Conversion of Refinery MTBE Units for Isooctene/Isooctane Production

$Dimer_8$ SM

Technology Profile

Overview The *$Dimer_8$*[SM] process uses a fixed bed reactor followed by catalytic distillation to achieve final isobutene conversion at high dimer selectivity. The *$Dimer_8$*[SM] process is the most attractive technology for converting a refinery based MTBE unit to isooctene/isooctane production.

Catalytic Distillation Technologies (CDTECH) and Snamprogetti jointly bring their extensive expertise in isooctene/isooctane production technologies along with their unparalleled experience base in ether production and catalytic distillation. CDTECH is a partnership between Lummus Technology, a CB&I company, and Chemical Research & Licensing, a CRI company. Snamprogetti is an international, technology-oriented, global contractor, wholly owned by Eni group of Italy.

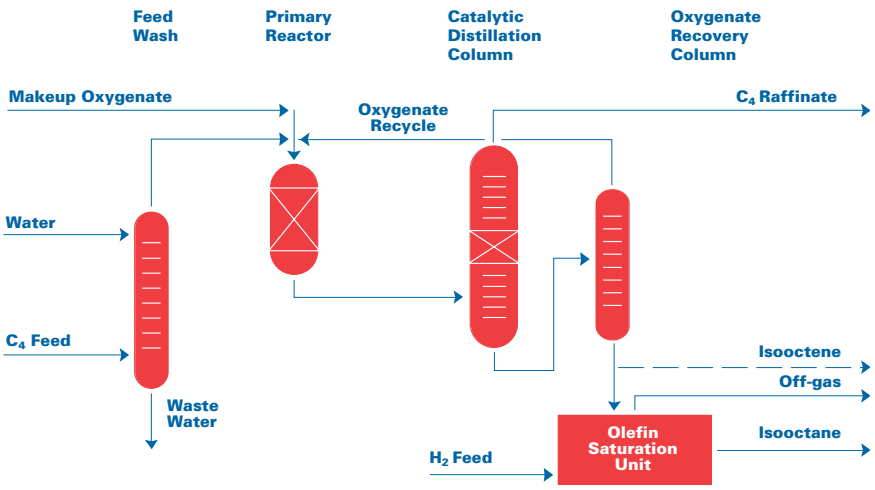
Isooctene/Isooctane Synthesis - General The selective dimerization of isobutenes over acidic ion-exchange resin produces isooctene or di-isobutylene (DIB). Oxygenates such as methanol, methyl-tert-butyl-ether (MTBE), water or tert-butyl-alcohol (TBA) are used as selectivators for the dimerization reaction, to prevent the formation of heavier oligomers. The *$Dimer_8$* process uses a fixed bed reactor followed by catalytic distillation to achieve final isobutene conversion at high dimer selectivity.

The boiling point reactor, by design, offers temperature control at the boiling point of the reaction mixture without external cooling. The retained heat of reaction reduces the reboiler duty in downstream fractionation. Alternatively, a water cooled tubular reactor (WCTR) can be used to achieve more precise temperature control across the length of the reactor. Either reactor can be used to achieve about 85% isobutene conversion at about 85-90% dimer selectivity, depending on the need of the refiner.

The unique catalytic distillation (CD) column combines reaction and distillation in a single unit operation. The continuous removal of heavier dimer product from the reaction zone enables further conversion of isobutene without loss of dimer selectivity. The use of CD eliminates the need for any downstream reaction/fractionation system to achieve such performance.

Isooctene can be used as a gasoline blendstock due to its excellent characteristics. Should olefin restrictions require a paraffinic product, the isooctene product can be saturated to isooctane in a trickle bed hydrogenation reactor. Hydrogenation uses a base or noble metal catalyst depending on the feed contamination level.

$Dimer_8$ Process Flow Diagram



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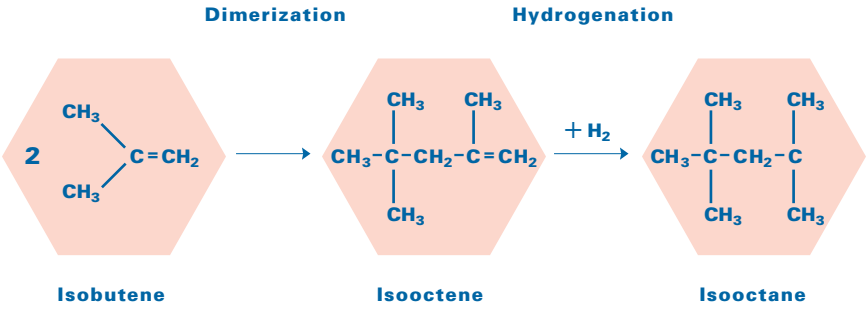
Process Chemistry



Advantages

Easy implementation:
- Minimum revamp changes
- Low capital cost
- Short schedule

90+% isobutylene conversion

80+% C_8 selectivity

High flexibility

Simple control

Experience

High octane/low RVP blend stock

Low utilities

Typical Overall Material Balance

Isobutylene conversion percent: 95+
C_8 selectivity percent: 85+

Feeds	Isooctene Production LB/HR	Isooctane Production LB/HR
C_4s (isobutene 15 wt. %)	100,000	100,000
Makeup oxygenate	22	240
Total	100,022	100,240
Products		
C_4 Raffinate	83,384	82,168
Isooctene product	16,678	18,095
Water imbalance*	-40	-23
Total	100,020	100,240

* Water imbalance represents water saturation of hydrocarbon streams across extraction columns.

Typical Product Composition (excluding C_5s)

	Wt.%	Wt.%
C_8 Olefins	84.2	82.2
C_{12} Olefins	13.7	16.8
Heavies	0.3	0.4
C_{8+} Ethers	1.7	0.6
Oxygenates (excluding C_8 ethers)	<500 ppmw	<500 ppmw
Total	**100.0**	**100.0**

Typical Product Properties

Specific gravity	0.733	0.728
RVP (psia)	1.8	1.6
BRON*	112-115	112-115
BMON*	93-96	93-96

* Base gasoline RON = 95, MON = 85

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