

Catalytic

Distillation

Technologies

**Overview** The *CDethers* catalytic distillation technology processes  $C_4/C_5$  streams from refinery units to produce MTBE/TAME. *CDethers* 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/TAME Coproduction From Refinery $C_4/C_5$ Feeds



### Technology Profile

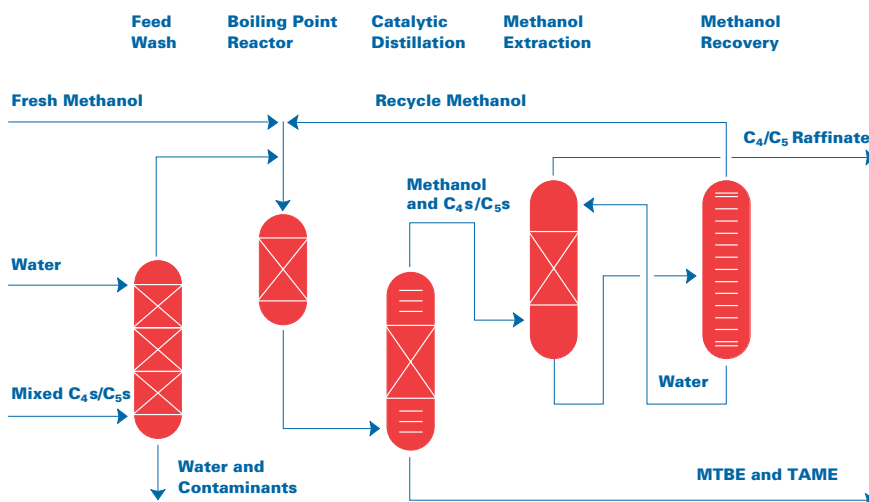
**MTBE/TAME Synthesis-General** MTBE and TAME are coproduced by the catalytic etherification of isobutylene and isoamylene with methanol. The patented *CDethers* process is based on a two-step reactor design, consisting of a boiling point fixed bed reactor followed by final conversion in a catalytic 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 simultaneous, high conversion of isobutylene and isoamylene (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 to ethers is achieved. Catalytic distillation also takes advantage of the improved kinetics through increased temperature without penalizing equilibrium conversion.

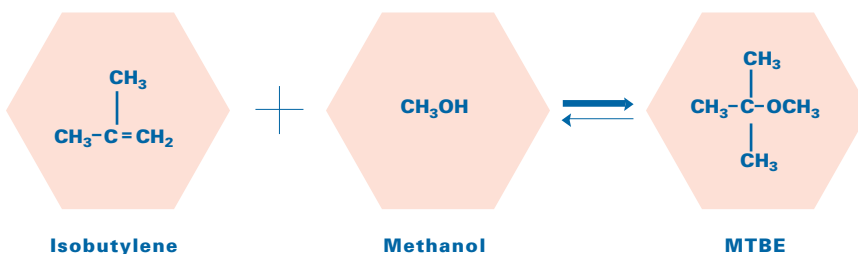
CDTECH's unique, proprietary technology is optimized for coproduction of MTBE and TAME, and is an improved option for small refineries, where operating separate units for these products is not economical.

### CDethers Process Flow Diagram

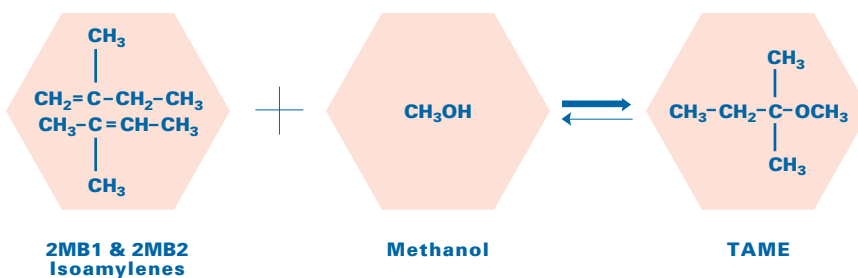


## Process Chemistry

## Etherification



## Etherification



## 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  
requirementCDTECH'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

Coproduct of MTBE/TAME at high  
conversion and low costIsobutylene conversion percent: 97+  
Isoamylyene conversion percent: 90+

## Typical Overall Material Balance

Feeds	LB/HR
C <sub>4</sub> S (Isobutylene 16 wt. %)	63,714
C <sub>5</sub> S (Reactive Isoamylyene 20.3 wt. %)	60,954
Methanol	10,808
Products	
C <sub>4</sub> /C <sub>5</sub> Raffinate	102,103
MTBE/TAME product	33,373

MTBE/TAME Product Composition (excluding C<sub>6</sub>+)

	Wt. %
C <sub>5</sub> <sup>-</sup>	<4.0
Methanol	<0.1
Dimers	0.5
Tertiary Alcohols	0.4
MTBE/TAME	>95.0
<b>Total</b>	<b>100.0</b>

## CDTECH

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