

Hydrogen Sulfide in Natural Gas Product

Natural Gas Processing Plants

One of the first steps in a typical gas plant is acid gas (H_2S and CO_2) reduction and control. The Natural Gas product will typically have maximum allowable H_2S concentrations <5 ppm.

Critical Control of H_2S

There are a variety of H_2S reduction systems, some using liquid scrubbers such as amines or solvents, or fixed adsorbent beds, but the optimal operation of these systems requires an on-line measurement of the acid gas in the outlets of these systems.

Traditional Measurement Solutions

Lead Acetate Tape devices have been used for on-line H_2S analysis, but the on-going cost and maintenance effort of replacing the tapes is high. Moreover, many regard the Lead Acetate tape to be a hazardous material with associated handling and disposal problems. On-line gas chromatographs are another method widely used for monitoring the levels of H_2S . Unfortunately, even with the latest in chromatography techniques, the analysis can take 3-6 minutes between measurement updates. Due to rapid changes in the acid gas concentration, this delay may not be acceptable. Gas chromatographs consume carrier and flame fuel cylinder gases, as well as requiring sulfur-free air for flame photometric detectors, so the consumable costs of GC's are high. Spectroscopic methods using broadband light sources and narrow band pass filters are prone to interferences from changing background concentration.

SpectraSensors' Solution

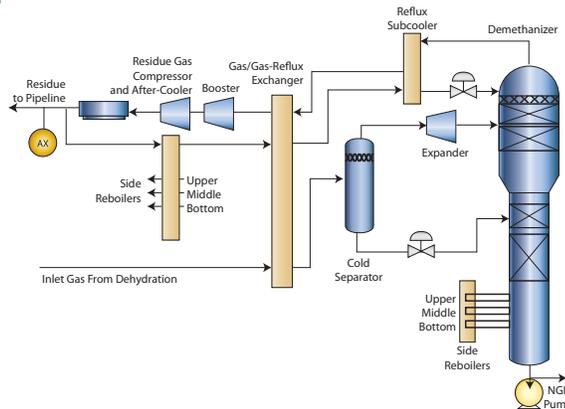
The SpectraSensors TDL analyzer offers a new solution to this control measurement. There are no cylinder gases or Lead Acetate tapes to replace on a routine basis, so the analyzer is very low maintenance and has a low cost of ownership over the life of the analyzer. The high resolution that is inherent to TDL technology eliminates errors due to interferences that have hampered other spectrometric approaches.

Only SpectraSensors employs Differential Spectroscopy to cope with the changes in background spectrum of the sample caused by changing operating conditions and feedstocks. The sample gas is passed through a copper nanoparticle scrubber to remove H_2S , and the spectrum of the H_2S -free sample is measured. The scrubber is then bypassed to measure the raw sample with H_2S , and the H_2S is measured by spectral subtraction. As the H_2S -free background spectrum can be applied repeatedly to the sample, the scrubber is only used as needed, controlled by logic in the electronic controller. The scrubber lifetime in normal service is a minimum of 18 months, so consumable costs and maintenance are low. Tunable Diode Laser technology means that analysis is fast; results can be updated every second if desired.

Validation

SpectraSensors analyzers require no calibration in the field and the calibration is stable for the life of the analyzer, however, validation of trace H_2S concentration is essential. At the SSI factory, the calibration is done by mixing certified blends of H_2S at fairly high concentrations with pure gases through NIST-traceable mass flow controllers.

In the Field, the analyzer can be validated by using a certified blend of H_2S in a background of Methane, available from a number of reliable specialty gas blenders.



KEY POINTS

- No cylinder gases or Lead Acetate Tapes – Virtually Maintenance Free
- Tunable Diode Laser and Detector are isolated from the process Gas – No damage for process contaminants
- Fast – Responds to changes in H_2S concentration in minutes
- Uses high resolution TDL technology – No interference from other compounds

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Application Data

Target Components	H ₂ S in Natural Gas Product (Residue Gas)
Typical Measurement Ranges	0-5 ppm, 0-10 ppm or 0-20 ppm
Typical Repeatability	±0.5 ppm
Measurement Response Time	1 to ~60 seconds*
Principle of Measurement	Differential Tunable Diode Laser Absorption Spectroscopy (H ₂ S scrubber included)
Validation	Certified blend of H ₂ S in Methane balance

*Application specific; consult factory.

Typical Background Stream Composition

Component	Minimum (Mole %)	Typical (Mole %)	Maximum (Mole %)
Hydrogen Sulfide	0	<2 ppm	10 ppm
Water	0	<1 ppm	10 ppm
Nitrogen	0	0.1	3
Oxygen	0	0	1
Methane	75	95	100
Carbon Dioxide	0	0	3
Ethane	0	3	10
Propane	0	1	5
Butanes	0	0.5	2
C5+	0	0.4	0.5

The background stream composition must be specified for proper calibration and measurement performance. Specify the Normal composition, along with the minimum and maximum expected values for each component, especially H₂S, the measured component. Other stream compositions may be allowable with approval from SpectraSensors.