

Application Note

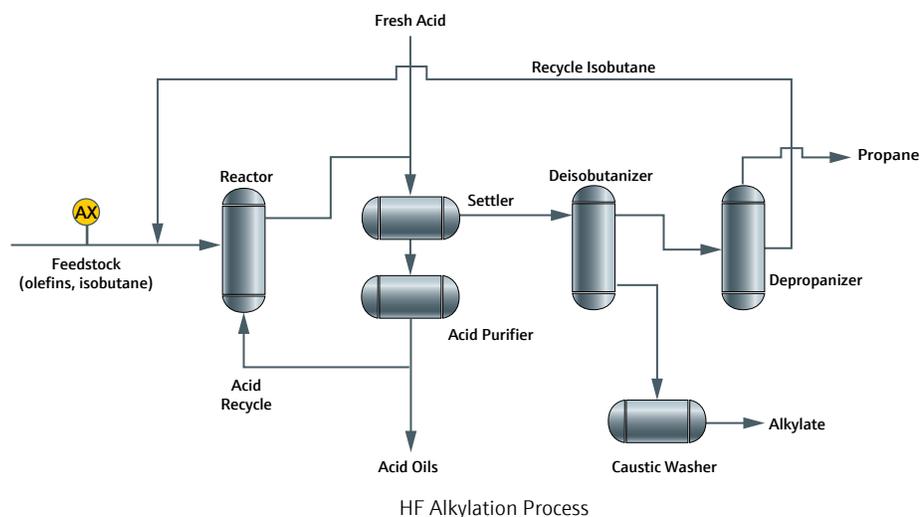
Water in HF alkylation feedstock

Industry:
Refining
Application Note 27301

Key Points

- Fast response to H₂O concentration changes
- Laser-based is highly selective and accurate for H₂O in alkylation feedstock
- Non-contact laser measurement avoids fouling and corrosion for reliable long-term operation, reducing the need for personnel to enter the HF alkylation unit area
- Automated analyzer validation minimizes personnel entry to HF alkylation unit area

HF Alkylation Alkylation is an acid-catalyzed reaction process that combines C₃ - C₅ olefins with isobutene to produce high octane fuel alkylate. Water is a contaminant that must be removed from the olefin feedstock in hydrogen fluoride (HF) alkylation units to minimize corrosion and formation of acid soluble oil and fluorinated by-products. Process efficiency and properties of the alkylate end product (octane number, vapor pressure) for gasoline blending are affected by HF acid purity and water content.



On-line H₂O monitoring Olefin feedstock from a Fluid Catalytic Cracker (FCC) is treated to remove water using cryogenic distillation and molecular sieve dehydration. The final water content of the olefin feedstock is typically in the range of 1 - 5 ppm_v. On-line monitoring of H₂O in the feedstock helps prevent excess levels of H₂O in the alkylation reactor that causes corrosive by-product formation and build-up requiring shutdown and maintenance of the alkylation unit.

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 controlling the H₂O content of feedstock entering an HF alkylation unit. The laser and detector components are isolated and protected from process gas and contaminants avoiding the fouling and corrosion that leads to frequent replacement of devices using direct contact sensors.

Application Data

Target Component (Analyte)	H ₂ O in HF Alkylation Feedstock
Typical Measurement Range	0-50 ppm*
Typical Repeatability	±1 ppm*
Measurement Response Time	1 to ~60 seconds*
Principle of Measurement	Tunable Diode Laser Absorption Spectroscopy
Validation	Certified Blend of H ₂ O in Nitrogen

*Consult factory for alternate ranges.

Typical Background Stream Composition

Component	Minimum (Mol%)	Typical (Mol%)	Maximum (Mol%)
Propylene (C ₃ H ₆)	0		25
Propane (C ₃)	0		15
Butanes (C ₄ H ₁₀)	25		85
Butenes (C ₄ H ₈)	0		70
C ₅	0		5
C ₆	0		3

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 H₂O, the measured component. Other stream compositions may be allowable with approval from SpectraSensors.

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