

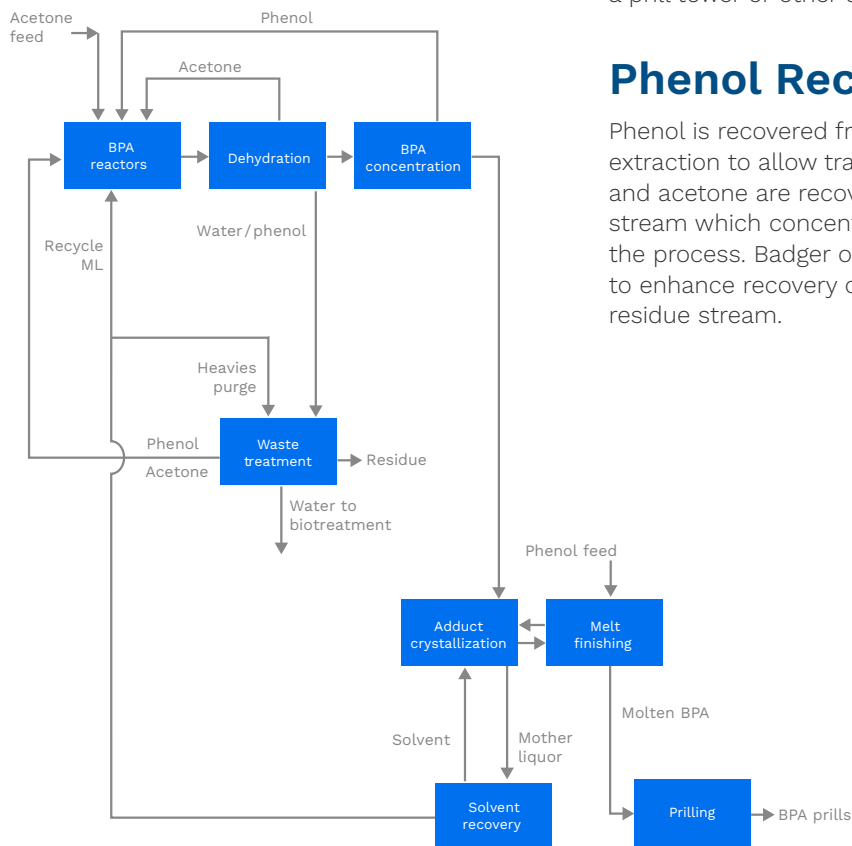
Badger Bisphenol A Process

The Badger Bisphenol A (BPA) process converts commercial-grade phenol and acetone into high-purity BPA suitable for polycarbonate, epoxy resin, and other chemical applications.

The BPA technology offered today by Technip Energies Badger Process Technology is based on a technology platform originally developed by Shell Chemical Co. for their plant in Texas now owned and operated by Hexion, Inc.

The process combines an efficient, low-cost ion-exchange resin catalyst system and a proprietary purification technology. With over 3.78 million tons of licensed BPA capacity, the Badger Bisphenol A technology has a proven record of success.

Bisphenol A process



Reaction/Dehydration

Acetone reacts with phenol in a 2-stage reaction section over ion exchange resin catalyst and a homogeneous co-catalyst. The crude reaction product is distilled to recover the co-catalyst and unreacted acetone, to remove co-product water, and to increase the BPA concentration in the product stream.

Crystallization/Melt Finishing

A proprietary crystallization process separates the desired p,p'-BPA isomer from impurities formed by side reactions. Melt finishing removes and recovers phenol from the crystallization product by vacuum distillation to produce a high-purity p,p'-BPA melt stream while minimizing thermal degradation. The molten BPA can then be solidified in a prill tower or other device.

Phenol Recovery

Phenol is recovered from the co-product water stream by solvent extraction to allow transfer of the wastewater for biotreatment. Phenol and acetone are recovered from the "heavies" purge to create a residue stream which concentrates and removes the by-product impurities from the process. Badger offers an advanced BPA Residue Recovery process to enhance recovery of phenol and acetone and substantially reduce the residue stream.



Bisphenol A technology highlights

LOW VARIABLE OPERATING COST

- Superior catalyst economics
- Improved feedstock consumption
- Competitive steam and power consumption

CATALYST PERFORMANCE

- Low-cost ion exchange resin catalyst with proprietary homogenous promoter to boost catalyst productivity and selectivity

SUPERIOR PRODUCT QUALITY

- 99.95% p,p-BPA purity
- Excellent product color
- Globally, the BPA prills from Badger-licensed plants are readily accepted by most polycarbonate (PC) producers, distinguishing Badger BPA technology from that of others. Of note, BPA plants in East Asia utilizing Badger technology have customers that use a variety of PC technologies to produce a full range of grades, including high-end optical grades



Commercial Experience

- Demonstrated performance with 11 licensed BPA plants in commercial operation with installed capacity of over 1.52 MM tpy
- Single train plant capacities of 60,000 tpy–240,000 tpy
- Technology reference plant operating since 1992
- 98% demonstrated on-stream factor



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