Analysis of Sulfur Compounds in Natural Gas Using the Agilent 490 Micro GC

Application Note

Micro Gas Chromatography, Natural Gas, Sulfur Compounds

Authors

Bernd Brendemuehl
Elster GmbH
Dortmund, Germany

Remko van Loon
Agilent Technologies, Inc.
Middelburg, the Netherlands

Introduction

Natural gas is a complex mixture of inert gas and low molecular hydrocarbons; it may contain impurities such as hydrogen sulfide (H_2S) and other organic sulfur compounds. Normally, raw natural gas is treated to remove large amounts of sulfur gases. Moreover, odorants like *tert*-butyl mercaptan (TBM) or tetrahydrothiophene (THT) are added to the natural gas to make it detectable for the human nose.

Gas chromatography is a proven technology to analyze natural gas and its impurities. This application note shows results from Elster GmbH for the separation of multiple sulfur compounds on a Micro GC equipped with a porous polymer U and CP-Sil 13 type column channel.

Instrument setup and conditions

For this experiment, an Agilent 490 Micro GC (p/n G3581A) was used; conditions are shown in Table 1.

Table 1. Analytical Conditions for Dual Channel Micro GC

	Channel 1 PoraPLOT U 10 m	**Channel 2 CP-Sil 13 for TBM**
Column temperature	65 °C	80 °C
Carrier gas	helium, 130 kPa	helium, 255 kPa
Injection time	50 ms	110 ms

Results and Discussion

Figures 1, 2A, and 2B show the fast analysis of natural gas using the Agilent 490 Micro GC equipped with a PoraPLOT U and a CP-Sil 13 CB column channel. Total analysis time until *n*-nonane is less than 300 seconds. Multiple sulfur compounds, both impurities and odorants, were analyzed on the same column channels.

- **Hydrogen sulfide (H_2S)** and **carbonyl sulfide (COS)** can easily be separated from ethane and propane in natural gas on the PoraPLOT U channel. Overlayed chromatograms are shown in Figure 3.
- ***Tert*-butyl mercaptan (TBM)** is separated from the other compounds in natural gas on a CP-Sil 13 CB. Figure 4 displays a chromatogram for natural gas and natural gas with TBM.
- Figure 5 proves that **tetrahydrothiophene (THT)** is separated from the typical hydrocarbons in natural gas using the CP-Sil 13 CB column channel.
- A calibration mix including **methyl mercaptan (MM)**, **ethyl mercaptan (EM)**, **dimethyl sulfife (DMS)**, **methyl ethyl sulfide (MES)**, and **diethyl sulfide (DES)** was analyzed on a CP-Sil 13 CB, shown in Figure 6. Methyl mercaptan and dimethyl sulfide are separated from the natural gas matrix. Ethyl mercaptan, methyl ethyl sulfide, and diethyl sulfide show coelution with the higher hydrocarbons in natural gas on the used column channel.

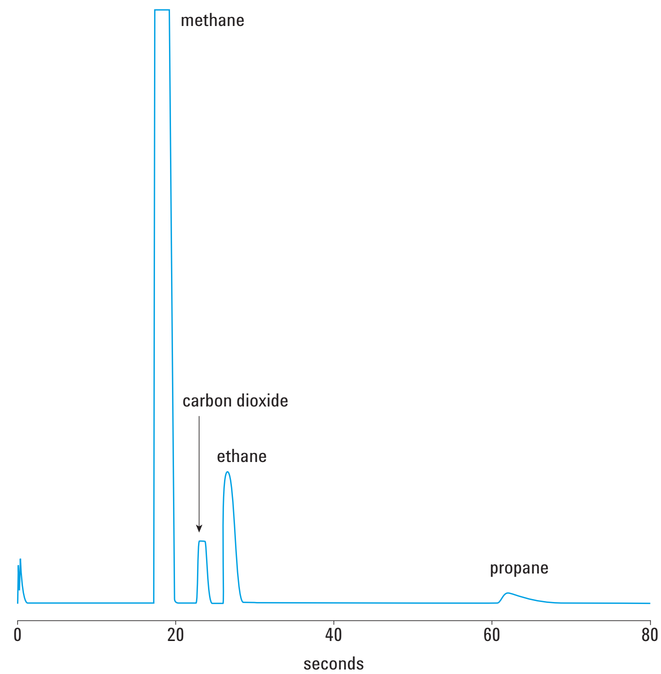

Figure 1. Natural gas on a PoraPLOT U.

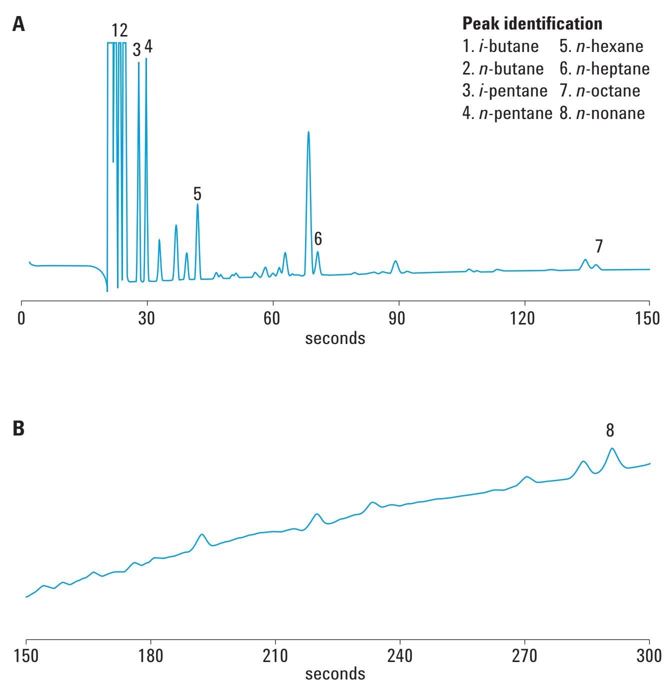

Figure 2. Natural gas on a channel 2; CP-Sil 13 CB.

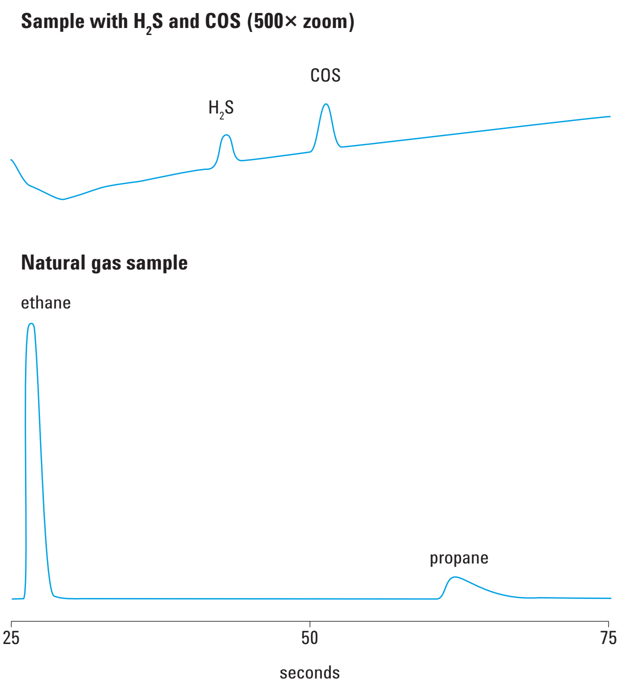

Figure 3. H_2S and COS in the PoraPLOT U column channel.

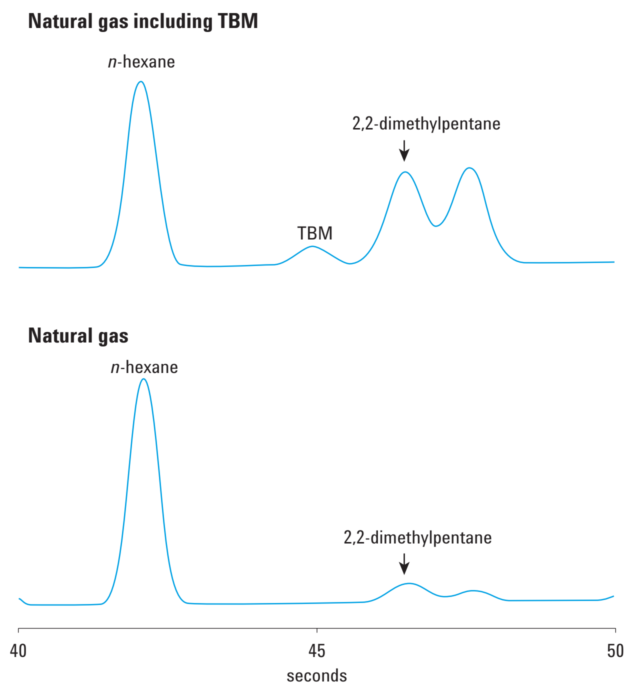

Figure 4. TBM separated from other compounds in natural gas.

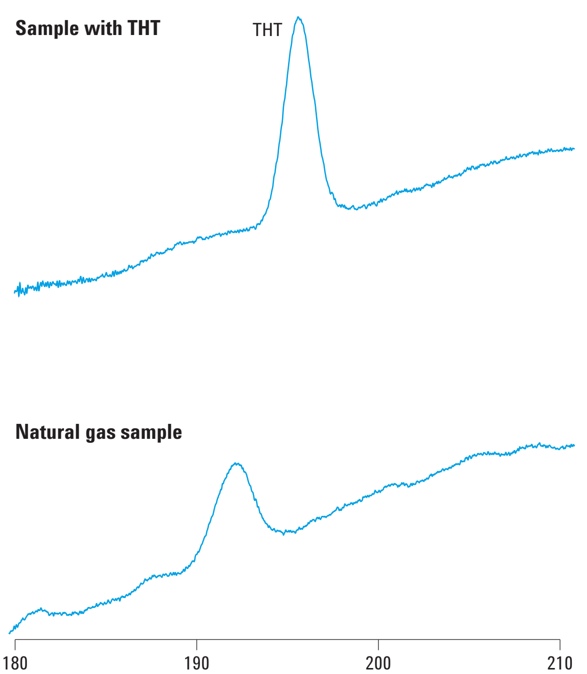

Figure 5. THT is separated for typical higher hydrocarbons in natural gas.

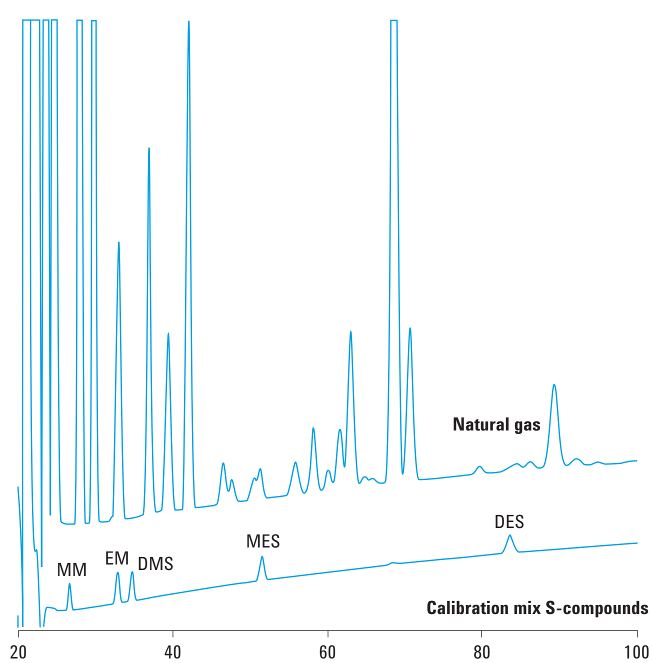

Figure 6. Elution pattern of methyl mercaptan (MM), ethyl mercaptan (EM), dimethyl sulfide (DMS), methyl ethyl sulfide (MES), and diethyl sulfide (DES) on a CP-Sil 13 CB.

Conclusion

Using the Agilent 490 Micro GC equipped with a 10-meter PoraPLOT U and a CP-Sil 13 CB for TBM (column length optimized), the sulfur compounds hydrogen sulfide (H_2S), carbonyl sulfide (COS), methyl mercaptan (MM), dimethyl sulfide (DMS), *tert*-butyl mercaptan (TBM), and tetrahydrothiophene (THT) are separated from the typical hydrocarbons in natural gas. In this setup and setting used, ethyl mercaptan (EM), methyl ethyl sulfide (MES), and diethyl sulfide (DES) are not fully resolved from the higher hydrocarbons in natural gas.

The 490 Micro GC delivers lab-quality separations in an ultra-compact, portable instrument. You get the results you need in seconds - for faster, better decision making, and confident process control.

For More Information

These data represent typical results. For more information on our products and services, visit our Web site at www.agilent.com/chem.

www.agilent.com/chem/microgc

Printed in the USA
December 18, 2012
5991-1190EN

Agilent Technologies