

APPLICATION NOTE

Analysis of Tert-Butyl Mercaptan (TBM) in a Natural Gas Matrix Using the INFICON 3000 Micro GC

INTRODUCTION

Natural gas is odorless and colorless, making it virtually undetectable by humans. Natural gas suppliers add odorants to natural gas before it reaches the consumer to serve as leak identifiers and warning agents. Adding these odorants reduces liability and prevents substantial property damage and severe personal injury resulting from natural gas explosions.

A concern surrounding the odorization of natural gas is the depletion of odorant amount and intensity over time, also called odorant fading. Odor fading can lead to undetected leaks, presenting a potential explosion hazard. Because of this phenomenon, odorants must be monitored frequently and consistently according to Federal Odorization Standard 49CF 192.625.

One of the most commonly used odorants in the United States and Europe is tert-butyl mercaptan (TBM). United States standards do not require natural gas suppliers to specify a concentration; however, in Europe, concentrations for TBM, as required by Marcogaz, range from 1.5 to 2.2 ppm.

The transportable INFICON 3000 Micro GC is able to detect TBM down to low ppm levels using a 14% phenyl, 86% dimethylpolysiloxane column. Within seconds, low concentration levels of TBM can be analyzed and separated from neighboring hydrocarbons. The 3000 Micro GC makes on-site analysis of TBM quick and easy, eliminating the need to send samples to a laboratory.

EXPERIMENTAL

A 1-Channel 3000 Micro GC was configured as follows:

- 15 m 14% phenyl, 86% dimethylpolysiloxane column
- Large variable volume injector (LVI)
- Thermal conductivity detector (TCD)

The LVI provides optimum sensitivity, while the TCD provides quick and simple detection.

The 3000 Micro GC was calibrated using a 2 ppm TBM standard. A natural gas sample containing an unknown amount of TBM was collected from a typical hot water heater. Additionally, a 0.75 ppm TBM standard was prepared by diluting the 2 ppm TBM standard with a natural gas standard. Both samples were then analyzed using the calibrated TBM method.

RESULTS

Figure 1 displays the labeled chromatogram of the 2 ppm TBM standard. The 3000 Micro GC has excellent retention time, height, and area repeatability producing percent relative standard deviation (%RSD) values under 3.04% for 10 consecutive runs. Table 2 displays the %RSD information for retention time, peak height, and peak area.

Ten runs of the natural gas sample from the water heater were compared. Within 90 seconds, TBM was detected, fully resolved, and quantified at 2.5 ppm. Figure 2 displays the chromatogram of 2.5 ppm TBM present in the natural gas sample. The %RSD value for 10 runs was less than 2.6%. Table 3 displays the %RSD information for retention time, peak height, and peak area. Figure 2 also displays the chromatogram of the 0.75 ppm TBM standard.

CONCLUSION

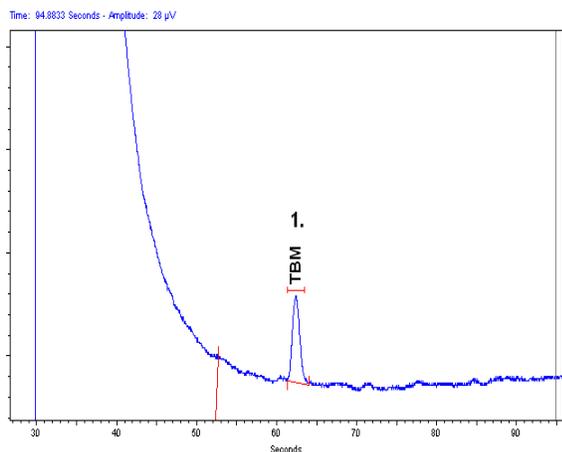
With its speed and precision, the 3000 Micro GC is an ideal instrument to analyze low ppm levels of TBM in natural gas. In under 90 seconds, 2.5 ppm TBM was fully resolved on one channel with excellent retention time, peak height, and area repeatability. The 3000 Micro GC is capable of detecting down to 0.75 ppm of TBM in natural gas.

DATA

Table 1 TBM standard information

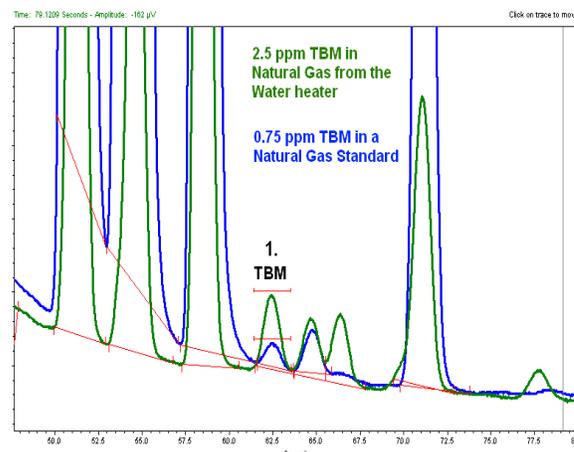
	Component	Concentration
Standard 1	TBM	2 ppm in Methane

Figure 1 Chromatogram of the 2 ppm TBM calibration gas standard



Column: 15 m, 14% Phenyl, LVI, 0.15 mm ID
 Column Temperature: 40°C, Isothermal
 Column Head Pressure: 36 psi
 Inject Time: 300 ms

Figure 2 Chromatogram overlay of natural gas sample from a water heater and TBM in natural gas standard



Column: 15 m, 14% Phenyl, LVI, 0.15 mm ID
 Column Temperature: 40°C, Isothermal
 Column Head Pressure: 36 psi
 Inject Time: 300 ms

Table 2 Repeatability data for 10 runs of the 2 ppm TBM calibration gas standard

Channel	Number of Analyte	Compound	Retention Time (s)	RT %RSD	Peak Height %RSD	Peak Area %RSD
A	1	TBM	62.44	0.073	3.04	2.915

Table 3 Repeatability data for 10 runs of the natural gas sample from a water heater

Channel	Number of Analyte	Compound	Retention Time (s)	RT %RSD	Peak Height %RSD	Peak Area %RSD
A	1	TBM 2.5 ppm	62.44	0.038	1.47	2.580



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