Application Note

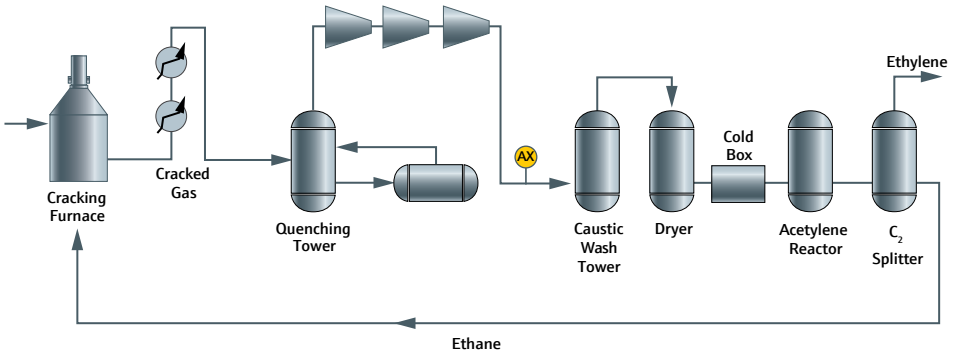
Carbon dioxide in caustic wash tower inlets

Industry:
Petrochemicals
Application Note 56203

Key Points

- Fast response to CO_2 concentration changes
- Laser-based measurement is highly selective and accurate for CO_2 in cracked gas
- Non-contact laser measurement avoids fouling and corrosion for reliable long term operation
- Low maintenance and OPEX costs – no cylinders of carrier gases or other consumables

Carbon dioxide in cracked gas Carbon dioxide is formed during steam cracking of hydrocarbon feed stocks. CO_2 must be removed from the cracked gas because it can freeze up and damage cryogenic fractionation equipment and will poison and deactivate polymerization catalysts. Inside a caustic wash tower, cracked gas is contacted with a countercurrent stream of aqueous sodium hydroxide (NaOH) which reacts with CO_2 forming sodium carbonate (Na_2CO_3) and sodium bicarbonate ($NaHCO_3$) which are absorbed in the liquid phase. Fresh NaOH solution must be added to maintain efficiency of the CO_2 scavenging reaction within the caustic wash tower.



CO_2 Measurement Point at Caustic Wash Tower Inlet

Carbon dioxide measurement All cracked gas passes through the caustic wash tower, so maintaining the scavenging efficiency of NaOH for CO_2 and H_2S directly affects plant operation. Monitoring the CO_2 concentration in cracked gas entering a caustic wash tower provides information needed to control NaOH concentration and compensate for changes in CO_2 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 CO_2 concentration, an important performance characteristic for monitoring and controlling CO_2 removal in caustic wash tower units. Laser and detector components are isolated and protected from process gas and contaminants avoiding fouling and corrosion and ensuring stable long-term operation.

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Application Data	
Target Component (Analyte)	Carbon Dioxide 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	Non-differential Tunable Diode Laser Absorption Spectroscopy
Validation	Certified blend of CO_2 in nitrogen balance

*Application specific; consult factory.

Typical Background Stream Composition

Component	Unit	Typical Concentration	Min for Application	Max for Application
Carbon Dioxide (CO_2)	ppm_v	200	10	500
Hydrogen Sulfide (H_2S)	ppm_v	500	0	1000
Hydrogen (H_2)	mol%	25	15	30
Methane (CH_4)	mol%	20	10	30
Ethane (C_2H_6)	mol%	15	10	30
Ethylene (C_2H_4)	mol%	25	20	40
Acetylene (C_2H_2)	mol%	0.3	0	0.5
Propylene (C_3H_6)	mol%	7.5	0	15
Propane (C_3H_8)	mol%	7.5	0	15
Methyl Acetylene Propyne (C_3H_4)	mol%	0.03	0	0.1
Propadiene (C_3H_4)	mol%	0.02	0	0.1
Carbon Monoxide (CO)	mol%	0.05	0	0.1
Butanes	mol%	0.05	0	0.1
Butenes	mol%	0.3	0	0.5
1,3-Butadiene	mol%	0.5	0	1
C_5+	mol%	0.1	0	0.5
Total	mol%	100		

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 CO_2, the measured component. Other stream compositions may be allowable with approval from SpectraSensors.Equem nempor ut quam terem nonstra nonsuli ampra, consulin te nicum cupienim con vit perum patia re mo ne aut consil consuspienam P.