

Detection of hydrogen sulfide using a spectrometer



Overview

Hydrogen sulfide (H_2S) is a gaseous signaling molecule that plays critical roles in numerous physiological and pathological processes, including plant stress responses.

Key Takeaways

Hydrogen sulfide spectrometers are specialized instruments designed to detect and measure H_2S concentrations in gas streams with high precision, using technologies such as tunable diode laser spectroscopy, cavity ring-down spectroscopy, and UV photometry.

Types of H_2

S Spectrometers

Tunable Diode Laser (TDL) Spectrometers TDL spectrometers, such as the GPro 500 and nanoplus lasers, use a laser tuned to specific absorption lines of H_2S to measure its concentration directly in situ. These analyzers offer fast, precise, and maintenance-light operation, often without the need for gas extraction or conditioning systems, making them ideal for harsh industrial environments like catalytic reformers and coke oven gas operations. They can achieve parts-per-billion (ppb) sensitivity and provide real-time monitoring with predictive diagnostics for maintenance.

Cavity Ring-

Down Spectroscopy (CRDS) CRDS analyzers are designed for ultrasensitive detection of H₂S at trace levels, down to a few ppb. They use a high-finesse optical cavity to measure the decay of laser light, allowing extremely precise quantification.

Modern CRD

S systems incorporate digital locking circuits for laser-cavity mode matching, achieving detection limits as low as 2 ppb and high signal-to-noise ratios, suitable for environmental monitoring, industrial safety, and biomedical applications.

UV Photometric Analyzers The AMETE

K 931 is an example of a UV photometric H₂S analyzer. It uses a single ultraviolet component with a fixed optical configuration and pulsed UV lamps to measure H₂S concentrations. This design provides robust, low-maintenance operation with high linearity and resolution, suitable for sulfur recovery, sour gas pipelines, and hydrocarbon processing.

Key Features and Advantages
In-situ measurement: Many TDL and CRDS analyzers operate directly in the gas stream, providing rapid response without sample extraction. High sensitivity: CRDS and TDL systems can detect H₂S at ppb levels, critical for safety, environmental monitoring, and biomedical diagnostics. Low maintenance: Alignment-free TDL analyzers and UV photometric systems reduce downtime and operating costs.

Configurable and versatile: Spectrometers can be adapted to different process conditions, including high temperatures, corrosive gases, and variable flow rates.

Predictive diagnostics: Intelligent Sensor Management (ISM) in some TDL analyzers provides alerts for cleaning or maintenance, enhancing reliability.

Applications

Industrial safety: Monitoring H₂S in natural gas, oil and gas processing, and low-NO_x combustion systems. Environmental monitoring: Detecting trace H₂S emissions to comply with air quality regulations. Energy infrastructure: Early detection of H₂S as a decomposition byproduct in SF₆-insulated high-voltage equipment.

Biomedical diagnostics: Measuring H₂S in exhaled breath as a biomarker for pulmonary diseases. Corrosion prevention: Continuous monitoring in chlorine compressors and other sensitive equipment. Hydrogen sulfide spectrometers provide reliable, precise, and rapid detection across a wide range of concentrations and environments, making them essential tools for industrial, environmental, and biomedical applications.

Article Content

Visualizing hydrogen sulfide dynamics in crop roots under heavy metal ...

Hydrogen sulfide (H_2S) is a gaseous signaling molecule that plays critical roles in numerous physiological and pathological processes, including plant stress responses. Effective fluorescent

Development of an assay for colorimetric and fluorometric detection of ...

In this research, we developed some colorimetric and fluorometric chemosensors and established an assay for the easy detection of H_2S following a specific mechanism. The sensing

Parts-per-Billion Detection of Hydrogen Sulfide via Cavity Ring ...

This system demonstrates rapid and precise hydrogen sulfide (H_2S) detection capability at parts-per-billion (ppb) concentration levels. Compared to traditional wavelength meters, our

Real-time methods of hydrogen sulfide detection

The reviewed papers focused on the elemental basis of the devices that, thanks to the development of microelectromechanics and nanotechnology, can be used for problems of control

Real-time methods of hydrogen sulfide detection

Out of the sensors based on non-optical methods, this paper considers semiconductor, electrochemical sensors, bio-sensors, sensors based on surface acoustic waves (SAWs) as the most common for the

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Fluorescent detection of hydrogen sulfide (H_2S) through the formation ...

Herein, we present a new quantification method based on the formation of pyrene excimers in solution.

Sensitive Detection of Various Forms of Hydrogen Sulfide via Highly ...

Herein, we report on a pro-fluorescent probe, NAP-Py-N 3 based on naphthalimide derivative, which was found to show high selectivity toward H_2S over various other analytes, including biothiols,

A Comparative Guide to Electrochemical and Spectroscopic Methods

This guide provides an objective comparison of two major analytical techniques for sulfide detection: electrochemical and spectroscopic methods.

Naked eye detection of arsenite, arsenate, and H₂S by a Schiff base ...

Considering the significant toxicity of arsenite (AsO₃²⁻), arsenate (AsO₄³⁻), and hydrogen sulphide (H₂S), the early detection of these ions and gas using simple methods like

A novel BODIPY-based colorimetric turn-on NIR fluorescent probe for ...

Hydrogen sulfide (H₂S) performs important effects in a great deal of physiological and pathological activities, and it is also closely associated with food spoilage in our daily life. In this

Hydrogen Sulfide | H₂S | CID 402

Hydrogen Sulfide | H₂S | CID 402 - structure, chemical names, physical and chemical properties, classification, patents, literature, biological activities, safety ...

Hydrogen Sulfide | H₂S | CID 402

Hydrogen sulfide is produced naturally by decaying organic matter and is released from sewage sludge, liquid manure, sulfur hot springs, and natural gas. ... Hydrogen sulfide is used to produce elemental

A diarylethene-functionalized fluorescent probe for distinguishable ...

Hydrogen sulfide (H₂S), as a kind of volatiles in spoiled garlicks and meats, is an indicator to determine the freshness of food [1,2]. In the bio-system, H₂S, is a kind of regulation of immune or

A systematic study of fluorescent coumarin sensors for the detection

A systematic study of fluorescent coumarin sensors for the detection of aqueous copper ions and aqueous hydrogen sulphide Samuel E. Walker a School of Chemistry, Monash University,

Gemelli Biotech's Innovative Trio-Smart® Breath Test Featured in ...

These studies used Trio-Smart®, a diagnostic 3-gas breath test developed and distributed by Gemelli Biotech that uniquely detects hydrogen sulfide, in addition to hydrogen and methane.

A novel benzothiazole-based fluorescent probe for continuous detection ...

Consequently, it is thus important to develop effective detection methods to efficiently evaluate Cu^{2+} levels in environments and biological systems. Many methods were developed for

Detection of PPB-Level H_2S Concentrations in Exhaled Breath Using

The continuous monitoring of hydrogen sulfide (H_2S) in exhaled breath enables the detection of health issues such as halitosis and gastrointestinal problems. However, H_2S sensors with high selectivity

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