Measuring Sulfides in Brewery Bottling Gas

Applied Analytics Application Note No. AN-013

Application Summary

Analytes: sulfides (e.g. hydrogen sulfide)

Detector: OMA-300 H_2S Analyzer

Process Stream: recycled CO_2 stream

Introduction

Prior to filling, beer bottles are purged with CO_2 to remove air and protect the taste against oxidation. In the fermentation process, yeast consumes sugar and expels a large amount of CO_2 which can be "reclaimed" and used for this bottle purging purpose. Unfortunately, fermentation often also produces toxic, odorous sulfides which can foam up into the piping and contaminate the reclaimed CO_2.

In order to continue using the great resource of CO_2 byproduct yet avoid contaminating the bottled beer with foul-smelling toxins, the reclaimed gas is run through sulfide removal skids. However, sulfide breakthrough can occur if the gas does not spend enough time in the scrubber. Employees are sometimes tasked with sniff-testing the reclaimed CO_2, but this is an unhealthy practice and is too discrete to vigilantly prevent product contamination.

An automatic, continuous analysis solution is required in order to immediately divert contaminated CO_2 from use in bottling as well as provide feedback control for the sulfur removal processing time.

Monitoring Sulfides in Multiple Streams by the OMA

The OMA system is used to continuously measure concentrations of hydrogen sulfide (H_2S) and dimethyl sulfide (DMS) in the fermentation byproduct gas. This system uses a full-spectrum UV-Vis spectrophotometer to detect the absorbance of sulfides in the reclaimed CO_2 stream, an ideal method as CO_2 has zero absorbance in the UV spectrum. The OMA provides fast-response alarms to high-concentration threshold which allows immediate diversion of contaminated CO_2.

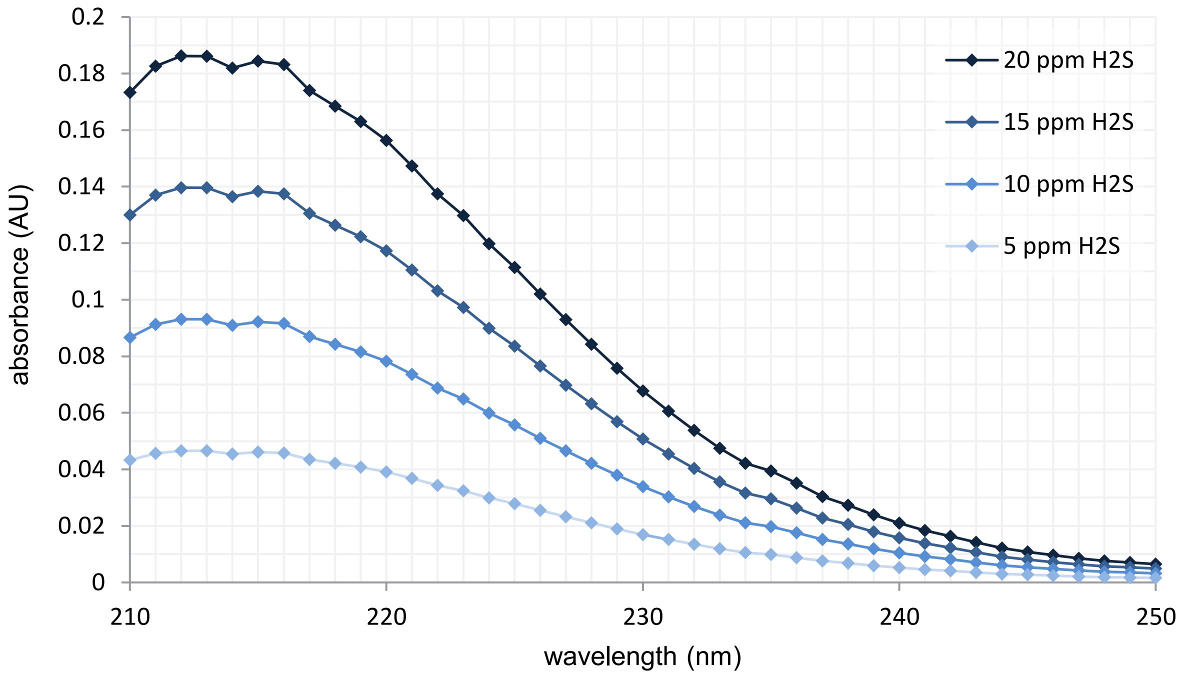
For this application, the OMA is typically multiplexed to automatically cycle analysis between multiple sampling points. This maximizes system value by allowing one unit to monitor the raw fermentation gas entering the reclamation system, gas coming off the acid aldehyde scrubbers, and the bottling gas coming off of the sulfur removal beds -- all with sample stream switching at user-defined intervals.

Using the OMA system, a brewery enables intelligent CO_2 reclamation which continuously prevents sulfide contamination of the beer product.

H_2S Absorbance Spectrum

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:

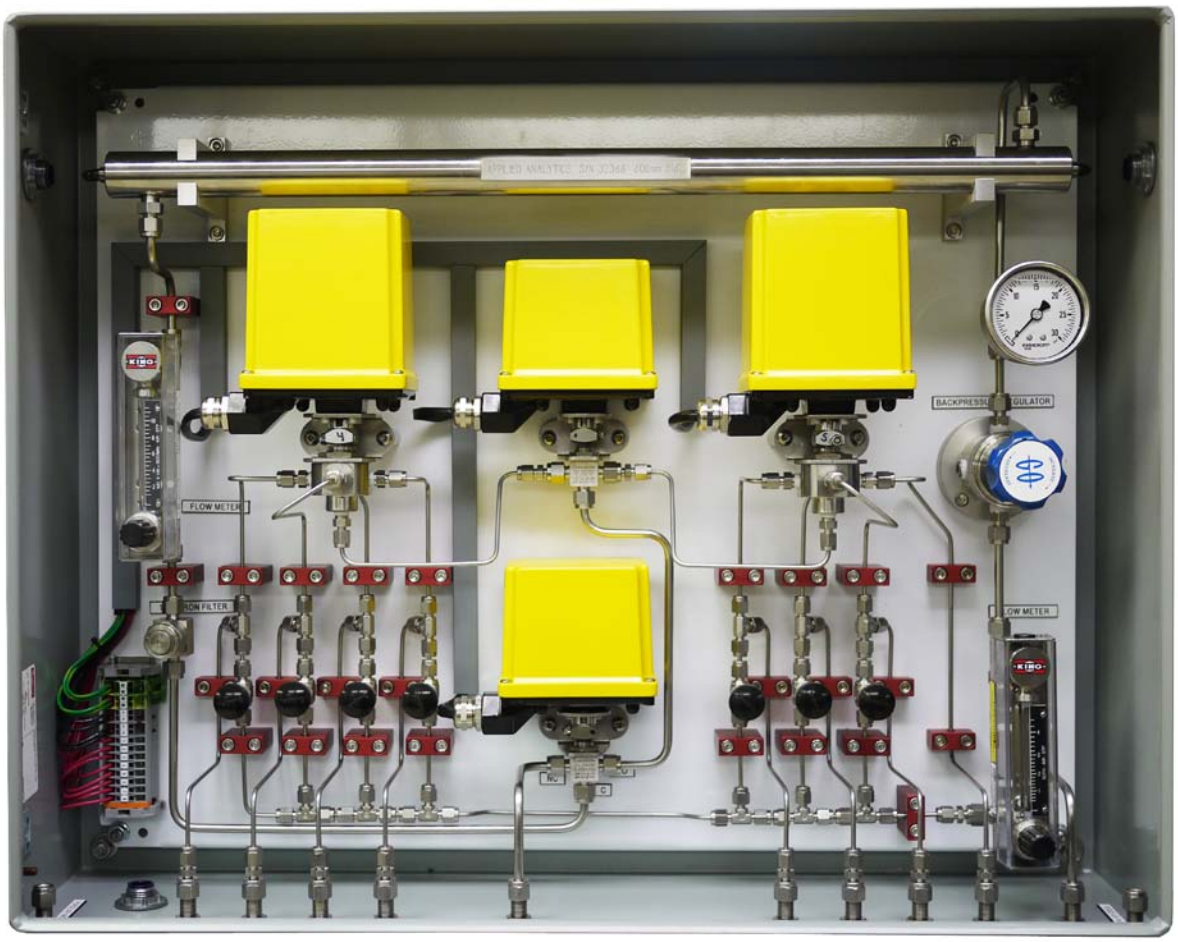


In the figures above, each diamond represents a single photodiode and data point. The nova II registers absorbance at each integer wavelength within the 215-235 nm measurement range and produces an H_2S absorbance curve. After being calibrated on a full spectrum of pure H_2S, the OMA knows the absorbance-concentration 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 Sample Conditioner

The system pictured below was designed for multiplexing an OMA to monitor 7 streams with one unit. On a set timing sequence, the system physically switches which sample stream is permitted to enter the flow cell. This type of design maximizes the system value by measuring sulfides before and after cleaning operations to provide rich breakthrough data.



Measuring Sulfides in Brewery Bottling Gas

Applied Analytics Application Note No. AN-013

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

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 bar): ±1 ppm 0-100 ppm: ±1% full scale or 1 ppm* 0-10,000 ppm: ±1% full scale 0-100%: ±1% full scale
	*Whichever is larger.	

Further Reading

Subject	Location
OMA-300 H2S Analyzer Brochure	http://www.a-a-inc.com/documents/OMAH2S.pdf
OMA-300 Process Analyzer Data sheet	http://www.a-a-inc.com/documents/AA_DS001A_OMA300.pdf
Advantage of Collateral Data Technical Note	http://www.a-a-inc.com/documents/AA_TN-202_CollateralData.pdf
Multi-Component Analysis Technical Note	http://www.a-a-inc.com/documents/AA_TN-203_MultiComponentAnalysis.pdf

APPLIED ANALYTICS™ is a registered trademark of Applied Analytics Group BV. | www.a-a-inc.com

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