Honeywell UOP

REFINING

UOP Uniflex™ MC™ Residue Hydrocracking Process

Robust, cost-effective solution for residue conversion

Introduction

The Uniflex MC process converts vacuum residue and other heavy feedstocks into higher-valued distillable products. This high conversion slurry hydrocracking technology combines elements of several commercial technologies: CANMET™ Hydrocracking process, UOP Unicracking™ process, UOP Unionfining™ process, and employs highactivity molybdenum based MicroCatTM catalyst. The catalyst is produced on site from readily available commodity chemicals. Uniflex MC is easily integrated into existing refinery configurations, providing refiners the ability to increase bottom-of -the -barrel conversion, reduce residual fuel oil production and increase production of light fuels. The product streams are also suitable as high value petrochemical complex feedstock.:

Technology Delivery

Uniflex MC is delivered as two separate technology packages; the Uniflex Process and the MC Catalyst System. Both are delivered through UOP's "Schedule A" Basic Engineering design package. The MC Catalyst System can also be supplied as part of an engineered, modular supply from UOP's Modular Equipment Group to reduce on-site construction and facilitate enhanced process automation and advanced control.

Process Chemistry

The Uniflex Process unit is a thermal cracking / hydrogenation process. Residue molecules are thermally cracked by application of heat at high pressure and with sufficient residence time. The cracked molecules react with hydrogen in the presence of catalyst to produce stable, lighter products predominantly in the transportation fuel range. As a side reaction, free radicals produced as a result of thermal cracking can react to form even larger free radicals which form a “mesophase” of condensed materials. The catalyst inhibits this reaction by terminating the free radicals. A second function of the catalyst is to prevent any mesophase formed from coalescing and forming larger molecules. The relationship between operating temperature, reactor size and catalyst addition rate can be optimized to a refiner's particular processing and economic situation.

Process Description

The configuration of the Uniflex process is very similar to that of a conventional hydrocracking process, consisting of a reaction section, a separation section to recover liquid and gaseous reaction products, and a fractionation section to separate its product into the various boiling- range fractions required by a refiner.

Feedstock, combined with catalyst, and hydrogen-rich recycle gas are heated and then introduced to the bottom of the first upflow reactor at operating temperature.

FEATURES & BENEFITS

High Reliability Design

- Based on a proven reactor system based on a commercial unit that demonstrated over 15 years operation.
- Supported by 30 years of extensive research, pilot plant operations, and development.
- UOP’s expertise in high-pressure hydroprocessing which is reflected in the design, technical services, and project optimization capabilities associated with Uniflex Technology. Ease of Operation

Generates the Highest Product Value

Uniflex has the highest total yield of valued products with 95-98% conversion of a wide range of low-value residue feedstocks. Selectivity to distillate products is the hallmark of Uniflex, with production of LPG, Naphtha, and Diesel as fuels or petrochemical feedstock.

High Product Quality as Products or Feedstocks

The integrated Uniflex/DHT process produces reformer grade Naphtha, Euro V Diesel and sweet, olefin-free LPG. The LPG and Light Naphtha are excellent Steam Cracker feeds with high normal paraffin content. LVGO can be processed in an FCC or Hydrocracking unit, with or without, pretreatment in the Uniflex unit.

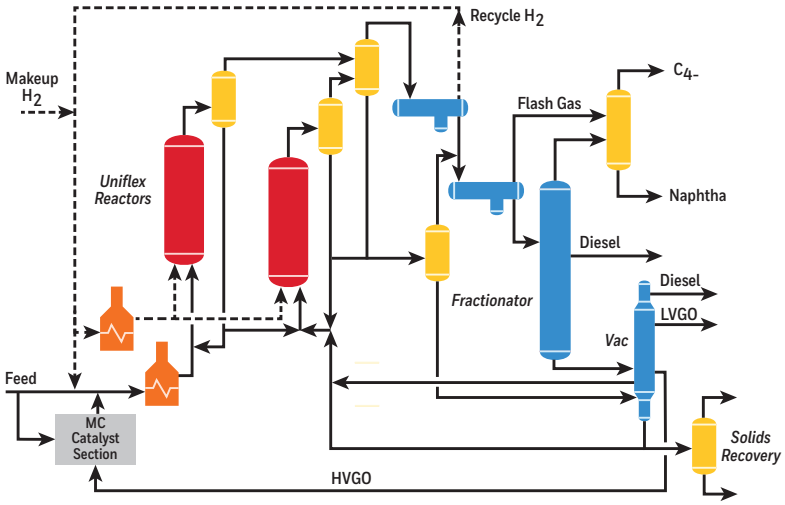
Integration with Other Units

Due to the number of products produced by any slurry hydrocracking technology, integration with the existing or new complex is critical to extract full value from the technology. UOP is uniquely positioned to optimize a total project with a broad understanding of refining and petrochemical configurations.

The reactor's unique design promotes intensive back-mixing of catalyst and reactants without reactor internals. The resulting near-isothermal conditions allow the reactor to operate stably at the higher severity required to achieve maximum residue conversion, while minimizing undesirable secondary cracking reactions that produce lower-valued gaseous byproducts.

The first reactor's liquid effluent is routed to the bottom of the second reactor. The second reactor effluent and vapor from the first reactor flow to the unit's separation section where liquid and vapor fractions are recovered. Vapors are scrubbed, combined with makeup hydrogen and recycled back to the reaction section. Liquid from the separator section flows to the unit's fractionation section for product recovery. A portion of the unconverted residue (pitch) is recycled to the second reactor. The rest of the unconverted residue can be used as a low-cost substitution fuel for conventional heavy liquid residue or coker feed, or used as a solid fuel for end users such as fluidized boilers and gasifiers. Optionally the pitch can be sent to a Solids Recovery section to produce additional liquid products and a solids stream, which can be sent for metals recovery.

Uniflex MC Process Configuration



Additional Processing Options

- Integrated Distillate Hydrotreating: With the addition of six pieces of equipment fuels products can be treated to produce sweet LPG, reformer grade Naphtha and Euro V quality Diesel. This is at a cost of about 50% of a new stand-alone DHT unit.
- Enhanced LPG Recovery: Where LPG has a higher value than fuel gas, recovery of this product can be increased to 99% at an effective capital cost and low utility consumption.
- Side-Car VGO Hydrotreating: VGO quality can be cost effectively improved with the addition of a small HT reactor on the product stream.

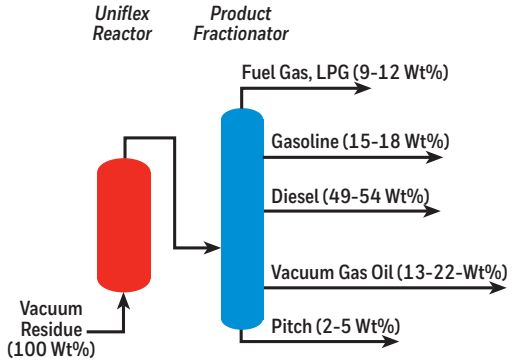
Product Yields

The yield structures produced when processing Vacuum Residue from a typical sour crude in a Uniflex process unit are illustrated in the figure shown below. The advantages of the yields versus other technologies include:

- Ability to be highly selective to Naphtha and Diesel
- Flexibility to shift to heavier products if desired
- Total liquid yields up to 115 vol%

These advantages provide refiners the ability to more-closely tailor their operations to satisfy projected declining residual fuel oil markets and increasing fuel and petrochemical feedstock demands.

Uniflex Process Typical Yields



MicroCat Catalyst

The high-activity catalyst (MicroCat) used in the Uniflex process is generated on-site in the MC Catalyst Section. The refiner will produce the MicroCat from commodity raw materials readily available in bulk quantities on the open market. This section contains simple process operations to produce consistent, high quality catalyst. On site quality assurance testing is part of the technology package.

Additional Opportunities

Refiners can also benefit from the synergies which arise when the Uniflex MC process is used in association with other Refining and Petrochemical processes. The Uniflex MC process unit can be used to upgrade/ convert marginal-quality refinery streams such as FCC slurry oils and heavy coker gas oils. For refiners with existing delayed coking units who are considering increasing refinery throughput, the addition of a Uniflex process can debottleneck the delayed coking unit and provide a significant increase in the refinery's overall liquid product yield.

For more information

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UOP4523-78 May 2018

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