

Application Note

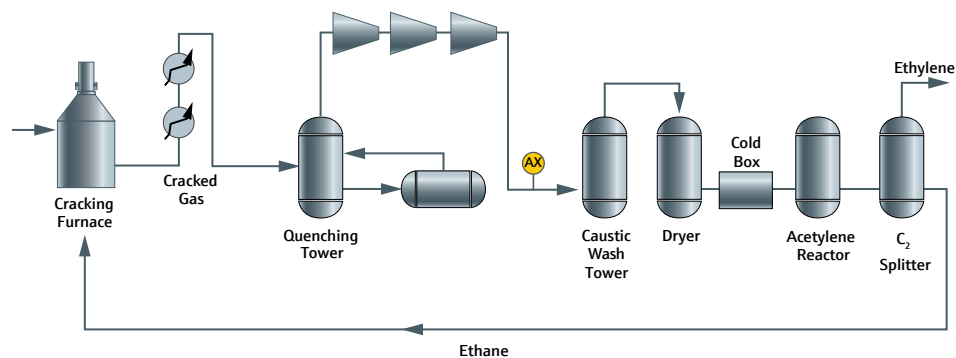
Hydrogen sulfide in caustic wash tower inlets

Industry:
Petrochemicals
Application Note 56902

Key Points

- Patented* Differential Spectroscopy technique measures H_2S at ppm levels in cracked gas
- Laser-based measurement is highly selective and accurate for H_2S in cracked gas
- Low maintenance and OPEX costs – no cylinders of carrier or combustion gases or lead acetate tape

Hydrogen sulfide in cracked gas During steam cracking of hydrocarbon feed stocks sulfur compounds present in the feed gas are converted to H_2S . Sulfiding agents added to the feed gas to passivate heating coils inside the cracking furnace to reduce coke formation also add to the amount of H_2S in cracked gas. H_2S must be removed because it is corrosive to process equipment and will poison and deactivate catalysts. Inside a caustic wash tower, cracked gas is contacted with a countercurrent stream of aqueous sodium hydroxide (NaOH) which reacts with H_2S forming sodium sulfide (Na_2S) and sodium hydrosulfate (NaHS) which are absorbed in the liquid phase. Fresh NaOH solution must be added to maintain efficiency of the H_2S scavenging reaction within the caustic wash tower.



H_2S Measurement Point at Caustic Wash Tower Inlet

Hydrogen sulfide measurement All cracked gas passes through the caustic wash tower, so maintaining H_2S scavenging efficiency directly affects plant operation. Monitoring the H_2S concentration in cracked gas entering a caustic wash tower provides information needed to control NaOH concentration and compensate for changes in H_2S loading and NaOH depletion.

SpectraSensors' solution SpectraSensors tunable diode laser absorption spectroscopy (TDLAS) analyzers have proven highly effective in this critical measurement. TDLAS analyzers have an exceptionally fast response to changes in H_2S concentration, an important performance characteristic for monitoring and controlling H_2S removal in caustic wash tower units. SpectraSensors' patented* differential spectroscopy technique enables detection and quantitation of ppm levels of H_2S in cracked gas. Laser and detector components are isolated and protected from process gas and contaminants avoiding fouling and corrosion and ensuring stable long-term operation.

*www.spectrasensors.com/patents

Application Data

Target Component (Analyte)	Hydrogen Sulfide in Caustic Wash Tower Inlets
Typical Measurement Range	0-500 ppm*
Typical Repeatability	±2% of Full Scale
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 Nitrogen balance

*Consult factory for alternate ranges.

Typical Background Stream Composition

Component	Unit	Min (Mol%)	Typical (Mol%)	Max (Mol%)
Hydrogen Sulfide (H ₂ S)	ppm _v	0	500	1000
Carbon Dioxide (CO ₂)	ppm _v	10	200	500
Hydrogen (H ₂)	mol%	15	25	30
Methane (CH ₄)	mol%	10	20	30
Ethane (C ₂ H ₆)	mol%	10	15	30
Ethylene (C ₂ H ₄)	mol%	20	25	40
Acetylene (C ₂ H ₂)	mol%	0	0.3	0.5
Propylene (C ₃ H ₆)	mol%	0	7.5	15
Propane (C ₃ H ₈)	mol%	0	7.5	150
Methyl Acetylene Propyne (C ₃ H ₄)	mol%	0	0.03	0.1
Propadiene (C ₃ H ₄)	mol%	0	0.02	0.1
Carbon Monoxide (CO)	mol%	0	0.05	0.1
Butanes (C ₄ H ₁₀)	mol%	0	0.05	0.1
Butenes (C ₄ H ₈)	mol%	0	0.3	0.5
1,3-Butadiene	mol%	0	0.5	1
C5+	mol%	0	0.1	0.5
Total	mol%		100	

The background stream composition must be specified for proper calibration and measurement performance. Specify the typical 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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