



Technology Profile

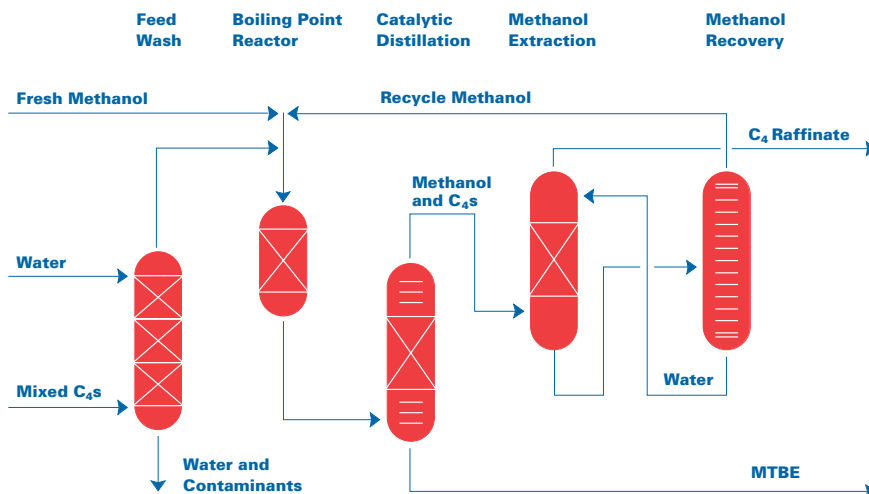
Overview The CDM_tbe catalytic distillation technology processes C₄ streams from refinery units to produce MTBE. The CDM_tbe process is one of a family of process technologies developed and commercialized by Catalytic Distillation Technologies (CDTECH) for license to the petroleum refining and petrochemical industries. CDTECH is a partnership between Lummus Technology, a CB&I company, and Chemical Research & Licensing, a CRI company.

MTBE Synthesis MTBE is formed by the catalytic etherification of isobutylene with methanol. The patented CDM_tbe 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 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. This design retains the heat of reaction as latent heat, reducing heat input requirements for the ensuing fractionation.

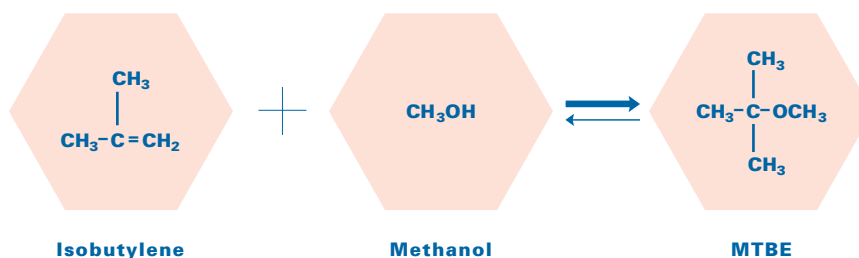
The unique catalytic distillation column combines reaction and fractionation in a single unit operation. It allows a high conversion of isobutylene (exceeding fixed bed equilibrium limitations) to be achieved simply and economically. By using distillation to separate the product from the reactants, the 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 butene-1 or for recovery to make high purity isobutylene via MTBE decomposition.

CDM_tbe Process Flow Diagram

Process Chemistry

Etherification


Typical Overall Material Balance Isobutylene conversion percent: 97+

Feeds	LB/HR
C ₄ s (Isobutylene 12.7 wt. %)	114,779
Methanol	8,160
Products	
C ₄ Raffinate	98,818
MTBE product	24,121

MTBE Product Composition (excluding C₅s)

	Wt. %
C ₄ s	<0.1
Methanol	<0.1
Di-isobutylene	0.5
TBA	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
- Elimination of cooling water requirement

**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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