UOP/HYDRO MTO Process
Methanol to Olefins Conversion

Introduction

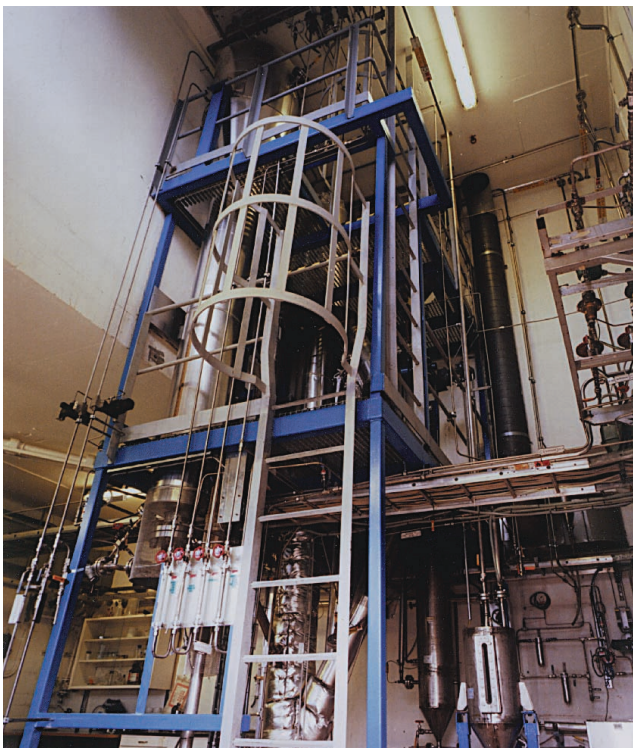
Changing natural gas into olefins is a two-step process. The first step, converting natural gas to crude methanol, has been available to the industry for some time. The second step, transforming the resulting methanol into olefins, has recently been introduced by UOP and HYDRO of Norway. The UOP/HYDRO MTO (methanol to olefins) process provides an economical means to convert natural gas to olefins. The UOP/HYDRO MTO process primarily converts the methanol into ethylene and propylene. Ethylene and propylene are in increasing demand worldwide and have significant financial value in the marketplace. UOP and HYDRO have developed the UOP/HYDRO MTO process for license to customers worldwide.

Other technologies for indirect conversion of methane to higher value products do exist. These processes have lower yields than the UOP/HYDRO MTO process and are, therefore, less economical. The UOP/HYDRO MTO process offers:

- Exceptional value for direct conversion of methane to polymer-grade ethylene and propylene.
- Direct use of ethylene and propylene in chemical-grade products with greater than 98% purity using a flowscheme that does not require expensive ethylene/ethane or propylene/propane splitters.
- Limited production of by-products compared to a steam cracker, which results in a simplified product recovery section.
- Easy integration into existing naphtha cracker facilities due to low paraffin yields.
- Flexibility to change the propylene to ethylene product weight ratio from 0.77 to 1.33.

Applications

The UOP/HYDRO MTO process can be utilized in locations with cheap, abundant natural gas reserves. By integrating the UOP/HYDRO MTO process into a gas to olefins (GTO) complex, feedstock prices can be held down and natural gas can be converted into a form that is more easily transported and of higher value. Existing naphtha or ethane-propane cracker facilities can increase olefin production and feedstock flexibility by installing an MTO reactor section and feeding into a revamped cracker fractionation section to minimize capital investment. Because the UOP/HYDRO MTO process produces a rich olefinic effluent containing low quantities of paraffins, the existing fractionation equipment can often be easily debottlenecked to handle the additional olefins produced. Yet another application would be downstream of an existing methanol plant with excess capacity, to meet local demands for olefins and polyolefins.

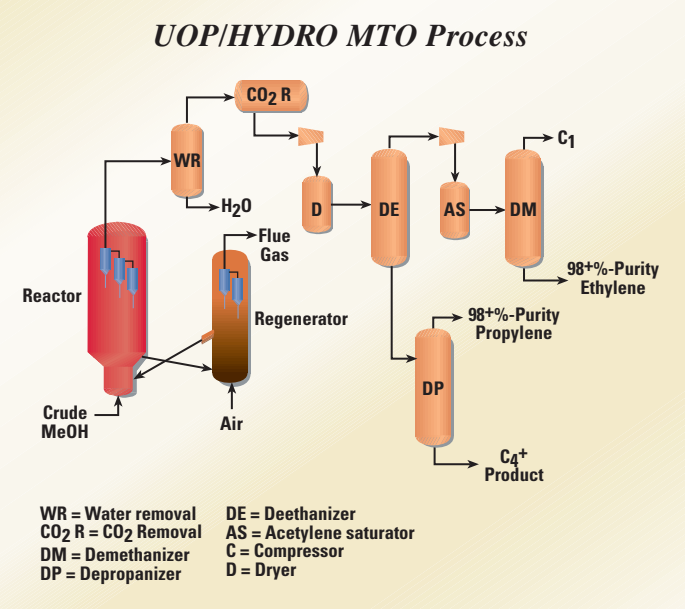


UOP/HYDRO MTO Demonstration Plant

Description

In the UOP/HYDRO MTO process, methanol is converted primarily to light olefins (ethylene and propylene). The process can provide a broad range of propylene to ethylene product ratios. The approximate ratios of products relative to the total light olefins (C_2+C_3) are shown below for high ethylene and high propylene operating modes. By simply changing the reactor operating severity, the UOP/HYDRO MTO process user can adjust between operation modes as market demands dictate.

Products (wt. ratios)	*High Ethylene Mode*	*High Propylene Mode*
Ethylene	0.57	0.43
Propylene	0.43	0.57
Butenes & Heavier	0.19	0.28
C_3=/C_2=	0.77	1.33



Long-term methanol conversion of 99.8% and stable product selectivity have been demonstrated at HYDRO's large process demonstration plant in Norway. This plant circulates and regenerates catalyst continuously and uses crude methanol as a feedstock at a rate of more than 0.75 MT per day.

The UOP/HYDRO MTO commercial process utilizes a fluidized bed reactor with a continuous fluidized bed regenerator. This technology is an extension of UOP's established FCC commercial technology.

Feedstocks

Feedstock for the UOP/HYDRO MTO process is methanol (crude or high purity) usually produced from synthesis gas (CO + H_2), which is produced from the reforming of abundant natural gas. Synthesis gas can also be produced by steam reforming of petroleum products such as naphtha, partial oxidation of natural gas and petroleum products, and coal gasification.

Catalyst

The reaction is catalyzed by the MTO-100 silicoaluminophosphate synthetic molecular sieve based catalyst. The catalyst has demonstrated the degree of attrition resistance and stability required to handle multiple regenerations and fluidized bed conditions over the long term. The catalyst is extremely selective toward the production of ethylene and propylene.

This simplified flowscheme demonstrates the use of the UOP/HYRO MTO process to make chemical-grade products. The process can make high-purity polymer grade olefins with the addition of splitters in the recovery section and a debutanizer.

For More Information

For more information, contact your local UOP representative or contact our Des Plaines sales office:

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