

Overview The CDEtherol[®] catalytic distillation technology processes C₅ streams from refinery units to produce TAME. The CDEtherol process incorporates features unique to both the CDTECH catalytic distillation and BP Etherol technologies. It 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.

TAME from Refinery C₅ Feeds



Technology Profile

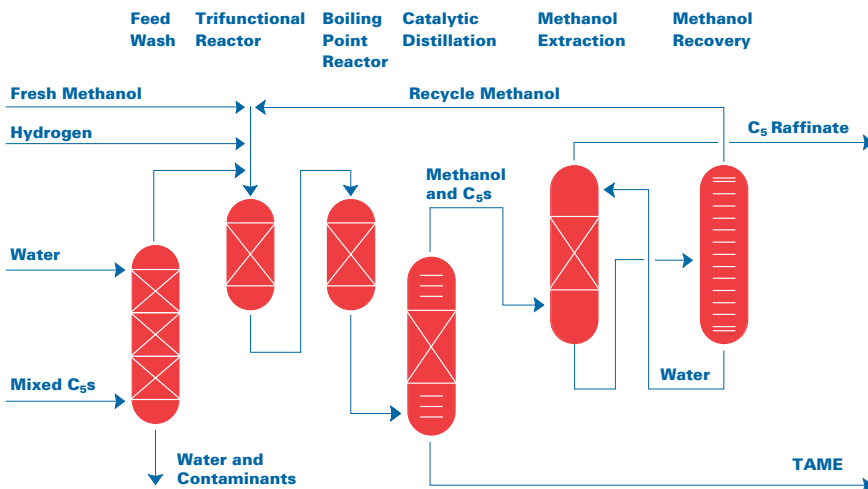
TAME Synthesis-General TAME is formed by the catalytic etherification of isoamylene with methanol. The patented CDEtherol process is based on a three-step reactor design, consisting of a trifunctional catalyst reactor followed by a boiling point fixed bed reactor, with final conversion in a catalytic distillation column. The process utilizes a proprietary trifunctional catalyst in its lead reactor and acidic ion exchange resin catalyst in its boiling point reactor and its proprietary catalytic distillation structures.

The trifunctional primary reactor provides simultaneous selective hydrogenation of diolefins, isomerization of 3MB1 to 2MB2, and etherification of isoamylene. The isomerization and selective hydrogenation provide better quality C₅ feed for alkylation with reduced acid consumption. Selective hydrogenation also reduces the gum precursors which, if left untreated, would impart color and odor to the product as well as reduce catalyst life. The reactor temperature is controlled by recycling some of the cooled reactants to the reactor feed.

The boiling point reactor is designed so that the maximum temperature is adjusted by setting the total system pressure. The reacting liquid mixture temperature cannot exceed the boiling temperature, thus providing precise control of the maximum temperature.

The unique catalytic distillation column combines reaction and fractionation in a single unit operation. It allows a high conversion of isoamylene (exceeding fixed bed equilibrium limitations) to be achieved simply and economically. Because distillation is used to separate the product from the reactants, the equilibrium limitation is exceeded and higher conversion of isoamylene is achieved. Catalytic distillation also takes advantage of improved kinetics through increased temperatures, without penalizing equilibrium conversion. Advanced process control maximizes catalyst life and activity to provide high sustained TAME production.

CDEtherol Tame Process Flow Diagram



Advantages**CDTECH's trifunctional reactor offers:**

Hydrogenation of diolefins to olefins (<100 ppm diolefins in raffinate)

Isomerization of 3MB1 to 2MB2

Conversion of reactive olefins to ethers

Reduction of acid consumption in alkylation due to diolefin reduction

Improved C₅ raffinate as gasoline blendstock due to reduced gum formation

A water white clear TAME product

Elimination of objectionable odor of TAME product

Increased catalyst life due to reduced fouling

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

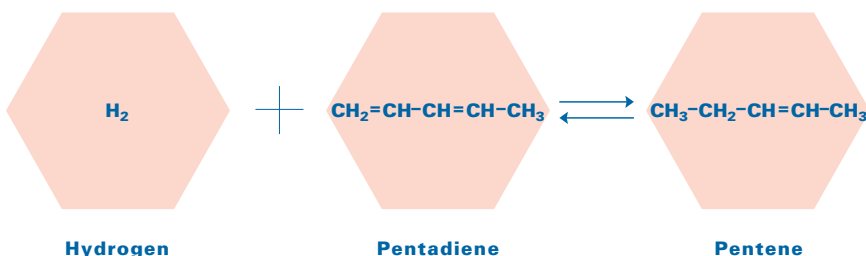
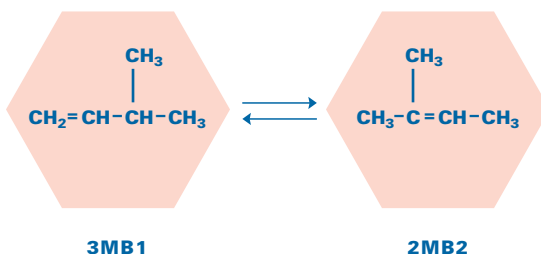
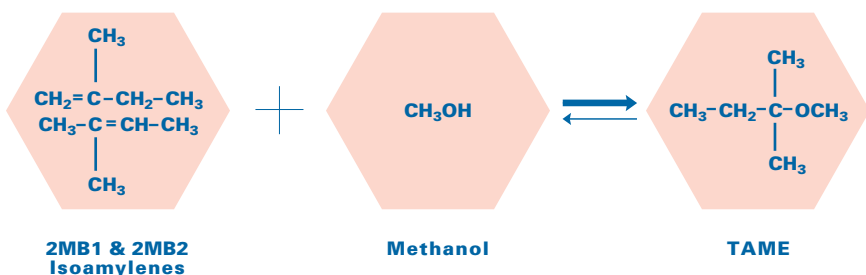
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Process Chemistry**Selective Hydrogenation****Isomerization****Etherification****Typical Overall Material Balance** Isoamylyene conversion percent: 95+

Feeds	LB/HR
C ₅ S (Reactive Isoamylyene 34 wt. %)	60,999
Methanol	8,944
Hydrogen	41
Products	
C ₅ Raffinate	40,061
TAME product	29,923

TAME Product Composition (excluding C₆+)

	Wt. %
C ₅ S	<1.0
Methanol	<0.1
Di-isoamylyene	0.5
TAA	0.4
TAME	98.0
Total	100.0