Honeywell UOP

PETROCHEMICALS

UOP Q-Max™ Process

Process solutions for cumene production

Introduction

The Q-Max process represents a new generation of cumene technology based upon highly selective and stable zeolitic catalysts. The Q-Max process provides excellent cumene product quality (99.97 Wt% purity) and near stoichiometric cumene yield (>99.7 Wt%). Two catalysts are used in the Q-Max process: QZ-2500H™ catalyst for alkylation service and QZ-2100™ catalyst for transalkylation service. Both catalysts are based on totally new zeolites invented and developed by UOP with optimized acid site densities and selectivities that exhibit exceptional stability and selectively, ultra high yield and product quality, and a significant reduction in undesirable C_3= oligomerization reactions resulting in extremely low heavy ends yield. Both catalysts are regenerable.

Compared to other zeolitic cumene technologies, the Q-Max process provides better tolerance to feedstock impurities, the highest cumene product quality, and excellent stability as proven in commercial production.

The Q-Max process now includes the next generation of UOP alkylation catalyst: QZ-2500H catalyst which was demonstrated in pilot runs to have the highest selectivity of any catalyst. This results in the Q-Max process having the highest yields and the lowest utility consumption commercially available.



Delivers the lowest feed and utility consumption of commercially available cumene technologies.

Three-fourths of all cumene units are integrated with a downstream phenol unit. Combining the Q-Max process with the UOP Phenol process results in numerous optimization benefits that can only be achieved by integrating the two processes. These include optimized equipment and utilities design and lower overall utility consumption.

For revamps of existing SPA and AlCl3-based cumene units, the Q-Max process results in increased capacity, higher yields, lower utility costs, less solid waste, longer catalyst cycles, and a non-corrosive environment.

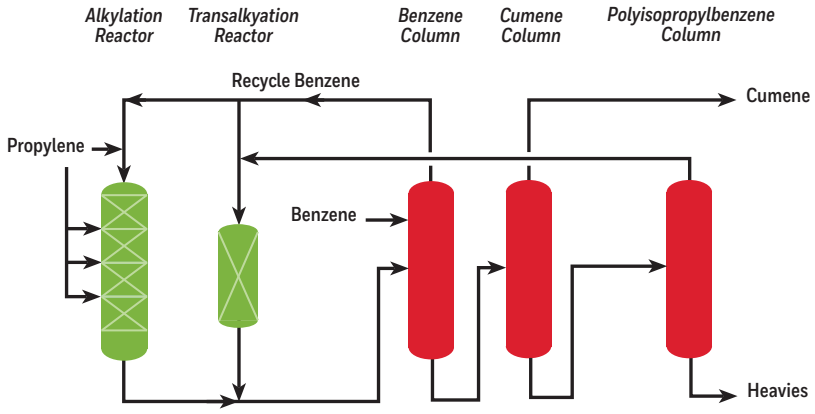
Description

The Q-Max process consists of an alkylation reactor, a distillation section, and a transalkylation reactor. Both reactors are fixed-bed. Propylene feed and a mixture of fresh and recycle benzene are charged to the alkylation reactor where the propylene reacts to completion to form mainly cumene. Effluent from the alkylation reactor is sent to the benzene column which separates the benzene for recycling. The benzene column also removes excess water and the propane that entered with the propylene feed. The benzene column bottoms stream is sent to the cumene column where cumene product is recovered overhead. The cumene column bottoms stream, containing mostly diisopropylbenzene, is sent to the polyisopropylbenzene (PIPB) column where DIPB and TIPB are recovered and recycled to the transalkylation reactor. The bottoms from the PIPB column consists of a small stream of heavy aromatic by-products which are normally blended into fuel oil.

A portion of the recycle benzene from the top of the benzene column is combined with the recycle DIPB and TIPB from the overhead of the PIPB column and sent to the transalkylation reactor. In the transalkylation reactor, the DIPB and TIPB are converted to cumene. The effluent from the transalkylation reactor is then sent to the benzene column.

The catalyst in both the alkylation and transalkylation reactors is regenerable. The typical design cycle length between regenerations is at least five years. The ultimate catalyst life is at least two cycles. Mild operating conditions and a corrosion-free process environment permit the use of carbon-steel construction and conventional process equipment.

Typical Q-Max Process



Feedstocks and Products

The Q-Max process accepts a wide range of propylene feed qualities, from FCC/refinery (65-80 mol-%) to chemical and polymer-grades (92-99.5 mol%). Benzene is typically ASTM Refined 535 or 545 grade. The Q-Max process tolerates the sulfur, water, and arsine normally found in feeds that are otherwise suitable. The high levels of basic nitrogen and arsine found in some propylene feeds can also be accommodated by the addition of process design options such as guard beds. Product quality depends on the level of impurity precursors in the feeds. The use of refinery or chemical-grade propylene may warrant the addition of a depropanizer and/or propylene feed column to the base Q-Max process.

Q-Max Process Product Quality

Typical commercial data with high-purity propylene and benzene feeds is as follows:

Cumene purity	99.97 Wt%
Ethylbenzene	<100 wt-ppm
n-Propylbenzene	225-300 wt-ppm
Butylbenzenes	≤15 wt-ppm
Cymenes (Depends on toluene in benzene)	<20 wt-ppm
Total Non-aromatics	~10 wt-ppm
Benzene	<5 wt-ppm
Diisopropylbenzene	<5 wt-ppm
Bromine index	<5
Sulfur	<0.1 wt-ppm

Commercial Experience

UOP is a leading supplier of technology to the cumene industry, providing over one third of world capacity awarded since 1996. Since the introduction of the Q-Max process UOP has been awarded nineteen projects on seventeen process units worldwide and counting – both new and revamp projects including numerous SPA conversions. Cumene capacities range from 37,000 up to 900,000 MTA. The total combined cumene capacity of the units is more than 5,400,000 MTA.

For more information
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