Measuring H2S in Sweet Gas

Applied Analytics Application Note No. AN-036

$$H_2S\ (sol'n) + R_3N\ (sol'n) \longleftrightarrow H_2S\ (sol'n) \bullet R_3N\ (sol'n)$$

Application Summary

Analytes: **H_2S** (hydrogen sulfide)

Detector: **OMA-300 H_2S Analyzer**

Process Stream: **sweet gas**

Typical Range: **0-10 ppm**

Introduction

Removing toxic, corrosive H_2S from hydrocarbon fuels is a universal undertaking to protect environment, equipment, and humans. Myriad technologies exist for this purpose, ranging by parameters like throughput and H_2S level in the feed.

While any such removal operation can benefit from validation of the H_2S-free 'sweetened' stream, the amine scrubber is a specific technology where online H_2S measurement is highly cost-effective. In this process, an amine solution absorbs H_2S from the sour gas feed, producing a sweetened gas stream which exits the absorber.

Over time, the amine solution becomes saturated (rich) with H_2S and can no longer effectively sweeten the incoming gas. At this point, the amine needs to be sent to the regnerator to be converted back to lean amine. H_2S breakthrough in the sweet gas can result from scrubbing with a rich amine or other problems with the process. Measurement of H_2S at this sampling point is necessary to monitor breakthrough.

The OMA H_2S Analyzer provides this continuous measurement with fast response and automated reliability. This system allows the operator to maximize the amine lifetime between regeneration cycles (saving power costs of reboiling) and ensure that H_2S breakthrough is rapidly addressed.

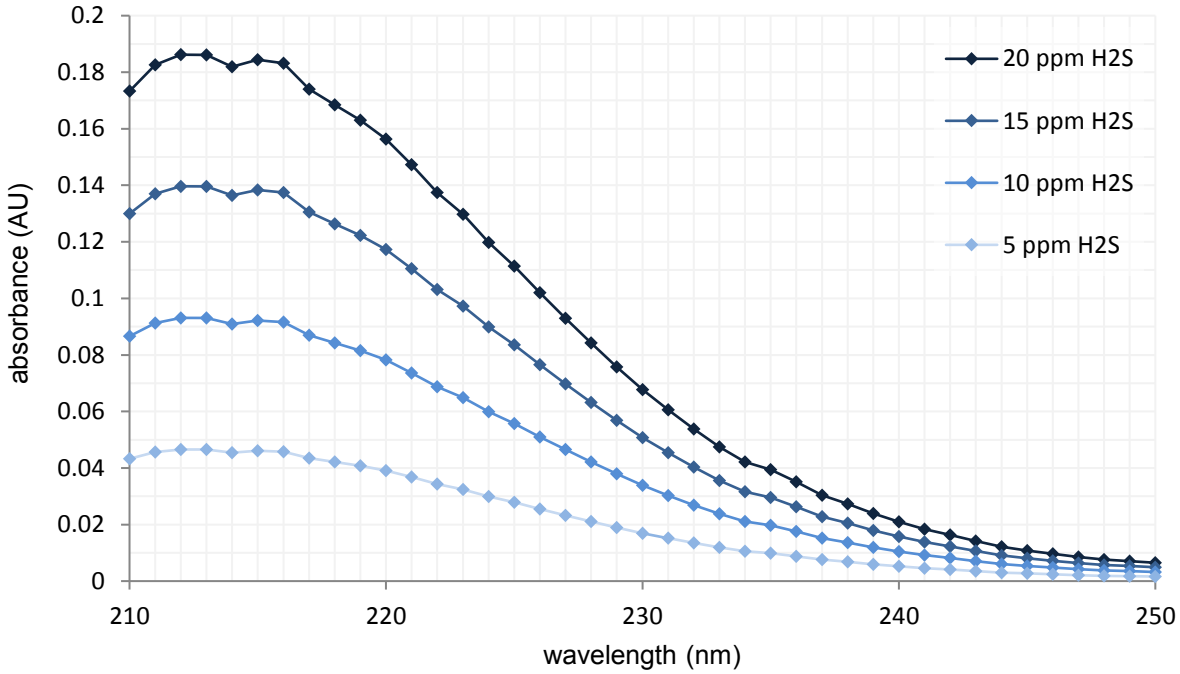
Applied Analytics also offers the OMA H_2S Analyzer for the following applications within the amine scrubber process:

- H_2S measurement in the lean amine stream from the regenerator (**Application Note No. AN-025**)
- H_2S measurement in the rich amine currently in the absorber (**Application Note No. AN-025**)
- H_2S measurement in the scrubber gas inlet for feed forward control

H_2S Absorbance Curve

Any single photodiode measurement is vulnerable to noise, signal saturation, or unexpected interference. This susceptibility to error makes a lone photodiode data point an unreliable indicator of one chemical's absorbance.

As accepted in the lab community for decades, the best way to neutralize this type of error is to use collateral data in the form of 'confirmation wavelengths,' i.e. many data points at many wavelengths instead of a single wavelength:



In the figures above, each diamond represents a single photodiode and data point. The nova II registers absorbance at each integer wavelength within the 210-250 nm measurement range and produces an H_2S absorbance curve. After being calibrated on a full spectrum of pure H_2S, the OMA knows the absorbance-concentration correlation for each measurement wavelength; the system can average the modeled concentration value from each wavelength to completely eradicate the effect of noise at any single photodiode.

The OMA visualizes the H_2S absorbance curve in this manner and knows the expected relation of each data point to the others in terms of the curve's structure. This curve analysis enables the OMA to automatically detect erroneous results at specific wavelengths, such as when a single photodiode is saturated with light. The normal photometer, with a single data point, is completely incapable of internally verifying its measurement.

Example Installation

The systems below measure H_2S at the inlet (0-5,000 ppm) and outlet (0-50 ppm) of a desulfurization process in Colombia:

The specifications below represent performance of the OMA-300 Process Analyzer in a typical scrubber application.

For technical details about the OMA-300 Process Analyzer, see the data sheet:
https://aai.solutions/documents/AA_DS001A_OMA300.pdf

All performance specifications are subject to the assumption that the sample conditioning system and unit installation are approved by Applied Analytics. For any other arrangement, please inquire directly with Sales.

Application Data		
Performance Specifications		
Accuracy	*Custom measurement ranges available; example ranges below.*	
	H_2S	0-10 ppm (@10 bar): ±0.1 ppm 0-10 ppm: ±1 ppm 0-100 ppm: ±1% full scale or 1 ppm* 0-10,000 ppm: ±1% full scale
		*Whichever is larger.

Further Reading

Subject	Location
OMA-300 H2S Analyzer Brochure	https://aai.solutions/documents/OMAH2S.pdf
OMA-300 Process Analyzer Data sheet	https://aai.solutions/documents/OMAH2S.pdf
AN-025: Lean Amine / Rich Amine Analysis Application Note	https://aai.solutions/documents/AA_AN025_Lean-Amine-Rich-Amine-Analysis.pdf
Advantage of Collateral Data Technical Note	https://aai.solutions/documents/AA_TN-202_CollateralData.pdf

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