

Cumene

with proprietary catalyst
PBE-1 zeolite based

Proprietary
process technology



polimeri europa



POLIMERI EUROPA PRODUCTION TECHNOLOGIES NOW AVAILABLE FOR LICENSING

Polimeri Europa

Polimeri Europa – the petrochemical company of Eni – manages the production and marketing of Basic Chemicals, Polyethylene, Elastomers and Styrenics.

With its 17 production sites throughout Europe and a widespread sales network, Polimeri Europa can present itself to the intermediates, thermoplastic resins and elastomers market as a sound and comprehensive supplier whose key strength is its integration. From raw materials to production plants, from research laboratories to technology, through to the interface with the market which can turn to a single source with the certainty of finding solutions to its requirements not only in terms of products, but also in terms of assistance and service. Thanks to the definition of the e-commerce and the logistic portal express, Polimeri Europa can offer to its customers the opportunity to use their tailored made e-shopping and logistics. Saving time and money.

On the basis of its first hand experience, Polimeri Europa can also license its proprietary production technologies aiming to satisfy the even more specific customers needs.

Polimeri Europa's commitment to quality, improvement and innovation continues, as does its pledge to promote sustainable growth with regard to the community and the environment.

Licensing

Proprietary process technologies

Phenol and derivatives

PBE-1 Zeolite catalyst based Cumene *
Phenol, Acetone, Alkylphenylstyrene *
Isopropyl Alcohol Acetone hydrogenation *
Isopropyl Alcohol to Cumene *

PBE-1 Zeolite catalyst
TS-1 Titanium silicalite catalyst based
Ammoxidation

DMC and derivatives

Dimethylcarbonate
via Carbon Monoxide and Methanol *
Dimethylcarbonate / Diphenylcarbonate *

Polyethylene

LDPE
HDPE
EVA

Styrenics

PBE-1 and PBE-2 Zeolite catalyst based
Ethylbenzene
Styrene monomer
GPPS
HIPS
EPS
ABS continuous mass polymerization
SAN

Elastomers

e-SBR
s-SBR
SBS / SB / LCBR
Polybutadiene

Proprietary catalyst technologies

Titanium silicalite
PBE-1 Zeolite
PBE-2 Zeolite

* Co-licensing in cooperation with Lummus Technology

Introduction to Polimeri Europa Cumene process

The Polimeri Europa process, based onto a PBE type zeolite based proprietary catalysts, has been industrially applied since mid 1990s. PBE-1 is a proprietary catalyst zeolite based showing higher selectivity to cumene than other common zeolite catalysts and is equally effective for alkylation of benzene and transalkylation of polyisopropylbenzenes to cumene. The mechanical resistance of the catalyst is at the highest level for a zeolite based catalyst.

Main process features of Polimeri Europa Cumene with proprietary catalyst PBE-1 zeolite based are:

- no environmental concerns associated to the the traditional SKPA (Solid Kieselguhr Phosphoric Acid) and $AlCl_3$ catalysts: exhausted catalyst itself is a completely inert material;
- no plant maintenance concerns due to catalyst acid syrups or fine powder production during operation and no special materials or coatings needed for plant equipments;
- optimization in distillation section to lower variable costs reducing the benzene recycle;
- long-lasting catalyst fully regenerable through an easy ex-situ regeneration procedure allowing several reaction/regeneration cycles with an unusually high ultimate catalyst lifetime;
- very easy loading and unloading operations due to the complete absence of catalyst agglomerates;
- total productivity in excess of 20 MT of cumene per kg of catalyst at every reaction cycle is normally obtained;
- low catalyst inventory due to the inherently high catalyst activity;
- high process efficiency due to unusually high selectivities to cumene in both alkylation and transalkylation reactors in a wide range of benzene to propylene ratios;
- no clay treaters for finished cumene due to its negligible Bromine Index;
- cumene product purity higher than 99.9% wt.



Since the early stages of development our Cumene proprietary process technology has gained benefit from a deep cooperation between leading scientists in the zeolite field within Eni SpA and technicians involved in industrial cumene production at Polimeri Europa (former EniChem). A complete kinetic model for alkylation and transalkylation reactors loaded with proprietary catalyst PBE-1 is available. Currently Polimeri Europa is proud to offer on the market one of the best and reliable zeolite based technologies for cumene production. Revamping of plants based on traditional SKPA technology with the Polimeri Europa Cumene PBE-1 Process can bring up to 80% extra capacity in the reaction section.

TECHNICAL DATA

Product purity and material balance

Cumene quality	
Cumene	99.9% wt min
Bromine index	5 max
Ethylbenzene	100 ppm wt max
n-Propylbenzene	300 ppm wt max
Butylbenzene	100 ppm wt max

Cumene plant material balance		MT per MT Cumene
<i>Raw materials</i>		
Benzene as 100%		0.651
Propylene as 100%		0.352
<i>Product</i>		
Cumene		1.000
<i>By products</i>		
Heavies		0.003
Fuel gas (propane)		(1)
Exhausted benzene		(2)

(1) Function of propylene purity, 100% recovery

(2) Function of non-aromatics in benzene feed

Process economics

Cumene plant utilities consumption		per MT Cumene
Steam import (32 bar g)		1,100 kg
Steam import (2.5 bar g)		233 kg
Cooling water		45 m ³ (1)
Electricity		23 kWh

(1) No air coolers assumed

Investments estimation

A 270 kt/y ISBL cumene unit has an estimated investment cost of 25 million Euro (NWE basis).

Wastes and emissions

The process produces no liquid or vapour emissions with the exception of vacuum pumps vents.

Spent catalyst can be regenerated several times and, at the end of its lifetime, can be disposed in a normal landfill. The plant can be provided with a vent recovery network, for continuous and non-continuous vents, to be sent to a combustor in order to lower all plant emissions to negligible amounts.

Industrial applications

First industrial application dates back to March 1996 when, at Porto Torres site (Sardinia, Italy), a first industrial test-run based on an initial cumene capacity of 70 kt/y was done.

In 1997 the new zeolite based technology was extended to 130 kt/y cumene capacity. In 2000, following four years of continuous trouble-free test-run operation, the fully proven technology was applied to the revamp of the existing cumene plant for a total of 400 kt/y cumene capacity at Syndial (a subsidiary of Eni SpA) Porto Torres site.



PROCESS DESCRIPTION

Fresh benzene is fed to the pre-treatment section (to remove impurities harmful to the catalyst as well as water possibly containing chlorine) and then enters into the distillation section where, along with recycled benzene and propylene, is pumped to the alkylation section.

In the alkylation section reaction of propylene with benzene takes place in liquid phase in one or more fixed bed reactors with multibed catalyst arrangement.

The alkylation effluent, which consists mainly of unconverted benzene, cumene and diisopropylbenzenes is sent to the distillation section.

The distillation separates, in three columns: propane (associated with fresh propylene) as off gas to be sent in the fuel gas network; recycle benzene; produced cumene (with a purity higher than 99.9% wt); heavies (made up of recoverable polyisopropylbenzenes and a very small amount of unrecoverable material); and a negligible amount of benzene to be purged.

The heavies enter the transalkylation section, where a column separates the recoverable polyisopropylbenzenes from the unrecoverables (the bottoms). Polyisopropylbenzenes are fed to the transalkylation reactor along with benzene, coming from the distillation section, to produce additional cumene, while bottoms are sent to OSBL.

The transalkylation reactor effluent, which consists mainly of unconverted benzene, cumene and a small amount of unconverted polyisopropylbenzenes, is sent to the above mentioned distillation section.

Feedstock impurities

PBE-1 zeolite based proprietary catalyst has been tested with all the possible benzene and propylene feedstock impurities showing a unique, highly proven resistance.

Polimeri Europa Cumene with PBE-1 zeolite based catalyst process can be fed with propylene at a very wide range of purity, from de-hydro and refinery to chemical and polymer grade, with a propane content from 50 to 1% wt.

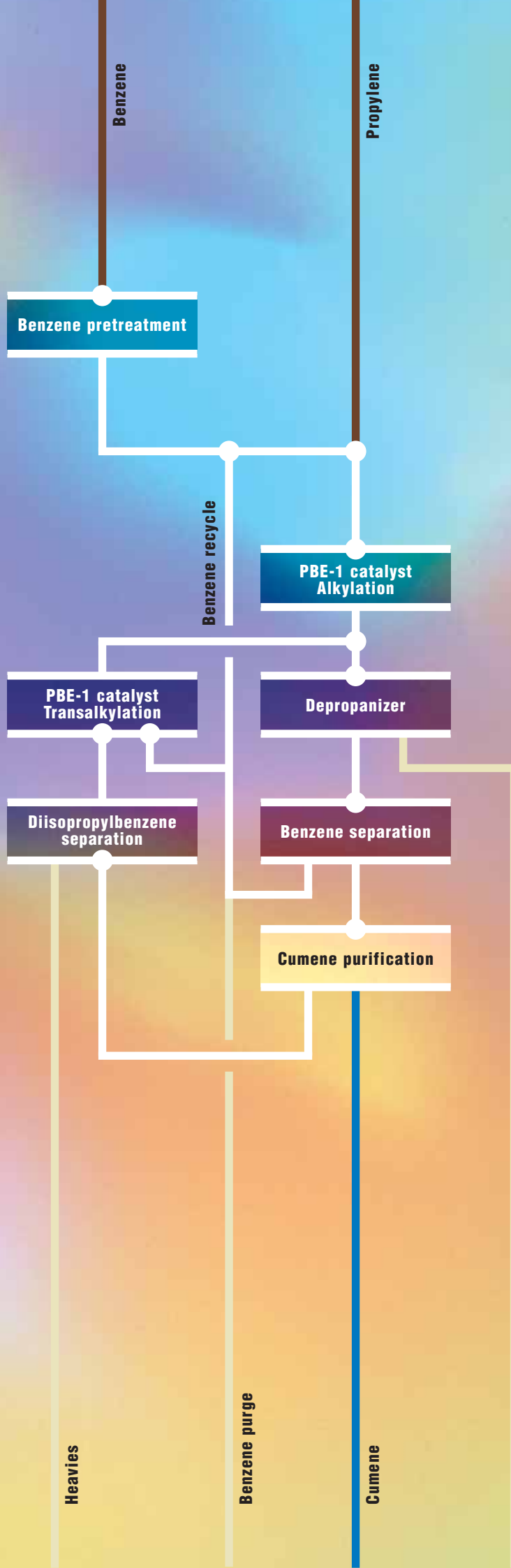
Ethylbenzene and butylbenzenes are formed in association with minor propylene impurities like ethylene and butylene, while cymenes are formed from toluene impurity in fresh benzene. Depending on the impurities level in the fresh feedstocks some of these by-products, never exceeding 500 ppm including n-propylbenzene, are distilled with cumene leading to the formation of typical phenol contaminants like: aldehydes (from ethylbenzene and n-propylbenzene) and cresols (from cymenes) as well as butylbenzenes contamination in the purified a-methylstyrene.

Raw materials

Process sections

Products

By products



Polimeri Europa SpA

A subsidiary of Eni SpA
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Responsible Care



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