Catalytic

Distillation

Technologies

MTBE From Steam Cracker and Dehydro C_4 Feeds

CDMTBE®

Technology Profile

Overview The CD*Mtbe* catalytic distillation technology processes C_4 streams from steam cracker or isobutane dehydrogenation units to produce MTBE. The CD*Mtbe* process is one of a family of process technologies developed and commercialized by Catalytic Distillation Technologies (CDTECH) for license to the petroleum refining and petrochemical industries. CDTECH is a partnership between Lummus Technology, a CB&I company, and Chemical Research & Licensing, a CRI company.

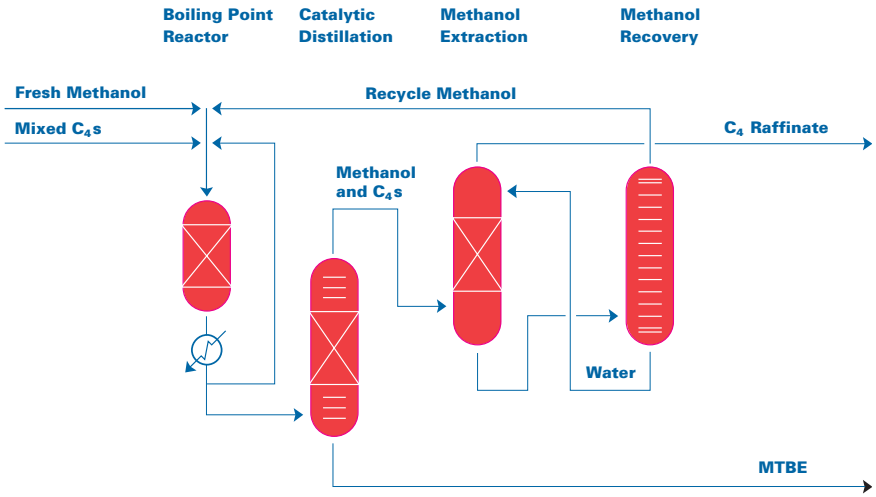
MTBE Synthesis-General

MTBE is formed by the catalytic etherification of isobutylene with methanol. The patented CD*Mtbe* process is based on a two-step reactor design, consisting of a boiling point fixed bed reactor followed by final conversion in a catalytic distillation column. The process utilizes an acidic ion exchange resin catalyst in both its fixed bed reactor and proprietary catalytic distillation structures.

The boiling point reactor is designed so that the liquid is allowed to reach its boiling point by absorbing the heat of reaction, after which a limited amount of vaporization takes place thereby maintaining precise temperature control. The amount of vaporization is fixed by recycling cooled reactor effluent. The maximum temperature is adjusted by setting the total system pressure. Since the reacting liquid mixture temperature cannot exceed the boiling temperature, control is far superior to those systems in which heat must be transferred by convection or conduction. Reactor effluent is cooled by condensation rather than by convection, resulting in the use of smaller-sized equipment.

The unique catalytic distillation column combines reaction and fractionation in a single unit operation. It allows a high conversion of isobutylene (exceeding fixed bed equilibrium limitations) to be achieved simply and economically. By using distillation to separate the product from the reactants, the equilibrium limitation is exceeded and higher conversion of isobutylene is achieved. Catalytic distillation also takes advantage of the improved kinetics through increased temperature without penalizing equilibrium conversion. MTBE synthesis is a highly selective process for removal of isobutylene. It can be used for pretreatment to produce high purity 1-butene or for recovery to make high purity isobutylene via MTBE decomposition.

CD*Mtbe* Process Flow Diagram



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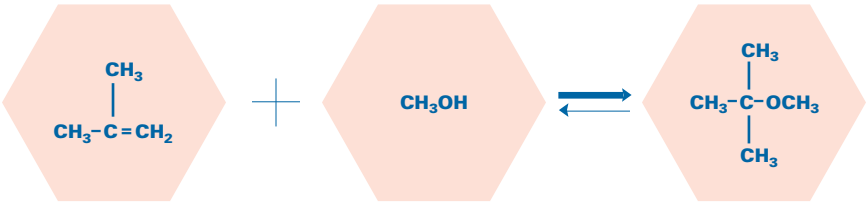
Process Chemistry

Etherification



Isobutylene **Methanol** **MTBE**

Typical Overall Material Balance

Isobutylene conversion percent: 99

Feeds	LB/HR
C_4s (Isobutylene 52.0 wt. %)	166,130
Methanol	48,764
Products	
C_4 Raffinate	79,858
MTBE product	135,036

MTBE Product Composition (excluding C_5s)

	Wt.%
C_4s	<0.1
Methanol	<0.1
Di-isobutylene	0.5
TBA + MSBE	0.4
MTBE	98.9
Total	**100.0**

Advantages

CDTECH's 'Boiling Point' reactor offers:
Simple and effective control
Elimination of hot spots
Long catalyst life
High flexibility
Low capital cost
Elimination of catalyst attrition
Most effective heat removal technique

CDTECH's catalytic distillation offers:
Improved kinetics
High conversion (beyond fixed bed equilibrium limit)
Low capital cost
Low utilities
Long catalyst life with sustained high conversion
Reduced plot area

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