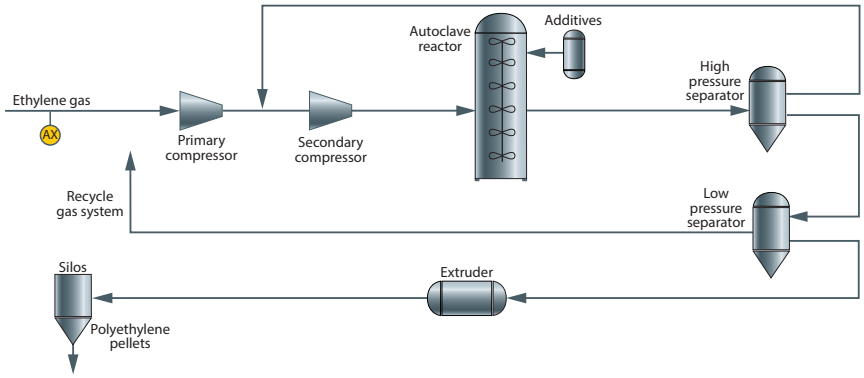
Petrochem: H_2O in pure ethylene



Low density polyethylene (LDPE) production process

Benefits at a glance

- Fast response to H_2O concentration changes
- Patented differential spectroscopy technique measures H_2O at sub-ppmv levels in ethylene
- Integrated permeation tube supports automated validation checks
- Laser-based measurement is highly selective and accurate for H_2O in ethylene

Ethylene purity

Ethylene is an important feedstock for production of polyethylene polymers and other petrochemicals. Catalysts used in LDPE, HDPE, and LLDPE polymerization processes are highly sensitive to H_2O and other contaminants that poison and reduce catalyst activity. Purity specifications for polymer-grade ethylene are very stringent. The maximum allowable H_2O concentration for some polymerization processes is 1 ppmv.

On-line H_2O measurement

Cracked gas undergoes molecular sieve dehydration before entering the acetylene converter and C_2 splitter fractionation column to separate ethylene product from ethane that is recycled back to the cracker feed stream. The ethylene product stream can pick up traces of water during transportation in pipelines and ships, or storage in salt caverns. On-line monitoring ensures the H_2O content of the pure ethylene product is within specifications for its intended use. Out-of-spec ethylene may be rejected by polyethylene producers, or sent to flare incurring high costs.

Endress+Hauser's solution

Tunable diode laser absorption spectroscopy (TDLAS) is a SpectraSensors technology that has proven highly effective for this critical measurement. TDLAS analyzers have an exceptionally fast response to changes in H_2O concentration, an important performance characteristic for monitoring ethylene purity in production plants and at custody transfer points in the feed streams to polymer plants. Endress+Hauser's patented differential spectroscopy technique enables detection and quantitation of sub-ppmv levels of H_2O in ethylene. An integrated permeation tube supports automated validation checks to verify the analyzer is operating properly during the extended periods of time when H_2O is not present in an ethylene stream. Laser and detector components are isolated and protected from process and contaminants avoiding fouling and corrosion and ensuring long term operation.

Endress+Hauser
People for Process Automation

Application data	
Target component (Analyte)	Water in pure ethylene
Typical measurement range	0-10 ppmv*
Typical repeatability	±0.050 ppmv or 2% of reading
Measurement response time	1 to ~60 seconds
Principle of measurement	Differential tunable diode laser absorption spectroscopy (TDLAS) (H_2O scrubber included)
Validation	Integrated H_2O permeation system

*Consult factory for alternate ranges.

Typical background stream composition

Component	Unit	Typical concentration	Min for application	Max for application
Ethylene (C_2H_4)	mol%	99.9	99.95	100
Acetylene (C_2H_2)	ppmv	0	<1	5
Water (H_2O)	ppmv	0	<1	5
Carbon monoxide (CO)	ppmv	0	0.5	3
Carbon dioxide (CO_2)	ppmv	0	<1	5
Hydrogen (H_2)	ppmv	0	<1	5
"Light Inerts" (C_1+C_2+N_2)	ppmv	0	100-200	1000
Propylene (C_3H_6)	ppmv	0	10	3000
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 water, the measured component. Other stream compositions may be allowable with approval from Endress+Hauser.