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Application News

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Gas Chromatography

Use of High-Speed Refinery Gas Analyzer (HSRGA) as efficient application on hydrocarbon processing industries (HPI)

User Benefits

- Refinery gas can be analyzed rapidly by means of the HSRGA in a reduced time of less than 6.5 min.
- High reproducibility of the system can be guaranteed with good identification of all the compounds in a wide range of concentrations.
- This system is able to analyze natural gas, giving more flexibility and extending the possible applications inside refinery industry for the same instrument.

Introduction

Refinery gas is one of the typical products obtained during distillation of crude oil. It contains mainly hydrogen and light hydrocarbons and can be used as feedstock in petrochemical industry as well as a fuel for internal use in the refinery [1]. Therefore, an accurate determination of its concentration becomes essential in order to define its further application inside the refinery.

The high-speed refinery gas analysis (HSRGA) is offered as a ready assembled and robust solution that provides good results in short time. In this instrument configuration the sample is divided in three different sections using one FID and two TCD as detectors. First the permanent gases are being analyzed by using capillary plot columns for proper separation and then detected with the first TCD. The hydrocarbons are also separated by means of capillary column and detected by using FID detector. Finally, this system offers the flexibility of analyzing He and H_2 in the second TCD using Nitrogen as carrier gas for better detection.

In this study, the aim was to analyze the sample with as short chromatographic runtimes as possible, providing reliable results. Additionally, the applicability of this setup for other typical products in oil industry like natural gas was investigated.

Sample Preparation and Calibration

To corroborate the reliability of the instrument for these purposes, two gas standard mixtures were used; one cylinder with a mixture of all compounds present in the refinery gas (table 1) and in the other cylinder a typical natural gas standard mixture (table 2). Both standards contained the usual concentrations expected from real samples. The cylinders were connected to the GC valve box inlet with a controlled flow of around 30 ml/min.

Table 1: Standard gas mixture of refinery gas

Compound	Concentration (%)
n-Hexane	0.1
Isopentane	1
Acetylene	1
Argon	1
Hydrogen	12.5
Allene	1
Isobutylene	1
Pentane	1
(Z)-But-2-ene	2
Ethylene	2
But-1-ene	2
(E)-But-2-ene	3
Carbon dioxide	3
Propene	3
Buta-1,3-diene	3
Ethane	4
Butane	4
Methane	5
Isobutane	5
Propane	6
Nitrogen	37.2

Table 2: Standard gas mixture of natural gas

Compound	Concentration (%)
n-Hexane	0.1
Isopentane	0.15
Pentane	0.15
Isobutane	0.3
Butane	0.3
Carbon dioxide	0.5
Propane	0.75
Ethane	2
Nitrogen	1
Methane	94.75

- **Results**

For the refinery gas standard measurements all the compounds where clearly identified (figure 1) for all the detectors. Even for the FID, which has many compounds to be detected, also a very good resolution and a total analysis time of less than 6.5 min was achieved as specified for this system.

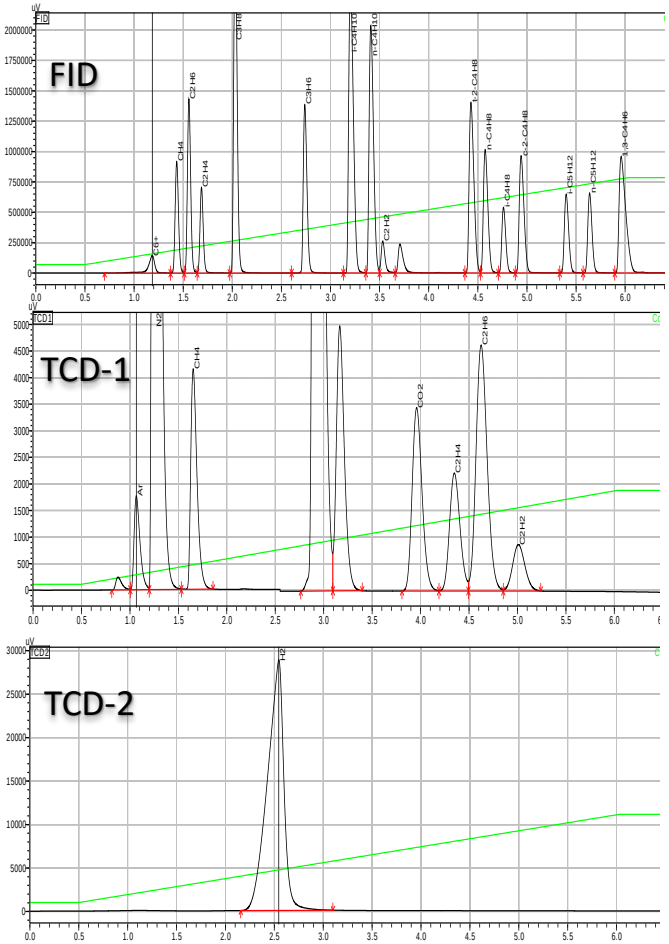

Figure 1: Chromatograms obtained for the refinery gas standard

In case of the relative standard deviation (%RSD) the values for each compound were all below 1% for area and 0.05% for retention time in 10 consecutive measurements. Therefore, a high reproducibility for this system is guaranteed.

For the natural gas standard measurements, the same method was applied obtaining again chromatograms with good resolution of peaks (figure 2).

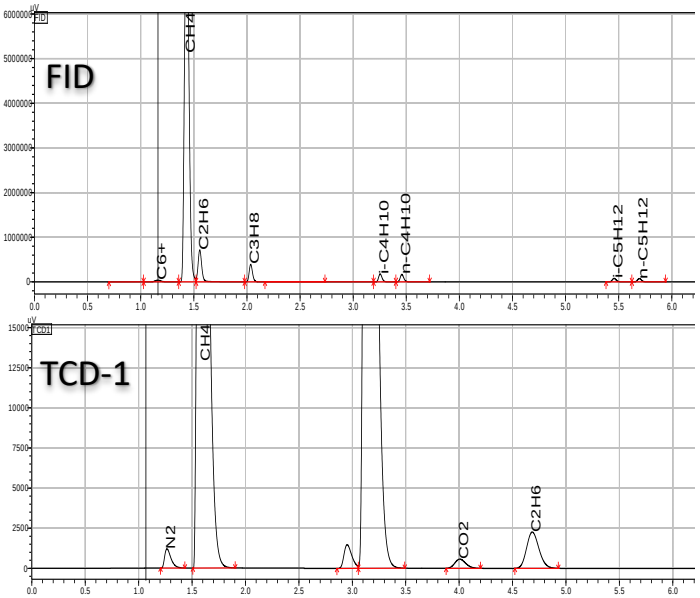

Figure 2: Chromatograms obtained for the natural gas standard (TCD-2 is not shown since there is no H_2/He in the sample)

Within the results the good resolution between methane (CH_4) and its neighbouring peaks is particularly important. Since methane is the main compound in natural gas, an accurate detection and peak separation is essential.

Likewise, for the natural gas analysis, reproducibility of the system is high, showing %RSD below 1% for area and below 0.05% for retention times.

These results demonstrate the flexibility of the high-speed refinery gas instrument that is also able to analyze different samples like natural gas without the need of changing any configuration or even purchasing additional instrumentation.

The Package

All items listed below are already included when ordering the system GC P/N 465-50402-58CN.

- ❑ *Main Unit*
  Nexis GC-2030
- ❑ *Accessory*
  Full size side mounted valve box (for four different valves installation)
- ❑ *Main Consumables*
  SH-Porapak N column (80/100 mesh, 1/8” x 1 m; P/N 980-18792)
  SH-Molsieve 5A (30 m x 0.53 mm x 50 µm; P/N 221-75763-30)
  SH-10% OV-1 (80/100 mesh, 1/8” x 1 m; P/N 465-01823-01)
  SH-Plot Al_2O_3/S (30 m x 0.53 mm x 15 µm; P/N 465-00285-05)
  SH-Molsieve 5A (60/80 mesh, 1/8” x 3 m; P/N 465-00143-03)
- ❑ *Software*
  LabSolutions LCGC

Figure 3: Nexis GC-2030 with side mounted valve box

Conclusion

With the increasing demand of solutions that offer fast and reliable analysis for refinery gas, the potential of devices like HSRGA in the European market is very high. This system is able to analyze all the typical compounds inside refinery gas in about 6.5 min. Therefore, a timesaving, as well as an accurate and reproducible solution can be guaranteed. Furthermore, it was also proved that this system can be used for determining concentrations of other typical products in the oil industry like natural gas, giving flexibility and extending the application field for the same instrument. Finally, the availability of such a system as ready assembled solution provides the advantage of a less time-consuming, simpler installation allowing for immediate operation.

References

[1] OPIS by IHS Markit. “Still Gas (Refinery Gas)”. https://www.opisnet.com/glossary-term/still-gas-refinery-gas/ (accessed Dec. 12, 2020).

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