Application Note: AN42012_E 02/04

Total Sulfur in Liquefied Petroleum Gas (LPG) Samples by Pulsed-UV-Fluorescense

Key Words

- Sulfur
- LPG
- Pulsed UV Fluorescence

Introduction

Liquefied Petroleum Gas also known as LPG is often used as fuel in the automotive industry beside the use of e.g. gasoline. The Sulfur content in LPG is tested to optimise the catalytic hydrodesulfurization process. Sulfur compounds in LPG will also influence emissions of sulfur dioxide resulting in atmospheric pollution.

Referenced Documents

The Total Sulfur Analyzer, model TS 3000, including the Gas/LPG Introduction Module, model EGM 1700 of Thermo Electron Corporation complies with the following standard method for this particular application:

ASTM D6667

Standard Test Method for determination of Total Volatile Sulfur in gaseous Hydrocarbons and Liquefied Petroleum Gases by Ultraviolet Fluorescence.

Principle of operation

Using the Thermo EGM 1700, the LPG sample is automatically introduced into the Liquids Module of the TS 3000 analyzer. During this process the EGM 1700 is supported with a 100 µL sample loop that switches automatically in order to increase the accuracy and sensitivity in the introduction. The EGM 1700 handles the LPG samples in the liquid phase up to 12-bar pressure and converts the sample into the gas phase at a 100°C. The instrument pyrolyses the sample under controlled conditions at 1000°C. The patented turbo combustion tube ensures complete combustion and transforms the sulfur into sulfurdioxide (SO_2).

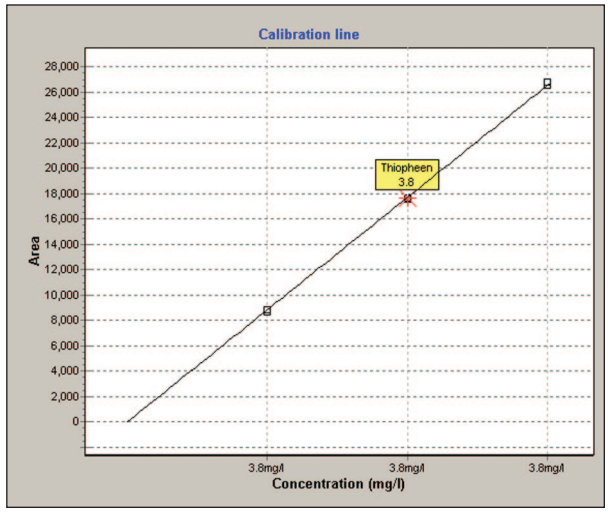
To remove the water out of the combustion gas, the formed SO_2 is directed through a polymer-based scrubber into the reaction chamber. Here the pulsating UV light excites the SO_2 molecules. As the exited SO_2 molecules decays to a lower energy level light is emitted and detected by a photo multiplier.

The EGM 1700 ensures repeatable and accurate results.

System settings

Oxygen injection	300 mL/min
Argon injection	80 mL/min
Oxygen combustion	100 mL/min
Oxygen ozonator	100 mL/min
Furnace temp. I	1000 °C
Furnace temp. II	1000 °C
Sample volume	100 µL upto 300 µL (for the standard) 100 µL for the samples

Calibration line Sulfur



STANDARD (µL VOLUME)	AREA (mV*SEC)
100	8807
100	8687
100	8817
200	17568
200	17608
200	17642
300	26526
300	26549
300	26793

(Standard 10 ppm Thiophene in n-butane, which contains 3.8 ppm S.)

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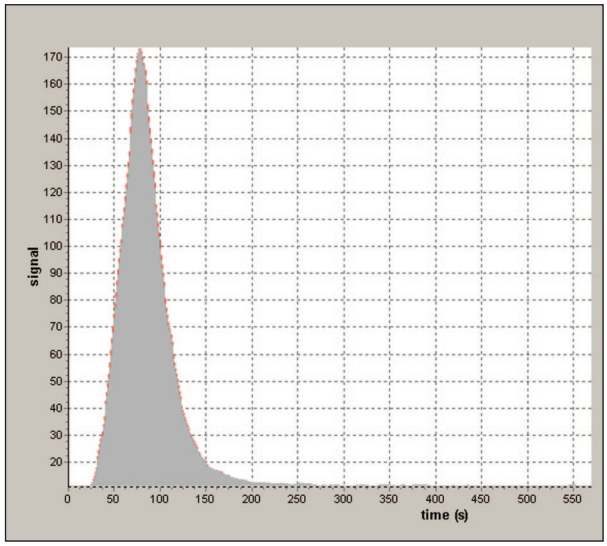
Results Total Sulfur analysis

	TOTAL SULFUR ANALYSIS	
SAMPLE	**AREA(mV*s)**	**RES (mg S/l)**
Propane	10450	4.52
Propane	10478	4.54
Propane	10522	4.56
Butane	9325	4.04
Butane	9402	4.07
Butane	9376	4.06
Mix	20734	8.98
Mix	20823	9.02
Mix	20749	8.99

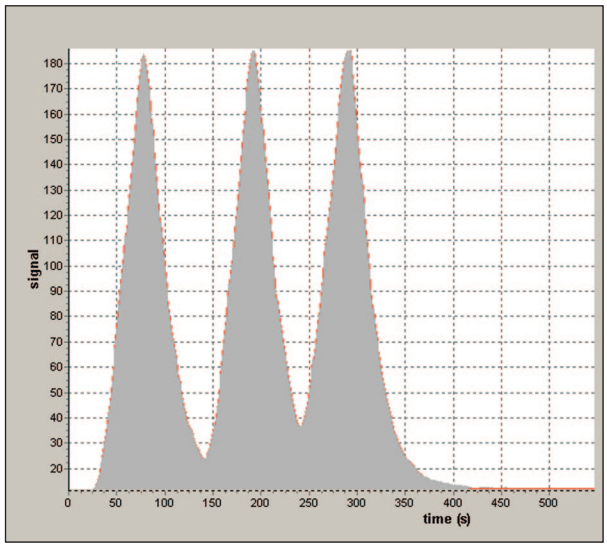
Summary Sulfur analysis

SAMPLE	MEAN (mg S/L)	SD (mg S/L)	RSD (%)
Propane	4.54	0.02	0.44%
Butane	4.06	0.015	0.38%
Mix	9.00	0.021	0.23%

Example peaks of Sulfur analysis



Sample Butane (100 µL sample volume)



Standard thiophene (300 µL sample volume)

Note: A complete Application Report with detailed test results is available on special request

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