Application Note

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Analysis of Tetrahydrothiophene (THT) in Natural Gas Using the Agilent 990 Micro GC

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Introduction

Natural gas, as a source of energy, is widely used for heating, cooking, and electricity generation. When it leaks and the concentration in air reaches the explosive limit, it is easy to ignite. Natural gas is odorless, so to detect a leak at an early stage, odorant is added as a leak indicator and warning agent.

Tetrahydrothiophene (THT) is an odorant that is widely used in Europe and China. THT is easily detected by a person with a normal sense of smell, and it is stable and does not corrode the transport pipeline. However, there are odorant-fading factors that impact the real concentration or intensity of odorants over time, for example, the adsorption or absorption to pipelines and contaminants in natural gas that mask the odorant. The frequent and consistent monitoring of odorants is vital to maintain their effectiveness.

Controlling the concentration of THT at the lowest level while remaining effective is important for cost savings. In China, the THT limit is 20 mg/m^3 (approximately 5.6 ppm) by CJJ/T 148-2010. In Europe, the range is 10 to 40 mg/m^3.

A previous work has shown that THT in natural gas can be analyzed on the Agilent 490 Micro GC.[1] The same is true for the Agilent 990 Micro GC. The work here demonstrated that the 990 Micro GC equipped with a CP-Sil 19CB channel can effectively monitor trace-level THT in simulated natural gas with good signal-to-noise ratio (S/N).

Experimental

The Agilent 990 Micro GC is equipped with a 6 m, CP-Sil 19CB straight channel for THT analysis.

Table 1. Test conditions for THT on an Agilent CP-Sil 19CB channel.

Channel Analytical Conditions	Setpoints
Column Pressure	200 kPa
Column Temperature	90 °C
Carrier Gas	Helium
Injection Time	255 ms

Table 2. THT standard sample.

Compound	Concentration (ppm)
n-C_6	4.95
tert-Butyl mercaptan	5.17
THT	4.01
n-C_9	3.94

Results and discussion

Figure 1 shows the chromatogram of 4 ppm THT on the CP-Sil 19CB channel. The THT elutes at 49.6 seconds, octane elutes at 31.3 seconds, and nonane elutes at 52.7 seconds. The resolution between THT and *n*-c_9 is 2.1. The S/N for the 4 ppm THT peak is greater than 20 at applied test conditions, which is good enough for trace-level THT analysis in natural gas. Repeatability evaluation was based on 10 injections of 4 ppm THT. The area repeatability is 2.5%, and the retention time (RT) repeatability is 0.019%.

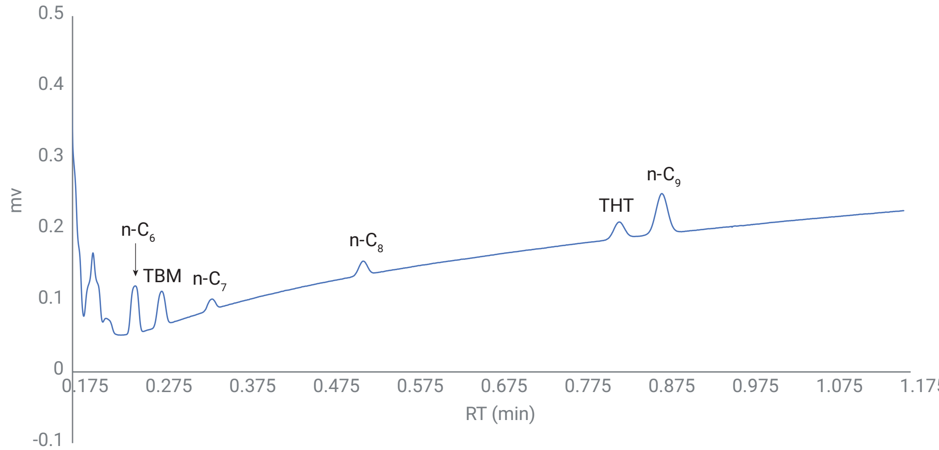

Figure 1. Measurement of 4 ppm THT on an Agilent CP-Sil 19CB column.

Table 3. RT and area repeatability of 4 ppm THT analyzed by the Agilent 990 Micro GC.

Injection no.10	RT (min)	Area (mv × s)
1	0.827	0.022
2	0.827	0.022
3	0.827	0.021
4	0.827	0.022
5	0.827	0.023
6	0.827	0.022
7	0.827	0.022
8	0.827	0.023
9	0.827	0.022
10	0.827	0.022
Average	0.827	0.022
RSD%	0.019	2.5

Conclusion

An Agilent CP-Sil 19CB straight channel can resolve THT from other hydrocarbons in natural gas. This midpolarity column has less retention capability on the heavier hydrocarbons such as nonane, which effectively improves the analysis speed to approximately one minute. The RT RSD% (<0.02%) and area RSD% (<3%) demonstrates the excellent repeatability of THT analysis, which proves that Agilent 990 Micro GC is an ideal platform for THT analysis in natural gas.

Reference

1. Van Loon, R. Analysis of Tetrahydrothiophene (THT) in Natural Gas Using Agilent 490 Micro GC, *Agilent Technologies Application Note*, publication number 5990-8528EN, **2011**.

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