



PX-Plus™

Aromatics

Application

The PX-Plus process selectively disproportionates toluene to benzene and xylenes. The process is *para*-selective, with the product having a *para*-xylene concentration in the xylene fraction of about 90%. This concentration is significantly above the equilibrium value of 25% which is achieved by transalkylation technologies, such as the Tatoray™ process. The PX-Plus process provides an economic way to expand capacity of existing *para*-xylene facilities.

Increasing the *para*-xylene concentration in aromatics complex feedstocks by adding a PX-Plus unit (see figure) has significant benefits. Recoveries from a single stage crystallizer can be increased from 65% to more than 90% when the feed *para*-xylene concentration is increased to 90%.

Due to the similarity of operating conditions to many refining and petrochemical units, existing equipment can often be considered for use in PX-Plus service to reduce investment.

The PX-Plus process can also be used for large scale grassroots facilities where sufficient toluene is available and where significant quantities of benzene are desired along with *para*-xylene.

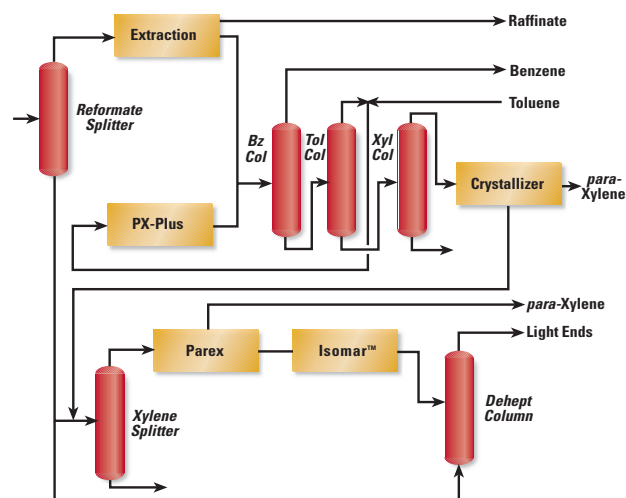
Process chemistry

The disproportionation of toluene to benzene and xylenes proceeds via a bimolecular intermediate. Once the bimolecular intermediate cleaves to benzene and xylene, some amount of shifting of methyl groups can occur on the xylene molecule. The catalyst pore structure allows benzene and *para*-xylene to escape while inhibiting the diffusion of *ortho*-xylene and *meta*-xylene.

Process description

In the PX-Plus unit, fresh toluene feed is first combined with hydrogen-rich recycle gas, preheated by exchange with the hot reactor effluent and vaporized, and then raised to the reaction temperature in a fired heater. The PX-Plus reactor is typically a down flow design. The reactants exit through the feed-effluent exchanger, are

Para-Xylene Expansion



condensed, and sent to the product (gas-liquid) separator, where recycle hydrogen is removed. The separator liquid is sent to the stripper column, where light by-products are removed overhead. The stripper bottoms stream is then sent to benzene-toluene fractionation. High purity benzene is recovered overhead, and unconverted toluene is recovered and recycled to the reactor. The *para*-xylene concentrate may be fed directly to a single stage crystallizer, or it may be sent to the Parex unit via the xylene column along with the fresh feed mixed xylenes and the recycle isomerate.

Features and benefits

Outstanding yields and performance - The table below shows typical PX-Plus process performance.

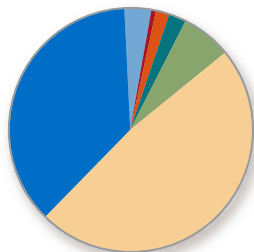
<i>Para</i> -xylene concentration in xylenes	90%
Toluene conversion per pass	30%
Benzene/xylenes, mol	1.32
Benzene quality	High

High catalyst stability - Commercial PX-Plus plants have run for over 3 years without requiring regeneration.

High toluene conversion - The PX-Plus process operates with 30% toluene conversion, while producing less than 2 wt-% light by-products per pass.

PX Plus Yield Distribution, wt-%

- Benzene
- *p*-Xylene
- *m*-Xylene
- *o*-Xylene
- Ethylbenzene
- Ag+
- Lights



Economics

A summary of the investment cost and the utility consumption for a typical PX-Plus unit is shown in the table at the right. The basis for this case is a PX-Plus unit processing 1600 KMTA (34,000 BPSD) of toluene feed. The investment cost is limited to the PX-Plus unit and stripper column and does not include further downstream product fractionation.

Estimated Erected Cost, US\$ MM 26
(2006 US Gulf Coast basis, Inside battery limits only)

Utility Consumption

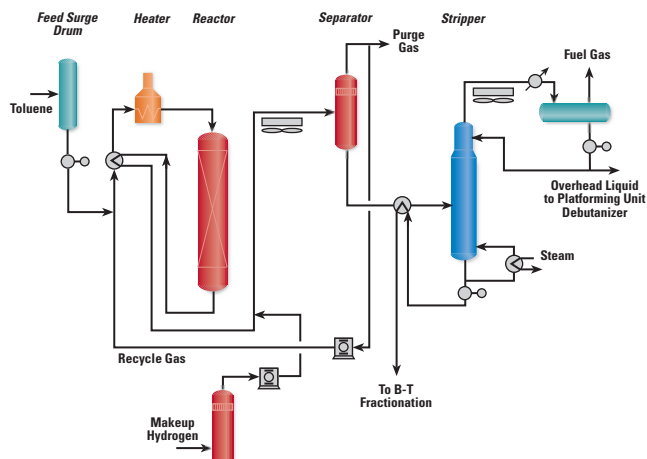
Electric power, kW	1130
Cooling water, m ³ /h	605
Fuel fired, mmkcal/hr*	9

* no credit taken for fuel value of light ends

Commercial experience

As of 2006, there are three PX-Plus units operating with feeds ranging from 650 to 1600 KMTA. The first unit came on stream in December 2003.

PX-Plus Process



For more information

PX-Plus technology services are available upon request. For more information, contact your local UOP representative or our Des Plaines sales office:

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