

## Refineries: Application Focus

### H<sub>2</sub>SO<sub>4</sub> Alkylation

#### Process Description

Olefins (C3-C4) from the FCC unit are combined with isobutane (i-C4). Concentrated Sulfuric Acid (H<sub>2</sub>SO<sub>4</sub>) is then mixed in and fed to the reactor that is operated with refrigeration to minimize formation of by-products. The alkylation reaction takes place combining the olefins with the isobutane to form the alkylate product which consists of high octane value products that are later blended into the gasoline pool. The hydrocarbons leaving the reactor mostly consist of alkylate, unreacted isobutane, n-butane, and propane.

The acid and alkylate product are separated by a settler and the acid is recovered for re-use in the reactor. The reactor hydrocarbons are separated by the main fractionator where the isobutane is recycled to the reactor, alkylate is drawn off the bottom and an n-butane product stream is separated from a side stream.

The light ends of the process fluids are used in the refrigeration loop and a side stream is passed through a propane stripper to recover propane.

Effective separation is a critical component of an efficient, reliable and safe H<sub>2</sub>SO<sub>4</sub> alkylation process.

Ensure your Alkylation unit operates reliably, with minimum corrosion, low acid consumption, and on spec products



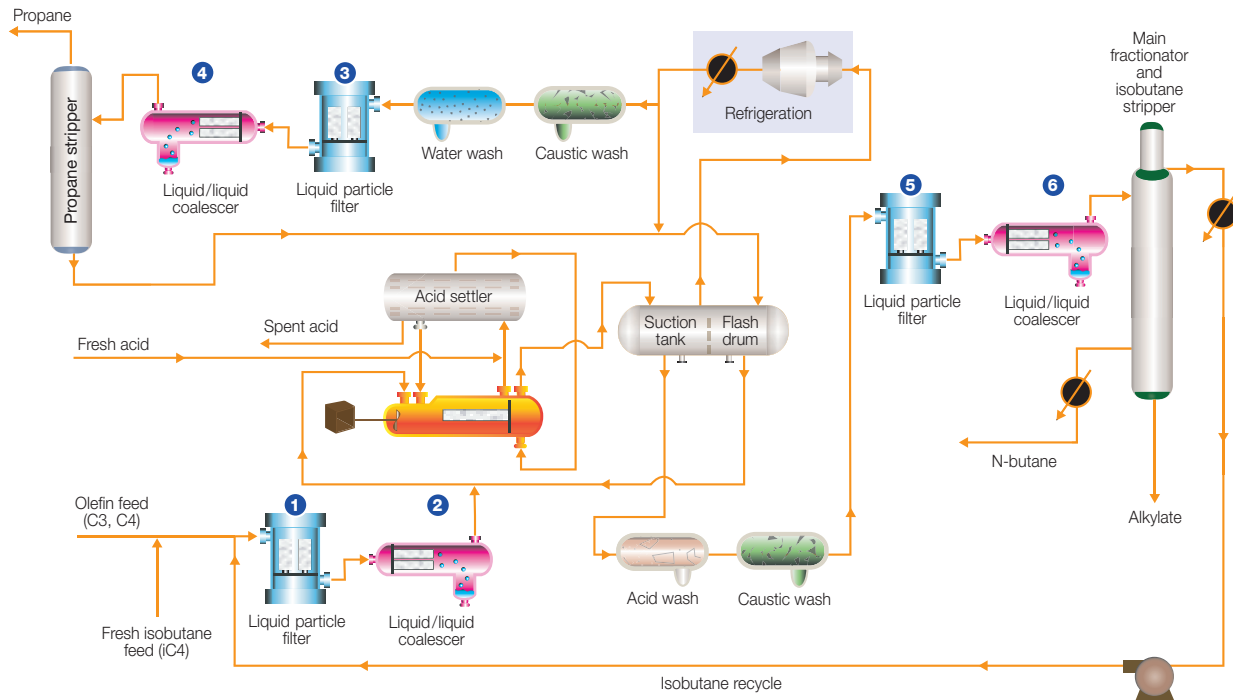
#### Refinery Needs

- Equipment reliability / minimized corrosion to meet 4-6 year refinery turn around schedule
- Meet product specs for high octane value alkylate and caustic free propane
- Low acid makeup costs by minimizing acid dilution from wet feedstocks
- Maintain high levels of safety by avoiding any equipment failures that could lead to fugitive acid emissions

#### Production Challenge/Pall Solution

Challenge	Solution
<b>Meet product specifications</b>	<p><b>Improve refinery productivity and product specifications</b> by removal of water from the olefin and isobutane hydrocarbon reactor feed streams and by removing any carryover caustic in the propane.</p> <ul style="list-style-type: none"> <li>• High efficiency AquaSep XS® and PhaseSep® liquid/liquid coalescers reliably meet 'clear and bright' product specification and sodium levels downstream.</li> </ul>
<b>Protect fractionator towers from corrosion &amp; plugging</b>	<p><b>Improve protection of main fractionator/isobutane stripper and propane stripper.</b></p> <ul style="list-style-type: none"> <li>• High efficiency PhaseSep liquid/liquid coalescers reliably remove caustic from the feed to the main fractionator / isobutane stripper and to the propane stripper tower to prevent corrosion and fouling of the internal trays.</li> </ul>
<b>Control acid makeup costs</b>	<p><b>Ensure the high sulfuric acid strength is maintained.</b></p> <ul style="list-style-type: none"> <li>• High efficiency AquaSep XS or PhaseSep liquid/liquid coalescers remove free water directly leading to acid dilution and need for replacement</li> </ul>

## Process Flow Diagram



**Note:** A representative sulfuric acid alkylation process is shown. Other specific alkylation processes exist.

### Key Applications/Filter Recommendations (*other applications not shown*)

Application	Pall Product	Advantages	Customer Benefits
1 3 5 Pre-filtration prior to liquid/liquid coalescer	Ultipleat® High Flow filter or Profile® Coreless PPS	Efficient removal of solids	Lower operating costs by improving the life of the liquid/ liquid coalescer
2 Feed/isobutane recycle stream water removal	AquaSep XS (or PhaseSep) liquid/liquid coalescer	Remove water (or caustic) from reactor feed hydrocarbons	Prevent dilution of acid catalyst and potential for corrosion and poor product yields
4 Caustic removal from feed to propane stripper	PhaseSep liquid/liquid coalescer	Remove carryover caustic	Reduce corrosion in propane stripper and meet propane quality spec
6 Caustic removal from feed to main fractionator/isobutane stripper	PhaseSep liquid/liquid coalescer	Remove carryover caustic	Reduce corrosion in main fractionator and meet butane and alkylate purity specs

#### For fast track upgrades, NO CAPEX:

**Pall-Fit filter and coalescer retrofits** enable a move to Pall quality without change to your existing filter housing

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