

Application Note

Hydrogen sulfide in solid scavenger vessel outlet

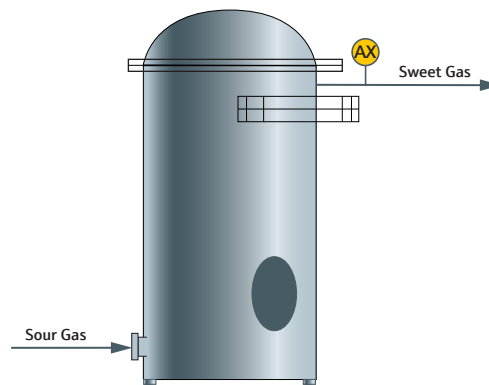
Industry:
Natural Gas Processing
Application Note 34602

Key Points

- Fast response to H₂S concentration changes
- Laser-based measurement is highly selective and accurate for H₂S in natural gas
- Patented* Differential Spectroscopy technique measures H₂S at low ppm levels in natural gas
- Low maintenance and OPEX costs – no cylinders of carrier and combustion gases, or lead acetate tape

*www.spectrasensors.com/patents

Gas sweetening using a solid scavenger Raw natural gas extracted from different geological formations contains varying amounts of acid gases (H₂S and CO₂). While amine treatment is the most widely used gas sweetening process, a solid scavenger is sometimes used to remove low to medium concentrations of H₂S and mercaptans. Iron oxide (Fe₂O₃) is one type of solid scavenger which reacts with H₂S in the gas stream to form Fe₂S₃. This process is used to remove H₂S to meet specifications for gas transmission pipelines. The maximum allowable concentration of H₂S in natural gas is typically < 5 ppm.



Solid Scavenger Vessel for H₂S Removal

On-line measurement of H₂S The solid scavenger material in the vessel must be changed out or regenerated periodically. An iron oxide scavenger bed may be regenerated using air. Monitoring the H₂S concentration in gas exiting the scavenger vessel ensures the gas meets specifications for pipeline transmission and provides an indication of scavenger condition.

SpectraSensors' solution SpectraSensors tunable diode laser absorption spectroscopy (TDLAS) analyzers have proven highly effective for this important measurement. TDLAS analyzers have an exceptionally fast response to changes in H₂S concentration, an important performance characteristic for monitoring the efficiency of the scrubbing process and quality of the resulting natural gas product. SpectraSensors patented* differential spectroscopy technique enables detection and quantitation of low ppm levels of H₂S in the outlet of a solid scavenger vessel. Laser and detector components are isolated and protected from the process gas and entrained contaminants avoiding fouling and corrosion, and ensuring stable long-term operation and accurate measurements.

Application Data

Target Component (Analyte)	H ₂ S in Solid Scavenger Vessel Outlet
Typical Measurement Ranges	0-10*, 0-20*, 0-50, 0-100 ppm _v
Typical Repeatability	±250 ppb _v or ±2% of Reading (whichever is greater)
Typical Accuracy	±500 ppb _v at 4 ppm _v or 16 ppm _v
Measurement Response Time	1 to ~60 seconds**
Principle of Measurement	Tunable Diode Laser Absorption Spectroscopy
Validation	Binary Cal Gas Bottle with Methane or Nitrogen Background (Nitrogen is optional with auto-validation)

* These low ppm measurements are performed by Differential TDLAS.

** Application specific; consult factory.

Typical Background Stream Composition

Component	Minimum (Mol%)	Typical (Mol%)	Maximum (Mol%)
Hydrogen Sulfide (H ₂ S)	0	<2 ppm	10 ppm
Water (H ₂ O)	0	50 ppm	5,000 ppm
Nitrogen (N ₂)	0	0.1	3
Oxygen (O ₂)	0	0	1
Carbon Dioxide (CO ₂)	0	1	3
Methane (C ₁)	50	95	100
Ethane (C ₂)	0	3	20
Propane (C ₃)	0	1	15
Butanes (C ₄ H ₁₀)	0	0.5	5
C ₅ +	0	0.4	2

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.

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