UOP
A Honeywell Company

SelectFining™ Process

Refining

Background

The SelectFining process is the latest addition to UOP's family of gasoline desulfurization technologies which is designed to produce ultra-low sulfur gasoline by removing more than 99% of the sulfur present in olefinic naphtha while:

- minimizing octane loss;
- maximizing liquid yield;
- minimizing H_2 consumption; and
- eliminating recombination sulfur.

The SelectFining process provides refiners with a simple, flexible solution to meeting both current and future gasoline sulfur specifications.

Process description

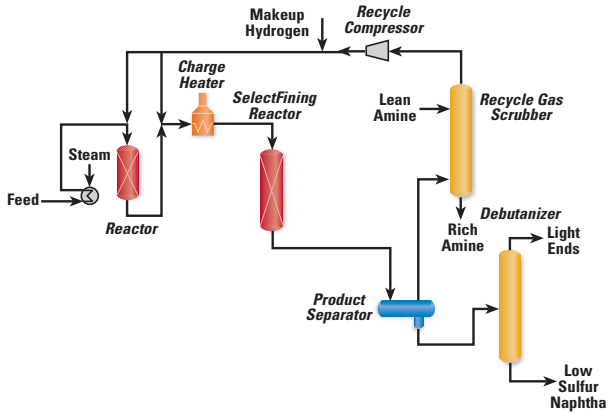
The SelectFining process can hydrotreat full boiling-range (FBR) olefinic naphtha or, when used in conjunction with a naphtha splitter, any fraction of FBR naphtha. This flexibility allows the feed to the SelectFining unit to be optimized based upon such refinery-specific factors as the final gasoline sulfur spec, the available gasoline blending components, and the types and amounts of olefin and sulfur species present in the feed.

The configuration of a single-stage SelectFining unit processing FBR olefinic naphtha (Figure 1) is very similar to that of a conventional hydrotreater. The operating conditions of the SelectFining process are similar to those of conventional hydrotreating, enabling refiners to implement SelectFining technology by reuse of existing idle hydroprocessing equipment.

Since FBR olefinic naphtha can contain highly reactive di-olefins (which may polymerize and foul equipment and catalyst beds), the SelectFining unit may include a separate reactor for di-olefin stabilization. Incoming naphtha is mixed with a small stream of heated hydrogen-rich recycle gas and directed to this reactor. The "stabilized" naphtha is then heated to final reaction conditions and processed in the unit's main reactor over SelectFining catalyst.

Effluent from the SelectFining unit's main reactor is washed, cooled and separated into its liquid and gaseous fractions. Recovered gases are scrubbed

Figure 1 ■ **SelectFining Process**

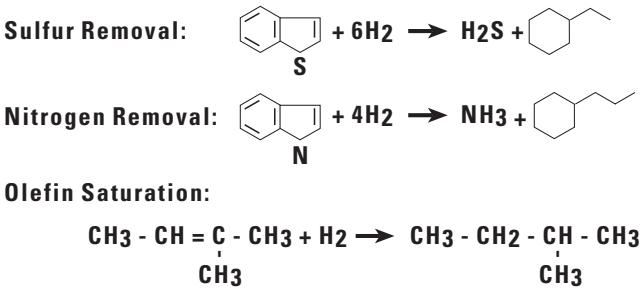


(for H_2S removal) and recycled to the unit's reactor section, while recovered liquids are debutanized (for RVP control) and sent to gasoline blending.

Process chemistry

While the principal reactions that occur in a hydrotreater involve conversion of sulfur and nitrogen components (Figure 2), conventional hydrotreaters also promote other reactions, including olefin saturation. Unfortunately, because olefins have higher octane than their paraffinic counterparts, saturation reactions reduce the feed's octane.

Figure 2 ■ **Hydrotreating Reactions**

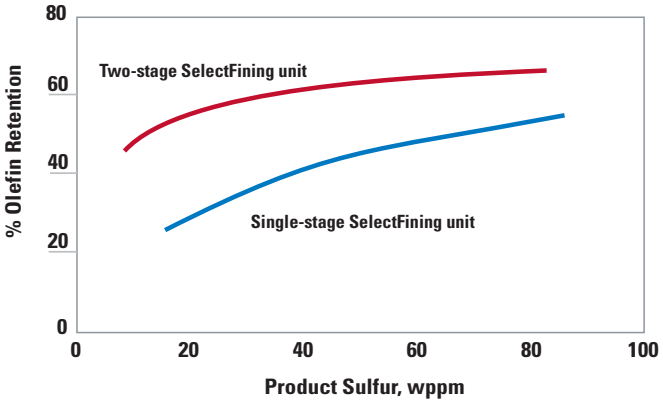


UOP's S 200 SelectFining catalyst was developed to effectively hydrotreat the olefinic naphtha while minimizing olefin saturation. It employs an amorphous alumina support (with optimized acidity) and non-noble metal promoters to achieve the optimal combination of desulfurization, olefin retention and operating stability.

Economics

Figure 3 illustrates the ability of a SelectFining unit to preserve olefins while desulfurizing FBR naphtha from a fluid catalytic cracking unit. When producing a 50 wppm sulfur product (~98% HDS), the additional olefin retention provided by the single-stage SelectFining unit corresponds to a 2.5 (R+M)/2 octane advantage relative to conventional hydrotreating. This advantage increases to 3.5 (R+M)/2 when a two-stage SelectFining unit is used.

Figure 3 ■ **Olefin Retention**

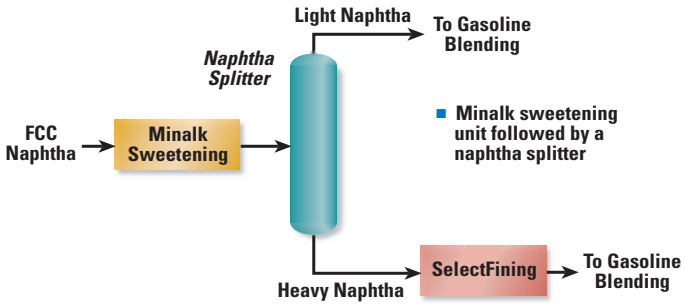


Based upon an octane value of $0.25 per octane-bbl, hydrogen cost of $3 per 1,000 SCFB and 20,000 BPSD naphtha throughput, the resulting savings in processing costs can range from $4 - $6 million per year depending upon the SelectFining process flowscheme used.

Applications

In addition to processing FBR naphtha, the SelectFining technology can also be integrated with Merox™ technology and naphtha splitting to optimize octane retention. For instance, an existing Merox sweetening unit can be used ahead of a naphtha splitter to convert the light mercaptan's into heavier boiling disulfides, which can then be converted in the SelectFining Unit.

Figure 4 ■ **SweetFrac Pre-treatment for Low Sulpher Gasoline Production**



UOP experience

UOP's experience in hydroprocessing and gasoline desulfurization is extensive with approximately 200 Unionfining™ units and more than 240 Merox units (for naphtha service) in operation.

The first commercial SelectFining unit, a 32,000 BPSD single-stage unit licensed to a U.S. Gulf Coast refiner, has been operating successfully since 2006.

For more information

SelectFining technological services are available on request. For more information, contact your local UOP representative or our Des Plaines sales office:

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