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TECHNICAL ARTICLE

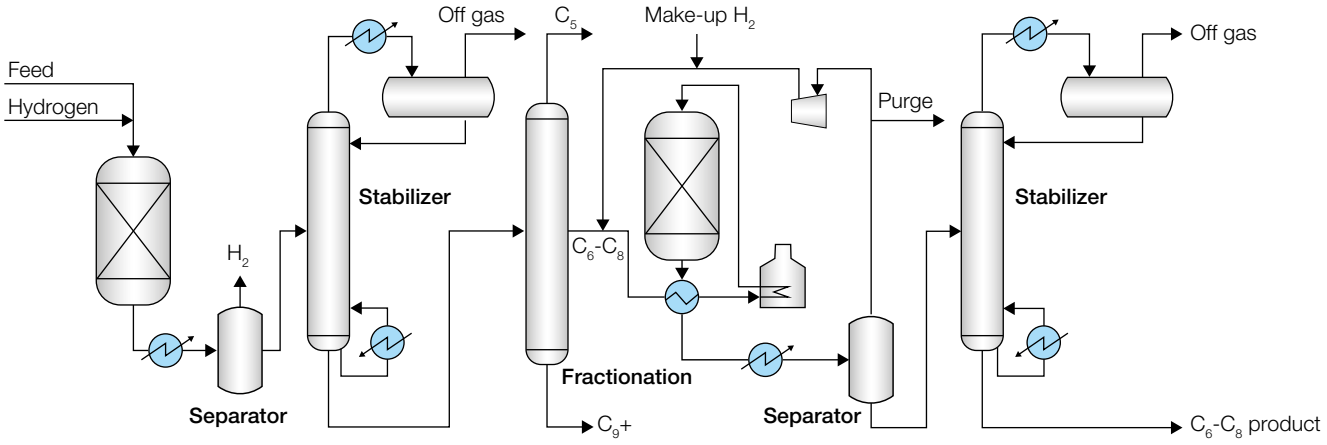
Pygas Hydrotreating technology

Sulzer Chemtech offers an optimized technology for two-stage pyrolysis gasoline (pygas) hydrotreatment, where di-olefins, olefins and styrene in the raw pygas feed is being saturated. The technology is simple and easy to implement into existing plant requirements. The process is applied to the C5+ fraction of raw pyrolysis gasoline.

In Sulzer Chemtech's pyrolysis hydrotreating technology process, the hydrotreating unit consists of three sections:

- First stage hydrotreating section to saturate mainly di-olefins to olefins
- Second stage hydrotreating section to saturate the olefins and de-sulfurize the pygas
- Fractionation section to stabilize the hydrotreated streams and to recover the C6-C8 heart cut for further processing for aromatics extraction and the C9+ cut.

Pygas Hydrotreating process



1st stage hydrotreating

2nd stage hydrotreating

Raw pygas is first fed to the first stage hydrotreating section. The pygas feed stream along with hydrogen is preheated by the recycle liquid stream to the desired temperature and sent to the first stage HDT reactor where most di-olefins in the feed are selectively saturated to olefins only, preserving the octane value of the hydrotreated stream.

The reactor effluent is sent to the first stage product separator. Part of the liquid from the bottom of the product separator is recycled back to the front section of the first stage hydrogenator to control reactor temperature rise. Excess hydrogen and light hydrocarbons are removed at the top of the separator and sent to the recycle gas compressor. The separator liquid is fed to a first stage stabilizer column. In the receiver, H_2 and light hydrocarbons are separated and drawn as a vapor product, which is sent as offgas to the battery limit (B.L.). The liquid from the receiver is fully returned as reflux to the column. The liquid stream from the stabilizer bottoms is C5+ gasoline fraction and can be sent to the gasoline pool. To produce BTX, this C5+ stream is sent to a fractionation section to obtain a C6-C8 heat cut, which will be further hydrotreated to saturate mono-olefins in the second stage hydrotreating section.

In the second stage hydrotreating section, the C6-C8 heart cut combined with a recycle vapor stream and makeup hydrogen is preheated in the second stage feed/effluent heat exchanger before being heated further to the desirable reaction temperature by a charge heater. The feed mixture passes through the fixed catalyst beds in the second stage HDT reactor where olefin species are saturated and sulfur species are converted to H2S.

The reactor effluent is then cooled in the second stage feed/effluent heat exchanger and subsequently in an after-cooler before being routed to a second stage product separator. In the product separator, the unreacted hydrogen and other light components are separated from the hydrotreated liquid products and recycled to the HDT reactor using a recycle gas compressor. A small vapor stream is purged as offgas to control the level of impurities in the recycle gas.

The hydrotreated liquid stream is fed to the second stage stabilizer column. The column vapors are partially condensed in the overhead condenser and sent to an overhead receiver. In the receiver, H_2 and light hydrocarbons are separated and drawn as a vapor product, which is sent as offgas to the B.L. The liquid from the receiver is fully returned as reflux to the column. The bottoms product from the stabilizer which is the hydrotreated C6-C8 cut is cooled further and sent to B.L. for further processing for Aromatics Extraction.

Economics	
Basis	500KTA (11’000BPSD) Feed rate
Erected cost	$26 MM (ISBL, 2009 U.S. Gulf Coast Basis)

Process advantages:

- Flexibility in pre-fractionator cut point and a proprietary vaporizer allows control of polymerization potential in the hydrotreaters
- Reactor operates at high liquid content with mixed phases to minimize polymer byproduct plugging
- Optimized recycle scheme minimizes hydrocarbon vaporization and thereby extends reactor run length
- Catalyst exhibits high activity, stability, mechanical strength and poison resistance
- Aromatics saturation in second stage reactor is less than 1%
- Efficient heat integration scheme reduces energy consumption
- Turnkey package for high purity benzene, toluene and paraxylene production available from licensor

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