

Application Note

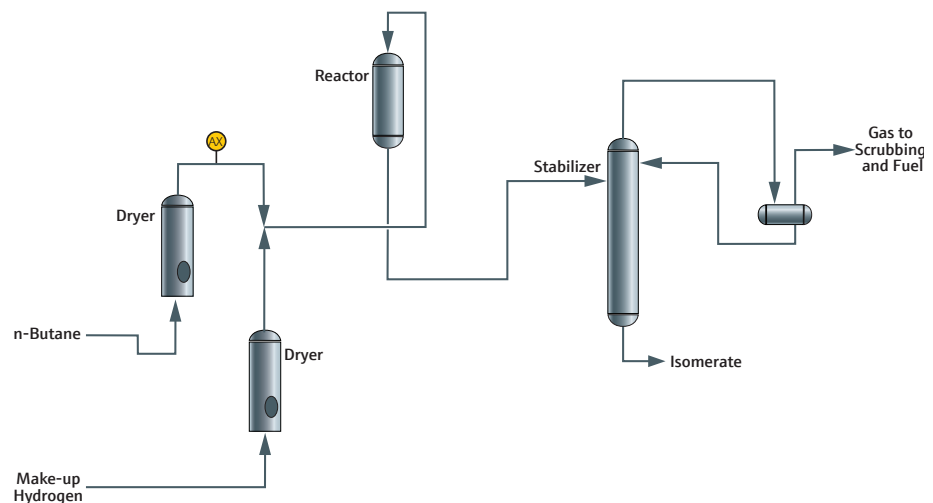
H₂O in n-Butane feed gas to UOP Butamer™ Process Reactors

Industry:
Refining
Application Note 27401

Key Points

- Exceptionally fast response to H₂O concentration changes
- Patented* Differential Spectroscopy technique measures H₂O at sub-ppm_v levels in n-Butane
- Integrated permeation tube supports automated validation checks
- Laser-based measurement is highly selective and accurate for H₂O in n-Butane

The UOP Butamer™ Process isomerizes normal butane (n-C₄) to isobutane (i-C₄). Refineries use isobutane as a feedstock for their alkylation units to produce high octane motor fuel alkylate. The catalysts used in Butamer reactors are very sensitive to contaminants (water and sulfur) in the feed gases. The n-Butane and hydrogen feed gases are passed through molecular sieve dryers to lower their moisture content to sub-ppm levels.



The UOP Butamer™ Isomerization Process

On-line H₂O monitoring The Butamer™ process utilizes high-activity chloride-alumina catalysts. Exposure to excess levels of water will permanently deactivate the catalyst by the hydroxyl group (OH⁻) of water molecules displacing the chloride activated acid sites on the catalyst. On-line monitoring of H₂O in n-Butane exiting molecular sieve dryer vessels prevents feed gas with 1 ppm or more of H₂O from entering the Butamer™ reactor and deactivating the catalyst.

SpectraSensors' solution SpectraSensors tunable diode laser absorption spectroscopy (TDLAS) analyzers have proven effective in this critical measurement. TDLAS analyzers have an exceptionally fast response to changes in H₂O concentration, an important performance characteristic for detecting breakthrough in molecular sieve dryer beds and preventing n-Butane with elevated levels of H₂O from entering a Butamer™ reactor. SpectraSensors patented* differential spectroscopy technique enables detection and quantitation of sub-ppm_v levels of H₂O in n-Butane. An integrated permeation tube supports automated validation checks to verify the analyzer is operating properly during the extended periods of time when H₂O is not present in the n-Butane feed gas.

*www.spectrasensors.com/patents

Application Data

Target Component (Analyte)	H ₂ O in n-Butane Feed to Butamer™ Reactors
Typical Measurement Range	0-5 ppm
Typical Repeatability	± 0.100 ppm
Measurement Response Time	1 to ~60 seconds
Principle of Measurement	Differential Tunable Diode Laser Absorption Spectroscopy (H ₂ O dryer included)
Validation	Integrated Permeation System

Typical Background Stream Composition

Component	Minimum (Mol%)	Typical (Mol%)	Maximum (Mol%)
n-Butane	75	82	95
i-Butane	5	15	25
i-Butylene		0.1	
Neo-Pentane		1.6	
i-Pentane		1.2	
n-Pentane		0.1	

The composition of n-Butane feed gas to Butamer™ reactors may vary. The background stream composition must be specified for proper calibration and measurement performance.

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