

Measuring H₂S in Water

Applied Analytics Application Note No. AN-034

Application Summary

Analytes: **H₂S** (hydrogen sulfide)

Detector: **OMA-300 H₂S Analyzer**

Process Stream: **water**

Introduction

H₂S-in-water is a broad category of measurement applications ranging from petrochemical cooling water to residential water supply. As one of the most toxic chemicals known to man (with adverse health effects beginning at 20 mg/L) and a precursor to acid rain, H₂S is always an environmental concern when allowed to accumulate in water bodies. In industrial processes, the corrosive effects of H₂S in water often require control at much lower concentrations in order to protect equipment.

Providing direct, continuous analysis of H₂S concentration in liquid water, the OMA H₂S in Water Analyzer is a trusted solution for these applications. Utilizing a UV-Vis dispersive spectrophotometer, the OMA measures the absorbance curve of H₂S with no sensitivity to the water background, as water has no absorbance in the UV wavelength domain.

OMA Benefits

- » Measures real-time H₂S concentration in a continuously drawn water sample
- » Direct analysis of water in liquid phase
- » Totally solid state build with no moving parts — modern design for low maintenance
- » Auto Zero normalizes reading on current background water spectrum — no re-calibration ever required
- » None of the hassles of paper tape: no consumables, no drive jamming, no sample dilutions for high range

Measuring H₂S in Water

Applied Analytics Application Note No. AN-034

OMA vs. Paper Tape

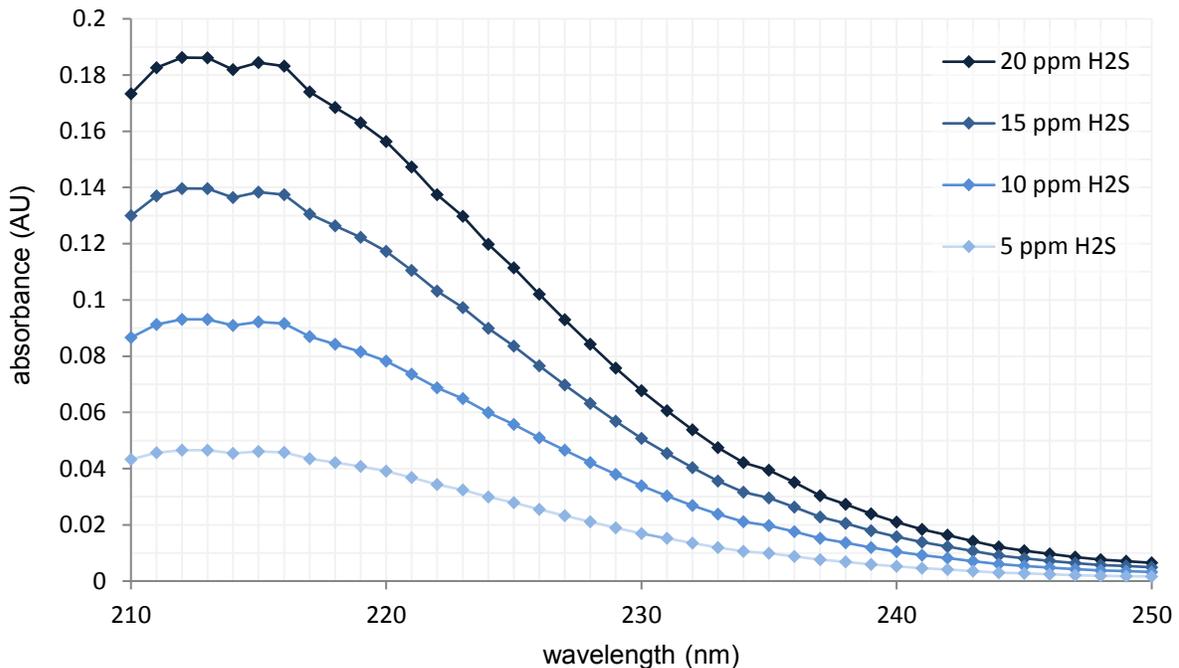
Lead acetate tape is a sensing mechanism developed in the 1940's which is still used commonly today, despite its many inconveniences and archaic design. The primary drawbacks reported by our customers who replaced these devices include: slow response (up to 3 minutes), tape drive jamming, monthly tape replacement and special disposal.

Paper tape is particularly unsuitable for water analysis because these systems cannot perform direct analysis of liquid water — they absolutely require the H₂S to be stripped into the gas phase for analysis. By comparison, the OMA only needs a headspace sample conditioner if the water is particularly opaque. For a typical H₂S-in-water application, the OMA provides a much simpler and less expensive solution than paper tape.

H₂S Absorbance Curve and OMA Calibration

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 OMA measures 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.

Measuring H₂S in Water

Applied Analytics Application Note No. AN-034

Experienced Applications for the OMA H₂S in Water Analyzer

» COOLING WATER

The enormous amount of water consumed by oil refining operations is mostly used for cooling purposes, where heat exchangers transfer the heat from a fuel process stream to the colder water. These heat exchangers have to withstand heavy throughput and eventually suffer leaks.

The presence of H₂S in the cooling water is a strong indication of a heat exchanger leak. Fast detection of the leak alerts the operator when to switch to an alternate heat exchanger and/or perform maintenance on the leaking heat exchanger.

Using the OMA H₂S in Water Analyzer, the refinery can optimize time between heat exchanger maintenance through continuous online monitoring of H₂S leaks into the cooling water stream. Easily configurable 4-20 mA alarms and set-and-forget operation make the OMA highly suitable for this application.

» DRINKING WATER SUPPLY

Depending on the source of the local drinking water, there may be a significant level of 'total sulfide' (H₂S and HS⁻) present. H₂S has adverse health effects at levels above 20 mg/L but has an unpleasant odor even at ppb levels, making any amount of H₂S highly undesirable in drinking water. Water plant managers use methods including air stripping and chlorine injection to remove H₂S and meet quality standards, but a method of total sulfide monitoring in the cleaned water is needed to optimize chlorine usage and verify water safety.

The OMA H₂S in Water Analyzer measures low ppm levels of both H₂S and HS⁻ simultaneously in drinking water. At a pH of 7.0, almost half of the H₂S exists as the HS⁻ ion, so this multi-component capability is critical for an accurate reading of total sulfide.

» STRIPPED SOUR WATER

In a refinery, sour water must be cleaned of its sulfide content before being recycled or released to the environment. This cleaning process is known as "stripping" because it flows gas (air or steam) through the sour water to strip H₂S and NH₃ out of the water. To verify that the sour water is being effectively stripped, online analysis is required in the stripped water stream.

Sour water is often too opaque to transmit a light signal, thus requiring the headspace sampling system to strip the analyte chemicals out of the liquid and into a gas phase sample. The OMA H₂S in Water Analyzer measures H₂S (and optionally, NH₃) in the headspace gas of the stripped sour water and performs an extremely accurate correlation to the concentration(s) in liquid.

Read more in [Application Note AN-027: Stripped Sour Water](#)

Measuring H₂S in Water

Applied Analytics Application Note No. AN-034

Example Sample Conditioner for H₂S in Water

The system pictured below was installed with an OMA-300 analyzer to monitor H₂S (0-5 mg/L) and sulfide ions (0-5 mg/L) in a basal water treatment process in Alberta, Canada.



Measuring H₂S in Water

Applied Analytics Application Note No. AN-034

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

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>	
	H₂S	0-10 ppm: ±0.5 ppm 0-100 ppm: ±1% full scale or 0.5 ppm* 0-10,000 ppm: ±1% full scale
		*Whichever is larger.

Measuring H₂S in Water

Applied Analytics Application Note No. AN-034

Revised 04 February 2020

Further Reading

Subject	Location
OMA-300 H ₂ S Analyzer Brochure	https://aai.solutions/documents/OMAH2S.pdf
OMA-300 Process Analyzer Data sheet	https://aai.solutions/documents/AA_DS001A_OMA300.pdf
Advantage of Collateral Data Technical Note	https://aai.solutions/documents/AA_TN-202_CollateralData.pdf
Multi-Component Analysis Technical Note	https://aai.solutions/documents/AA_TN-203_MultiComponentAnalysis.pdf



is a registered trademark of Applied Analytics, Inc. | www.aai.solutions

Headquarters

Applied Analytics, Inc.
Burlington, MA, USA
sales@aai.solutions

North America Sales

Applied Analytics North America, Ltd.
Houston, TX, USA
sales@appliedanalytics.us

Brazil Sales

Applied Analytics do Brasil
Rio de Janeiro, Brazil
vendas@aadbl.com.br

Europe Sales

Applied Analytics Europe, AG
Genève, Switzerland
sales@appliedanalytics.eu

Middle East Sales

Applied Analytics Oil & Gas Operations, L.L.C.
sales@appliedanalytics.ae

India Sales

Applied Analytics (India) Pte. Ltd.
sales@appliedanalytics.in

Asia Pacific Sales

Applied Analytics Asia Pte. Ltd.
Singapore
sales@appliedanalytics.com.sg

China Sales

Applied Analytics China Limited
China
sales@appliedanalytics.cn

© 2020 Applied Analytics, Inc. Products or references stated may be trademarks or registered trademarks of their respective owners. All rights reserved. We reserve the right to make technical changes or modify this document without prior notice. Regarding purchase orders, agreed-upon details shall prevail.