

Analysis of COS and H₂S on AC Hi-Speed Refinery Gas Analyzer

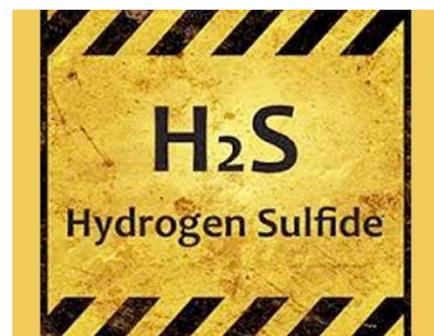
- AC Hi-speed RGA: the versatile refinery gas composition analyzer
- Analysis of H₂S and COS in a broad concentration range with an analysis time of less than 8 minutes
- Fully inert sample flow path
- Superb repeatability



Keywords: Carbonyl sulfide, Hydrogen sulfide, Hi-speed RGA

Introduction:

Hydrogen sulfide and carbonyl sulfide are chemical compounds that occur in the oil and gas industry, especially in refineries where products are produced that must meet strict specifications and emission requirements. Hydrogen sulfide occurs naturally in crude oil ("sour crude") or can be generated by refining processes, such as hydrocracking, hydrolysis and elemental sulfur production. The increasing demand for crude oil in the world, coupled with the increasing concentration of sulfur in the crude oil and products formed in the processing of hydrocarbons, puts more emphasis on safety, the environment and the operational aspects related of a refinery.



Gases produced in the refinery (such as desulfurization gas) can also contain H₂S and COS at different concentration levels, and therefore it is important for process optimization, emission control, etc. to have the ability to measure these components in a wide concentration range. AC Analytical Controls offers the AC Hi-speed RGA, which can measure these components in a wide variety of refinery gases.

AC Hi-speed RGA

The AC Hi-speed RGA is a versatile analyzer capable of analyzing the composition of refinery gases with an extended range of components and concentrations. Such as fuel gas, atmospheric overhead, FCC overhead, recycle gas, desulfurizer gas, and finished products such as LPG, propane or butanes streams.



Some of these gases may contain hydrogen sulfide and carbonyl sulfide in concentration levels ranging from low ppm to high percentages. For the analysis of the low ppm range, PAC recommends the use of a PAC SeNse base trace sulfur analyzer, but for concentrations in the range of 0.1% and above the AC Hi-speed RGA can be used.

The standard method used for the AC Hi-speed RGA provides separation of hydrocarbons up to C6 + and the inert gases (nitrogen, hydrogen, helium, oxygen, carbon monoxide, carbon dioxide), all within an analysis time of less than 6 minutes.

The versatility of the system makes it easy to set other methods, such as:

- LPG composition with an analysis times less than 3 minutes.
- Extended method for hydrocarbons including BTEX analysis.
- New method for the additional analysis of H₂S and COS in less than 10 minutes.

All the above methods are based on the same hardware configuration and columns. The user can choose the method that provides the separation and necessary information and is suitable for the gas to be analyzed.

Other feature highlights of the AC Hi-speed RGA are:

- Fully inert sample flow path ensures optimal resistance to corrosive materials.
- Sample shut-off valve for superb repeatability and accurate introduction of the gas into the system
- Micropacked columns for the inerts separation mounted in an isothermal oven, contributing to the excellent repeatability of the analyzer.
- Optional availability of a programmable 13X column for easy conditioning and maintaining optimum separation of oxygen, nitrogen, methane and carbon monoxide.

Results

The below chromatogram shows the result of an analysis of calibration gas containing 0.2% H₂S and COS on the dedicated method. The method has been optimized by changing some of the valve timings, so that the two components are eluting from the precolumn to the analytical column, where they are further separated.

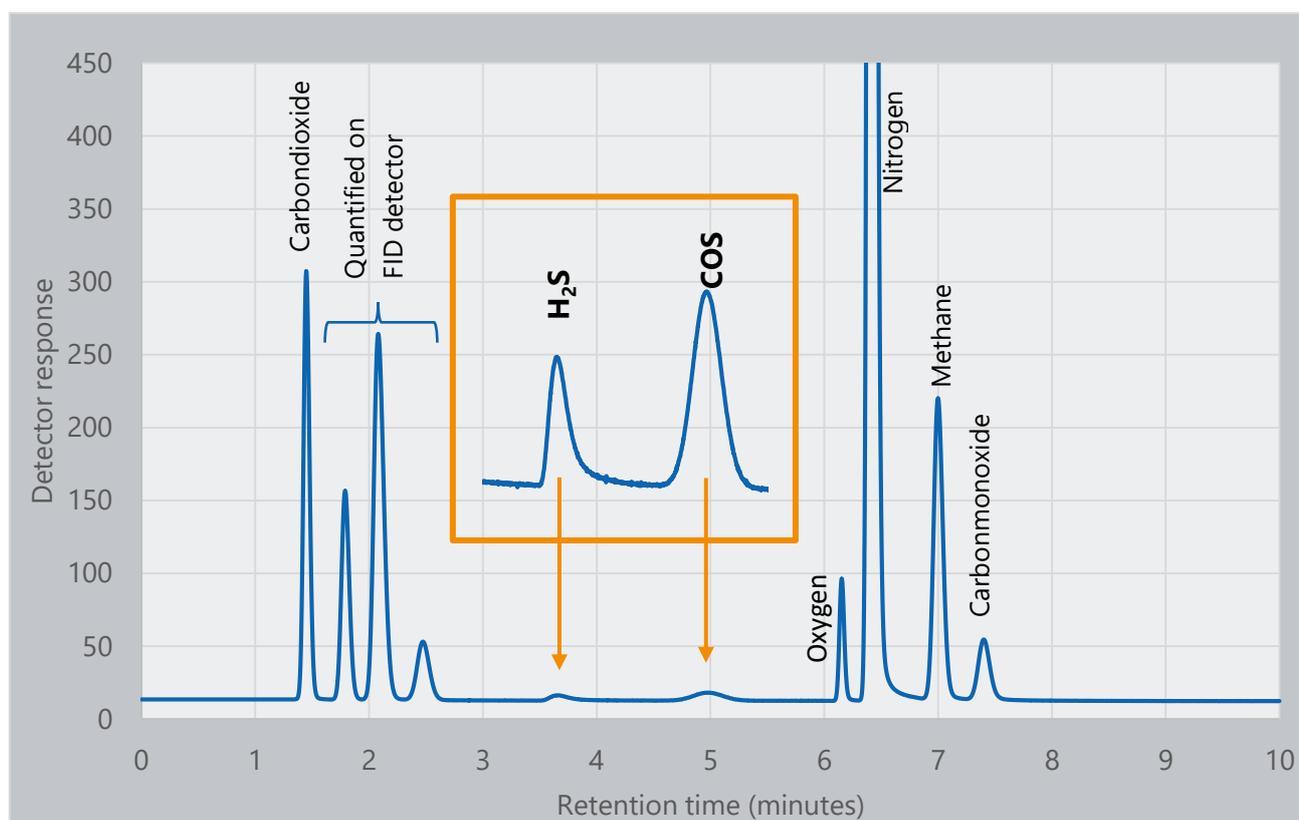


Figure 1: Chromatogram of gas containing approximately 0.2% H₂S and COS

Repeatability

Area (concentration) and retention time are the two primary measurements in gas chromatography. The precision in which they are measured ultimately determines the precision of the generated quantitative data. Retention time and area precision require that all parameters (temperature, pressure, flow, injection) are controlled to exact tolerances.

Table 1: Area and Retention time repeatability of a 0.2% H₂S and COS standard

Run #	Hydrogen sulfide		Carbonyl sulfide	
	Rt (min)	Area (0.2 mol%)	Rt (min)	Area (0.2 mol%)
1	3.661	50.6	4.984	102.7
2	3.660	53.1	5.010	102.8
3	3.664	52.1	5.010	102.9
4	3.668	53.1	5.015	102.7
5	3.668	53.0	5.014	102.1
6	3.669	53.8	5.023	104.3
7	3.665	53.2	5.028	103.2
8	3.670	52.2	5.017	102.0
Average	3.666	52.6	5.013	102.8
RSD %	0.1	1.9	0.3	0.7

Conclusion

The AC Hi-speed RGA is a versatile analyzer capable of analyzing the composition of a whole range of refinery gases, including those containing H₂S and COS at concentration levels above 0.1%. Its robust design ensures an excellent separation for all components with a superb repeatability.