

Overview The Benzene CDHydro catalytic distillation technology processes reformate streams from refineries to reduce benzene to levels required in reformulated gasoline. The Benzene CDHydro 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.

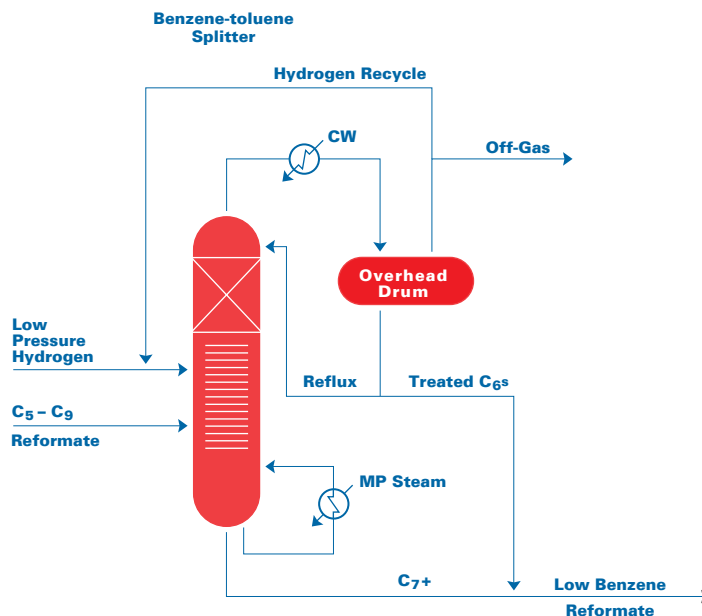
Selective Hydrogenation The patented Benzene CDHydro process achieves hydrogenation of benzene to cyclohexane in a catalytic distillation column. Hydrogenation reduces benzene in the gasoline pool. The process uses commercially available catalyst in proprietary catalytic distillation structures.

Reformate and hydrogen are fed to the catalytic column. Hydrogenation of benzene to cyclohexane can exceed 90%. Benzene conversion can easily be limited to lower levels through control of hydrogen addition. The washing action of the reflux minimizes oligomer formation, flushing heavy compounds from the catalyst and promoting long catalyst life. Treated C₆ product is taken overhead. Excess hydrogen and lights are recycled and vented from the overhead drum. C₇₊ product is taken out the bottom with essentially full recovery of heavy aromatics.

The unique catalytic distillation column combines reaction and fractionation in a single unit operation. This constant pressure boiling system assures precise temperature control in the catalyst zone. Low reaction temperature and isothermal operation enhance safety.

Capital costs are considerably lower than conventional hydrotreaters since the single column design eliminates costs associated with fixed-bed systems and operates at low enough pressure to avoid the need for a hydrogen compressor. The Benzene CDHydro process would typically be installed in a benzene-toluene splitter, either as a retrofit or in a new column.

Benzene CDHydro Process Flow Diagram



Catalytic

Distillation

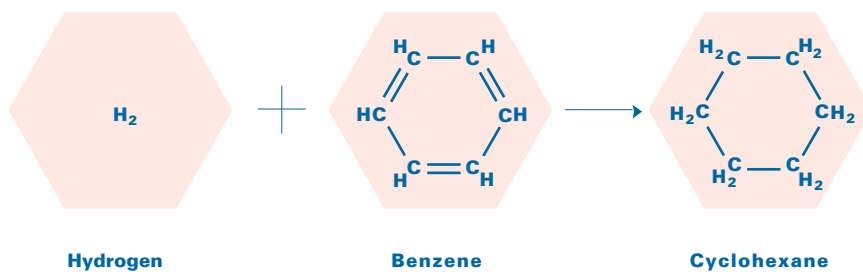
Technologies

Selective Hydrogenation
of Benzene in Reformate

BENZENE **CDHYDRO**[®]

Process Chemistry

Hydrogenation



Advantages

Benzene CDHydro process offers:

Low operating pressure

Low operating cost

Low benzene in reformat

Retrofit to existing columns

All carbon steel construction

No hydrogen compressor

CDTECH's catalytic distillation offers:

Isothermal operation

High conversion

Low capital cost

Low utilities

Reduced plot area

Typical Overall Material Balance

Feeds	LB/HR	
C ₅ + (Benzene 9 wt.%)	227,000	
Hydrogen (100 % basis)	2,065	(9.4mm SCFD)
Products (will depend on separation requirements)		
Treated C ₆ s	97,535	
C ₇ +	131,530	
Off-gas (if PSA hydrogen is used)	0	

Typical C₆ Product Composition

(will depend on feed composition and client requirements)

Residual Benzene in distillate (wt.%)	0.78
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