

## Tower Technical Bulletin

### Minimize Fouling Problems in Alkylation Columns

#### Background

Sulfuric and Hydrofluoric Acid alkylation units are both important sources of high quality gasoline for the refinery blend pool. Both processes are subject to equipment fouling from trace acid or acid by-product buildup, which can limit the unit capacity and/or alkylate quality. Fortunately, trays and vessel internals can be designed to minimize fouling problems and improve Alky unit run lengths and product quality.

#### Pre-treatment Section – Good Mixing and Good Separation Reduce Downstream Problems

Though there are various treating section configurations and designs, the main objectives hold true for all; efficiently mix the treating agent with the net effluent (which contains traces of free sulfuric acid and reaction intermediates) to maximize the contact between the two fluids and then effectively separate the two liquids. With well-mixed effluent and treating fluid, the trace acid and esters can be neutralized and removed from the hydrocarbon stream. Sulzer's SMV™ static mixers develop the optimal droplet size to improve the contact between the two fluids. The SMV mixers not only assist with neutralizing corrosive components, but also minimize the creation of small droplets, thus reducing the formation of difficult-to-separate emulsions.



Turbulent Mixing in SMV Mixer

In the downstream separator, Sulzer's Mellaplate™ separator internals have successfully been installed to improve separation between the treating agent and the neutralized effluent. Increased separation efficiency reduces the risk of water or caustic carryover to the de-isobutanizer column minimizing the chances of corrosion and fouling.

#### Design Columns to Resist Fouling Build-up

Sulfuric and HF alkylation columns are prone to fouling due to different mechanisms. In Sulfuric alkylation units, proper pretreatment minimizes the risk of fouling in columns, but many units operate at throughputs beyond original design conditions so acid by-products will end up in the columns. These cases can benefit from additional anti-fouling features designed into the column internals.

In HF alkylation units, traces of acid will react with carbon steel equipment, producing iron fluoride, a corrosion product that will deposit in calm zones of fractionator trays. Fouling can accumulate and reduce capacity over time, or severe carryover can cripple the column to a point that requires a unit shutdown.

Sulzer trays equipped with LVG™ and SVG™ large-sized fixed valves (V-Grid's) have been the industry standard in alkylation columns for more than 40 years. When sieve trays are used in fouling applications, the vapor exits the orifices vertically, allowing solids to accumulate around the orifice edge, slowly reducing the orifice size. These restricted orifices increase vapor velocity and cause entrainment of liquid onto the trays above, reducing efficiency and causing potential hydraulic problems. The elevated design of the V-Grid™ valves allow the vapor to exit laterally, continuously sweeping solids out away from the tray deck orifices.



The V-Grid valves, coupled with the additional design features of push valves and anti-fouling weirs are important components of the Sulzer VG AF™ tray design. Installations with VG AF trays have successfully reduced fouling build-up and improved column run lengths in a wide variety of process applications, including refinery alkylation unit columns.

#### The Sulzer Refinery Applications Group

Sulzer Chemtech has over 50 years of operating and design experience in refinery applications. We understand your process and your economic drivers. Sulzer has the know-how and the technology to provide a scrubber internals design with reliable, high performance.

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