

Overview

Polimeri Europa and Lummus Technology, a CB&I company, offer the Polimeri/Lummus technology for the production of phenol from cumene. This technology incorporates many decades of operating experience by Polimeri Europa and Lummus' design expertise, as well as proven and superior technology features. Together, they assure the reliability and excellent performance of the phenol plant.

The Polimeri/Lummus process produces the highest quality phenol (99.99 wt%), suitable for polycarbonate and resin production. It can also co-produce high quality, pharmaceutical grade acetone containing less than 200 ppm water and 50 ppm methanol.

The process utilizes advanced technology for the air oxidation of cumene followed by acid-catalyzed decomposition to phenol and acetone. This state-of-the-art technology minimizes heavy by-product formation and maximizes conversion, which improves overall yield while providing smooth, reliable, and safe operation. The process features flexible, integrated waste water and vent gas treatment systems, allowing the plant to conform to local environmental regulations.

The Polimeri/Lummus process utilizes the latest control systems and operates smoothly, at high yields and low cost, with flexibility and minimal effect on the environment. Maximum heat integration is provided to minimize energy input.

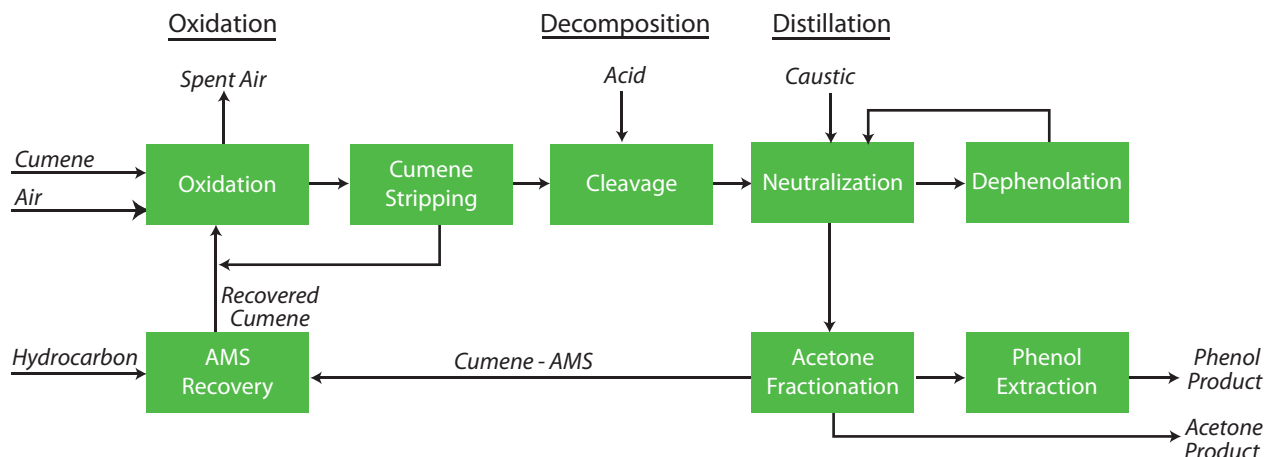
Advantages

Process Features	Process Benefits
Advanced oxidation technology	Combines the low cost and safety of wet oxidation with the high yield of dry oxidation • Enhances selectivity and minimizes reactor volume
Minimized air consumption and turbo-expander option	Lowers electric power consumption
Advanced cleavage technology that incorporates the latest process control and automated shutdown systems	Provides superior selectivity and safety
Heat interchange systems	Conserves and reuses heat, lowering energy consumption
Vent gas treatment and wastewater treatment	Low environmental impact
Highest purity phenol with low carbonyl content and high sulfuric acid discoloration index • Acetone has long permanganate time and low water and benzene content	Highest quality products

Performance Characteristics

Phenol Product Quality		Acetone Product Quality	
Purity (dry basis)	99.99 wt%	Purity	99.8 wt% min.
Total GC impurities*	<10 wppm	Color, Pt-Co	5 max.
Color, APHA	5 max.	Distillation range (@760 mmHg)	0.5°C
Freezing point	40.85°C min.	Aldehydes	<50 wppm
Carbonyls, as mesityl oxide	<10 wppm	Benzene	<10 wppm
*Excluding cresols		Non-volatiles	5 wppm
		Water (Note 1)	0.2 wt%
		Permanganate time	3 hrs min.
Note 1: Pharmaceutical grade acetone containing less than 200 ppm water and 50 ppm methanol can be produced if required			

Block Flow Diagram



Process Description

Phenol and acetone are produced from cumene in two steps: liquid phase oxidation of cumene to cumene hydroperoxide (CHP), followed by acid-catalyzed decomposition (cleavage) of CHP to phenol and acetone. Phenol, acetone, unconverted cumene, and by-products are then distilled in a series of distillation towers to recover high purity phenol and acetone products and to recover cumene for recycle.

Fresh and recycle cumene are fed to a series of oxidizers where the cumene contacts air and is converted to CHP. The oxidate is concentrated in a multi-stage cumene stripping system. Concentrated CHP flows directly to the cleavage unit where it is decomposed under precisely controlled conditions that are optimized to permit CHP decomposition without producing heavy by-products.

Cleavage effluent is neutralized before being sent to the first column of the acetone/phenol fractionation section to separate acetone, cumene, and light by-products from phenol and heavier. The distillate goes to a second column to produce acetone. The bottoms of this column – a mixture of mainly cumene and by-product alpha-methylstyrene

(AMS) formed during cleavage – is sent to the AMS recovery system where the AMS is hydrogenated to cumene and the resultant cumene stream is recycled back to oxidation.

The bottoms from the first fractionation column – containing phenol, some cumene and AMS, and all the heavy by-products – is fractionated under vacuum to produce a crude phenol distillate, which further undergoes extractive distillation and stripping to make product phenol. The phenol distillation bottoms contains all of the heavy by-products, acetophenone, and some phenol and may be used as fuel.

All acetone- and phenol-containing vents are collected and chilled. Recovered phenol and acetone are recycled into the process, thus minimizing losses while at the same time reducing air emissions. After treatment, the vent gas can be discharged directly to atmosphere. All aqueous wastes and drains are collected in closed systems and then treated via extraction to remove phenol, which is recycled to the process. The resulting wastewater is of sufficiently high quality to be sent directly to an off-site bio-oxidation unit for final treatment before discharge.

Process Chemistry

Oxidation



Cleavage

