

Application Note

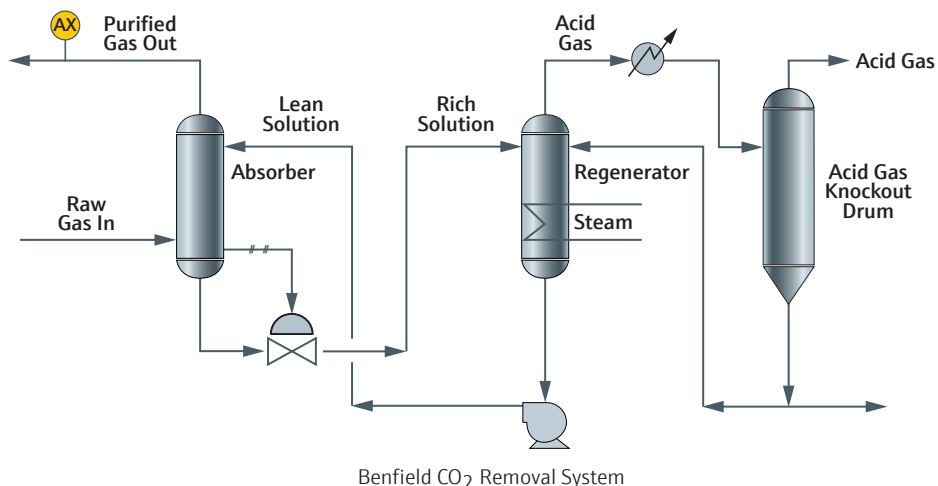
Carbon dioxide in outlet of Benfield™ absorber vessels

Industry:
Syngas/Ammonia
Application Note 65803

Key Points

- Fast response to CO₂ concentration changes
- Laser based measurement is highly selective and accurate for CO₂ in Syngas
- Non-contact laser measurement avoids fouling and corrosion for reliable long-term operation
- Low maintenance and OPEX costs – no carrier gases or consumable items

Benfield process for treating syngas The U.S. Bureau of Mines (USBM) developed the hot potassium carbonate process for removing CO₂, H₂S, and other sulfur compounds from syngas. The process was further refined and improved by Benson and Field, former USBM employees. The Benfield process is widely used in the ammonia industry to treat syngas downstream of steam reformer units. The process is also employed in some natural gas processing plants.



On-line monitoring of CO₂ In operation, feed gas is contacted with a hot potassium chloride (K₂CO₃) solution with an activator compound which removes CO₂ by chemical reaction and absorption. Measuring the CO₂ in syngas at the outlet of a Benfield absorber vessel ensures the process is operating efficiently and the treated syngas meets specifications for ammonia synthesis or other uses.

SpectraSensors' solution SpectraSensors tunable diode laser absorption spectroscopy (TDLAS) analyzers have proven highly effective for this gas processing measurement. TDLAS analyzers have an exceptionally fast response to changes in CO₂ concentration, an important performance characteristic for monitoring process efficiency and the quality of the resulting syngas. 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)	CO ₂ Outlet of Benfield Absorber Vessels
Typical Measurement Range	0-100 ppm*
Typical Repeatability	±2% of full scale*
Measurement Response Time	1 to ~60 seconds*
Principle of Measurement	Tunable Diode Laser Absorption Spectroscopy
Validation	Certified blend of CO ₂ in Nitrogen

*Consult factory for alternate ranges.

Component	Unit	Typical Concentration	Min for Application	Max for Application
Carbon Dioxide (CO ₂)	ppm _v	50	2	200
Hydrogen (H ₂)	mol%	50	35	65
Methane (CH ₄)	mol%	40	20	60
Ethane (C ₂ H ₆)	mol%	2	0	5
Ethylene (C ₂ H ₄)	mol%	2	0	5
Propylene (C ₃ H ₆)	mol%	3	0	5
Butenes (C ₄ H ₈)	mol%	2	0	5
Water (H ₂ O)	mol%	0.4	0	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 CO₂ the measured component. Other stream compositions may be allowable with approval from SpectraSensors.

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