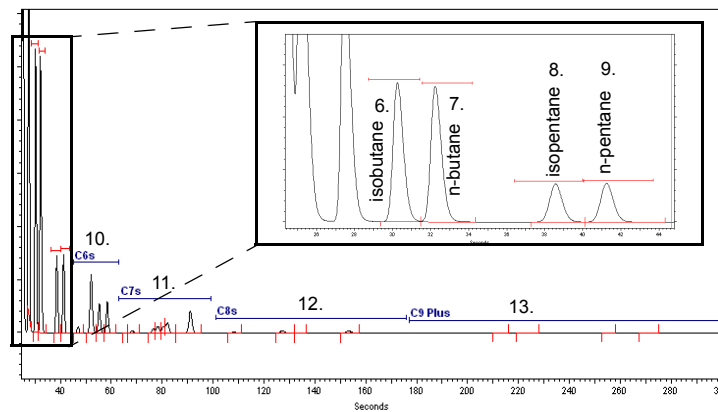
Component	Mole %
nitrogen	1.525
methane	88.671
CO ₂	1.206
ethane	2.994
propane	2.006
isobutane	1.004
n-butane	0.996
isopentane	0.300
n-pentane	0.300
C6s	0.603
C7s	0.320
C8s	0.056
C9 plus	0.019

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

Figure 3 Chromatogram of a natural gas sample using a Molsieve column

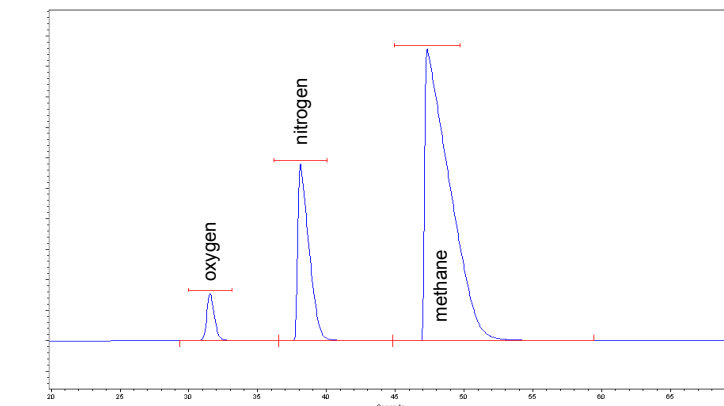


Table 2 Repeatability data for the natural gas calibration standard

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.



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