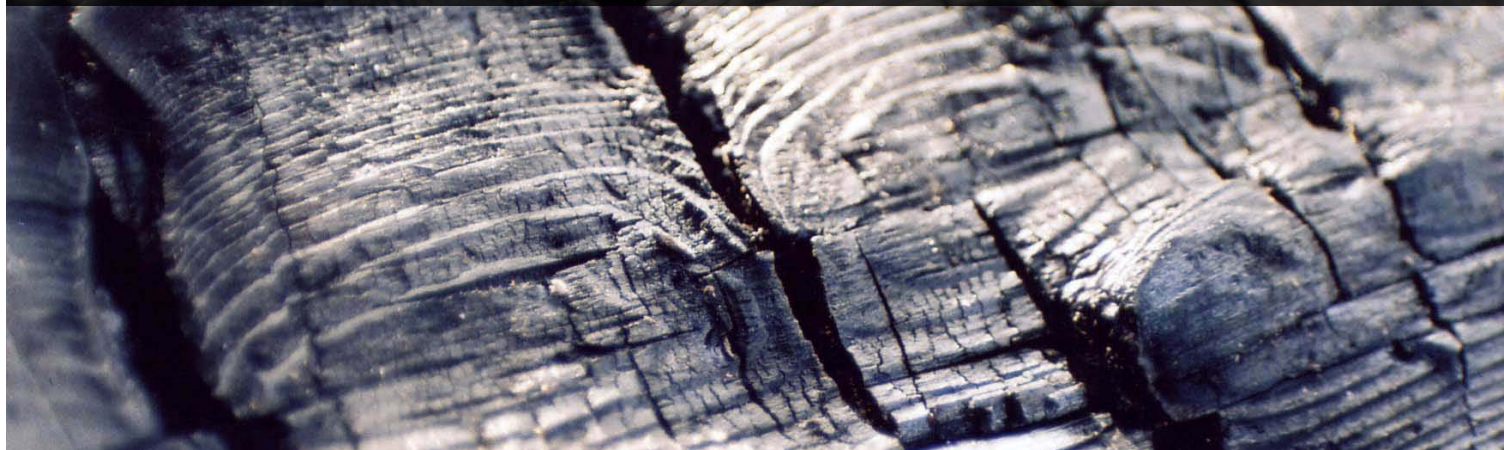# Measuring Hydrogen Sulfide in Syngas

Applied Analytics Application Note No. AN-031

## Application Summary

Analytes: **H₂S** (hydrogen sulfide)

Detector: OMA-300 H₂S Analyzer

Process Stream: syngas

## Introduction

Produced through the gasification of coal, solid waste, and various other carbon-containing feedstocks, **syngas** is important as a fuel for certain internal combustion engines as well as a raw material for the Fischer-Tropsch process, which produces synthetic liquid hydrocarbon fuels from the syngas. The composition of syngas varies widely depending on the feedstock type, but typically comprises some mixture of hydrogen, carbon monoxide, carbon dioxide, nitrogen, and methane.

The feedstock to syngas production often contains some hydrogen sulfide, especially when produced from coal or biomass. Since $H_2S$ degrades the syngas quality by making it corrosive and producing $SO_2$ emissions, $H_2S$ levels have to be carefully controlled in the syngas product. The variation in feedstock type also brings large variation in $H_2S$ loading, thus requiring a method of continuous $H_2S$ monitoring in the syngas production process.

The OMA H₂S Analyzer uses a high-resolution UV-Vis spectrophotometer to measure real-time $H_2S$ concentration in a syngas process stream. The fast response of the photometric technology combined with the transparency of the syngas background in the UV-Vis wavelength domain makes the OMA an ideal instrument for online syngas $H_2S$ analysis. This system also has additional benches available for adding analytes (e.g. COS or other sulfur compounds).

## OMA Benefits

»   Continuously measures $H_2S$ concentration in syngas using dispersive absorbance spectrophotometer

»   Syngas background ($H_2$, CO, $CO_2$, moisture) is transparent in the UV-Vis wavelength domain — no interference

»   Totally solid state build with no moving parts — modern design for low maintenance

»   Direct measurement of hot, wet, high-pressure sample with rugged sample flow cell

»   Decades of field-proven performance in crude oil analysis all over the world

**H$_2$S 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:
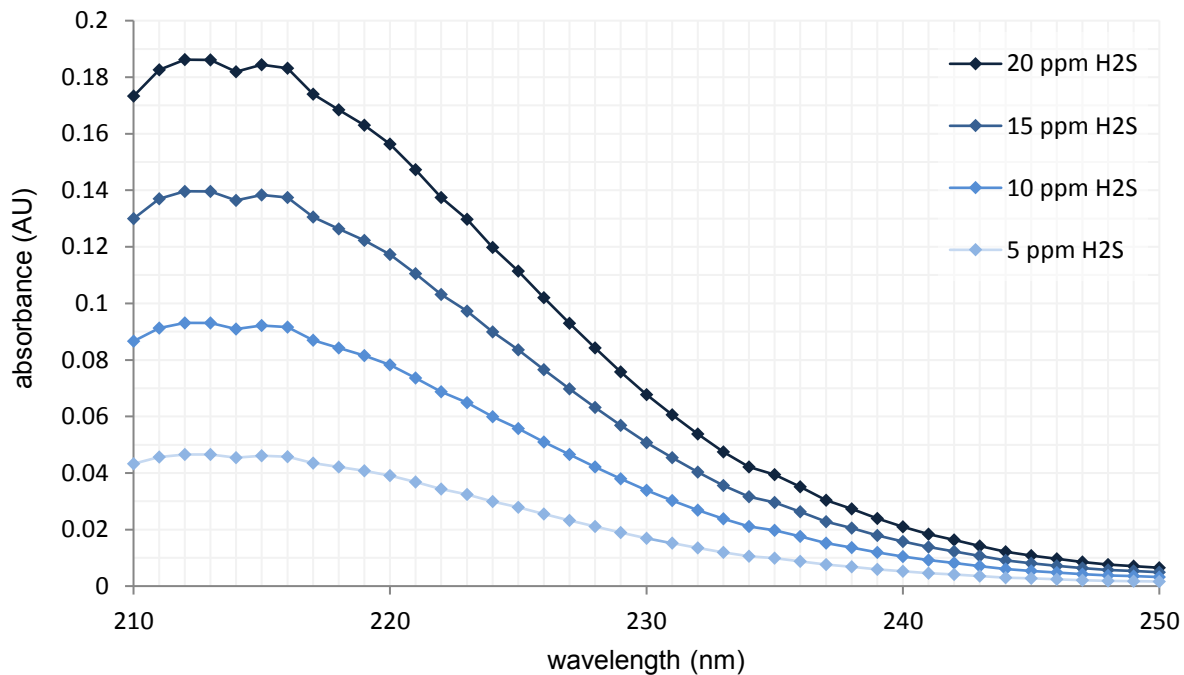


In the figures above, each diamond represents a single photodiode and data point. The nova II registers absorbance at each integer wavelength within the 210-250 nm measurement range and produces an H$_2$S absorbance curve. After being calibrated on a full spectrum of pure H$_2$S, the OMA knows the absorbance-concentration 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$_2$S 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.

# Measuring Hydrogen Sulfide in Syngas

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

For technical details about the OMA-300 Process Analyzer, see the data sheet:
http://www.a-a-inc.com/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.

<div style="writing-mode: vertical">Subject to modifications. Specified product characteristics and technical data do not serve as guarantee declarations.</div>

| Application Data | | |
|---|---|---|
| **Performance Specifications** | | |
| Accuracy | *Custom measurement ranges available; example ranges below.* | |
| | **H$_2$S** | 0-10 ppm: ±1 ppm<br>0-100 ppm: ±1% full scale or 1 ppm*<br>0-10,000 ppm: ±1% full scale |
| | | *Whichever is larger. |

**Further Reading**

| Subject | Location |
|---|---|
| OMA-300 H2S Analyzer<br>Brochure | http://www.a-a-inc.com/documents/OMAH2S.pdf |
| OMA-300 Process Analyzer<br>Data sheet | http://www.a-a-inc.com/documents/AA_DS001A_OMA300.pdf |
| Advantage of Collateral Data<br>Technical Note | http://www.a-a-inc.com/documents/AA_TN-202_CollateralData.pdf |

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**Headquarters + Manufacturing**  
Applied Analytics, Inc.  
Burlington, MA │ sales@a-a-inc.com

**North America Sales**  
Applied Analytics North America, Ltd.  
Houston, TX │ sales@appliedanalytics.us

**Europe Sales**  
Applied Analytics Europe, SpA  
Milan, Italy │ sales@appliedanalytics.eu

**Asia Pacific Sales**  
Applied Analytics Asia Pte. Ltd.  
Singapore │ sales@appliedanalytics.com.sg

**Middle East Sales**  
Applied Analytics Middle East (FZE)  
Sharjah, UAE │ sales@appliedanalytics.ae

**Brazil Sales**  
Applied Analytics do Brasil  
Rio de Janeiro, Brazil │ sales@aadbl.com.br

**India Sales**  
Applied Analytics (India) Pte. Ltd.  
Mumbai, India │ sales@appliedanalytics.in