Bisphenol -A

Chiyoda Corporation, one of the world's leading engineering and construction contractors, has developed a new process to produce the highest quality Bisphenol-A (BPA) for polycarbonate production. The new process is named the CT-BISA® process. All of the commercial plants are now operating successfully.

As of May 1, 2001, ownership of CT-BISA® Process was transferred to Mitsubishi Chemical Corporation (MCC), a largest petrochemical /chemical company in Japan. And the new name of this process technology is "BISA-MAX".

It may require production technology and catalysts to be developed in order to flexibly meet with varieties of the market demand. Since MCC is a company who has abundant operating and production data/information as well as well equipped R & D facilities with experienced researchers and staffs, BISA-MAX Process will be surely improved to produce better quality or economically efficient products in the future market.

As a part of the collaborative relationship between MCC and Chiyoda, regarding BISA-MAX Process, Chiyoda will support MCC in licensing, preparation of process/basic design package and other related issues, in accordance with MCC's request. Chiyoda would be upfront with (prospective) clients of BISA-MAX Process licensing for and on behalf of MCC.

If you have any questions/requests on this process, please direct your inquiry to MCC

with a copy to Chiyoda

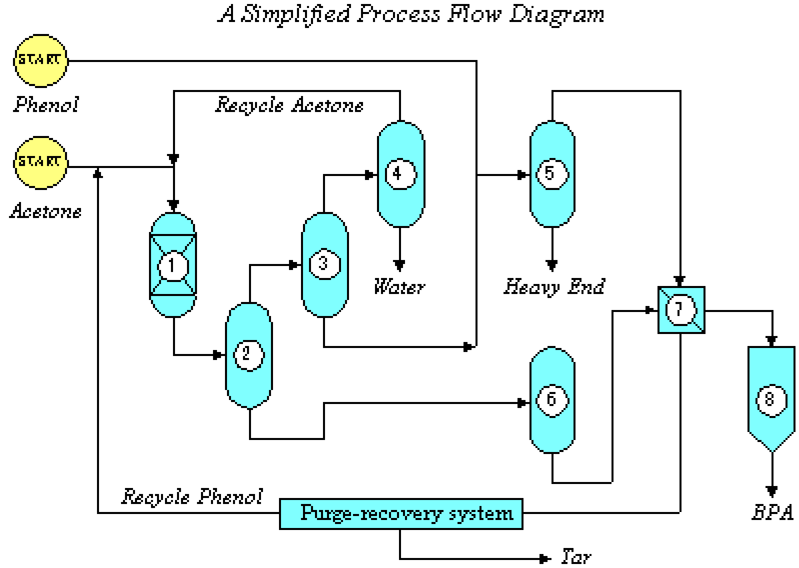
Contact Person of MCC is as follows;
Mitsubishi Chemical Corporation
Petrochemicals Segment
Phenol, Caprolactam and Melamine Dept. Strategy Group
Deputy General Manager Mr.S.Handa
(Please send to the above linked e-mail address with a copy to Chiyoda)

Process Features

The process uses a cation exchange resin as a catalyst. The simple and reliable continuous process offers numerous remarkable features, such as ;

- Catalyst
  Achieves high acetone conversion, high BPA selectivity and longer life.
- Product Quality
  Produces the highest grade BPA product suitable for any polycarbonate producers including non-phosgene route polycarbonate producers.
- Operating Economies
  Ensures lower raw material and utility consumption thanks to the higher efficiency of the reactor and a simpler purification system.
- Investment Cost
  Costly corrosion resistant construction materials are not required, and this leads to a reduction of construction and maintenance costs.
- Environmental Impact
  Only a small amount of waste water, which is easy to treat, is discharged from the process. All the other wastes are treated internally before discharging.
- Bigger Capacity
  One train for most part of process at scaling up to a bigger capacity of 100-150 KMTA.
- Operation Personnel
  A few persons can operate even a large plant such as the above.

A Simplified Process Flow Diagram



Process Description

Acetone and excess phenol react in BPA Synthesis Reactor (1), which is packed with a cation exchange resin catalyst.

Unreacted acetone, water and some phenol are separated from the reaction mixture by distillations (2,3,4). The acetone is recycled to BPA Reactor (1), the water is efficiently discharged, and the phenol is mixed with feed phenol and purified by distillation (5).

The crude product stream containing BPA, phenol and impurities is transferred to the crystallizer (6) where the crystalline product is formed, and the impurities are removed into the mother liquor. The crystals separated from the mother liquor are washed with the purified phenol at a solid-liquid separator (7).

The crystals are then melted and the molten BPA is sent to the prilling tower (8) where the spherical prills are produced as the final product of BPA, or the molten BPA is solidified by alternate devices to form such shapes as flakes and pellets. The solidified BPA can be conveyed to bagging and storage facilities.

The mother liquor containing impurities, phenol and dissolved BPA is mostly recycled to the BPA reactor. Part of the mother liquor is sent to the purge recovery system where these impurities are partially decomposed and recombined to form BPA. The effluents are mixed with the mother liquor and recycled to the BPA reactor. The undesirable impurities are condensed at the purge recovery system and discharged as tarry materials which can be used as fuel. The optimal purge ratio from the mother liquor is determined to control the product quality while keeping the consumption of raw materials low.

Product Quality

Typical quality values for BPA prills are as follows

	Chiyoda process	Other resin process
Freezing Point, deg-C	156.8	156.7 - 8
Free Phenol, wt.ppm	10 - 15	10 - 40
Iron, wt.ppm	< 0.1	< 0.1
Melt Color (175 deg-C/0 hr), APHA	5 - 10	10 - 20
Melt Color (175 deg-C/2.5 hr), APHA	10 - 25	20 - 60
Solution Color (50% MeOH), APHA	5	5 - 10
2,4' BPA isomer, wt.ppm	50 - 100	200 - 1,500

Commercial Plants

Company	Location	Capacity	Start-up
Shin Nippon Bisphenol	Tobata, Japan	70,000 T/Y	1991
Taiwan Prosperity Chemical Corporation	Kaohsiung, Taiwan	25,000 T/Y	1995
Mitsubishi Chemical Corporation	Kashima, Japan	70,000 T/Y	1998
Shin Nippon Bisphenol	Tobata, Japan	Revamp to 90,000 T/Y	1999
Mitsubishi Chemical Corporation	Kashima, Japan	Revamp 100,000 T/Y	2000
Mitsubishi Chemical Corporation	Kurosaki, Japan	100,000 T/Y	2002
China National Blue Star Chemical Cleaning Corporation	Wuxi, China	25,000 T/Y	(2003)

Japan Petroleum Institute Award

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