

Measuring H₂S in Scrubber Outlet Gas

Applied Analytics Application Note No. AN-036



Application Summary

Analytes: **H₂S** (hydrogen sulfide)

Detector: **OMA-300 H₂S Analyzer**

Process Stream: **scrubber outlet gas**

Typical Range: **0-10 ppm**

Introduction

Removing toxic, corrosive H₂S 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 H₂S level in the feed.

While any such removal operation can benefit from validation of the H₂S-free 'sweetened' stream, the amine scrubber is a specific technology where online H₂S measurement is highly cost-effective. In this process, an amine solution absorbs H₂S from the sour gas feed, producing a sweetened gas stream which exits the absorber.

Over time, the amine solution becomes saturated (rich) with H₂S and can no longer effectively sweeten the incoming gas. At this point, the amine needs to be sent to the regenerator to be converted back to lean amine. H₂S breakthrough in the scrubber outlet gas can result from scrubbing with a rich amine or other problems with the process. Measurement of H₂S at this sampling point is necessary to monitor breakthrough.

The OMA H₂S 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 H₂S breakthrough is rapidly addressed.

Applied Analytics also offers the OMA H₂S Analyzer for the following applications within the amine scrubber process:

- » H₂S measurement in the lean amine stream from the regenerator ([Application Note No. AN-025](#))
- » H₂S measurement in the rich amine currently in the absorber ([Application Note No. AN-025](#))
- » H₂S measurement in the scrubber gas inlet for feed forward control

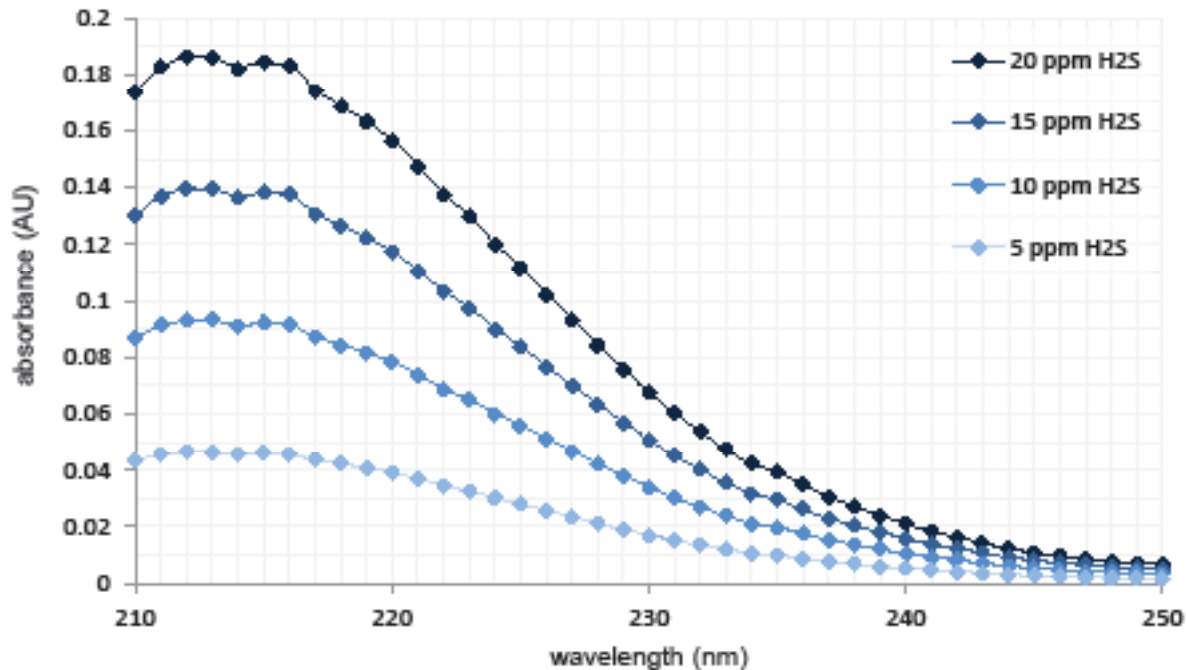
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H₂S Absorbance Curve

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 H₂S absorbance curve. After being calibrated on a full spectrum of pure H₂S, 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 H₂S 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.

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Example Installation

The systems below measure H₂S at the inlet (0-5,000 ppm) and outlet (0-50 ppm) of a desulfurization process in Colombia:



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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:

http://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.

Subject to modifications. Specified product characteristics and technical data do not serve as guarantee declarations.

Application Data					
Performance Specifications					
Accuracy	<i>Custom measurement ranges available; example ranges below.</i>				
	<table border="1"><tr><td rowspan="4">H₂S</td><td>0-10 ppm (@10 bar): ±0.1 ppm</td></tr><tr><td>0-10 ppm: ±1 ppm</td></tr><tr><td>0-100 ppm: ±1% full scale or 1 ppm*</td></tr><tr><td>0-10,000 ppm: ±1% full scale</td></tr></table>	H₂S	0-10 ppm (@10 bar): ±0.1 ppm	0-10 ppm: ±1 ppm	0-100 ppm: ±1% full scale or 1 ppm*
H₂S	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.				

Measuring H2S in Scrubber Outlet Gas

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Further Reading

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



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