



## Parex™

### Aromatics

#### Application

The Parex process is an innovative adsorptive separation method for the recovery of *para*-xylene from mixed xylenes that offers high product purity, high product recovery, high on-stream efficiency, and extended adsorbent life. “Mixed xylenes” refers to a mixture of C<sub>8</sub> aromatic isomers that includes ethyl benzene, *para*-xylene, *meta*-xylene, and *ortho*-xylene. These isomers boil so closely together that separating them by conventional distillation is not practical. The Parex process provides an efficient means of purifying and recovering *para*-xylene using a solid zeolitic adsorbent which is selective for *para*-xylene. Unlike conventional batch chromatography, the Parex process simulates a moving bed of adsorbent with continuous counter-current flow of a liquid feed over the adsorbent. Feed and products enter and leave the adsorbent bed continuously, at nearly constant compositions. This technique is called simulating-moving-bed separation.

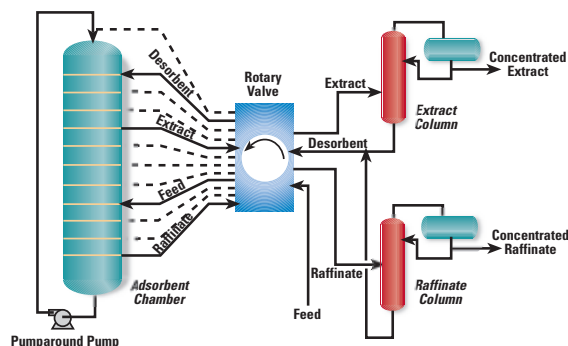
In a UOP aromatics complex, the Parex unit is located downstream of the xylene column and is integrated with an Isomar™ unit. The feed to the xylene column consists of the C<sub>8</sub><sup>+</sup> aromatics product from a CCR Platforming™ unit and the xylenes produced in a Tatoray™ unit. The C<sub>8</sub> fraction from the overhead of the xylene column is fed to the Parex unit, where high purity *para*-xylene is recovered in the extract. The Parex unit raffinate, a stream depleted in *para*-xylene, is sent to the Isomar unit where an equilibrium concentration of *para*-xylene is re-established. Isomar product is recycled back to the xylene column. The Parex process is designed to recover more than 97 wt-% of the *para*-xylene from the feed in a single pass while delivering product purity of 99.9 wt-%.

The high purity *para*-xylene produced by the Parex process is used for the production of polyester fibers, resins, and films. In downstream processing, *para*-xylene is converted to terephthalic acid (TPA) or dimethyl terephthalate (DMT), which is then reacted with ethylene glycol to form polyethylene terephthalate (PET), the raw material for most polyesters.

#### Process description

The key separation takes place in the adsorbent chambers. Each adsorbent chamber is divided into several discreet adsorbent beds. Each adsorbent bed is sup-

#### Parex



ported from below by a specialized internal grid, that is designed to ensure highly efficient liquid flow distribution. Each level of internal grid is connected to a flow directing device, known as a rotary valve, by a bed line. The internals between each adsorbent bed are used to inject or withdraw liquid from the chamber while simultaneously collecting liquid from the bed above and redistributing the liquid to the bed below.

A typical Parex unit has 24 adsorbent beds with 26 levels of chamber internal grids, and 24 bed lines connecting the beds to the rotary valve. Due to practical construction considerations, most Parex units consist of two adsorption chambers in series with 12 beds each.

In the Parex process, there are four major streams that are distributed to the adsorbent chamber by the rotary valve. These “net” streams, routed “in” and “out” of the adsorbent chambers, include:

1. **Feed in** - mixed xylenes feed
2. **Dilute extract out** - *para*-xylene product diluted with desorbent
3. **Dilute raffinate out** - ethyl benzene, *meta*- and *ortho*-xylene diluted with desorbent
4. **Desorbent in** - recycle desorbent from the fractionation section

In a simplified version of the process, only four of the bed lines are active at any given time, carrying the net streams into and out of the adsorbent chambers. The rotary valve is used to periodically advance the positions of the liquid feed and withdrawal points as the composition profile moves down the chambers. A pump provides the liquid circulation from the bottom of the first adsorbent chamber to the top of the second. A second pump

provides circulation from the bottom of the second adsorbent chamber to the top of the first. In this way, the two adsorbent chambers function as a single continuous loop of adsorbent beds.

The dilute extract is sent to the extract column for separation of the C<sub>8</sub> and lighter components rich in *para*-xylene from the desorbent. The overhead from the extract column is sent to a finishing column where the highly pure *para*-xylene product is separated from any toluene which may have been present in the feed.

The dilute raffinate from the rotary valve is sent to the raffinate column for separation of the C<sub>8</sub> components depleted in *para*-xylene from the desorbent. The overhead from the raffinate column contains unextracted C<sub>8</sub> aromatic components: ethyl benzene, *meta*-xylene, *ortho*-xylene, and any nonaromatics which may have been present in the feed. The raffinate is sent to the Isomar unit where additional *para*-xylene is formed and is then recycled back to the Parex unit. See the technical datasheet on Understanding the Sorbex Process for additional information.

The desorbent from the bottom of both the extract and raffinate columns is combined and recycled to the adsorbent chambers through the rotary valve. In order to maintain desorbent quality, provision is made to take a slipstream of the recycle desorbent to a small desorbent rerun column where any accumulating heavy contaminants are rejected. Mixed xylene feed to the Parex unit is first stripped, clay treated, and rerun. As a result of the high quality of the feed, the amount of heavy contaminants to be removed intermittently from the bottom of the desorbent rerun column is not significant.

## Features and benefits

**Highest *para*-xylene purity and recovery** - Modern designs allow for production of 99.9 wt-% pure *para*-xylene at 97 wt-% recovery per pass. Previous generation design Parex units can also be modified to 99.9 wt-% purity. No other adsorptive or crystallization technology can consistently match this performance.

**Highest reliability** - On stream availability generally exceeds 350 operating days per year, on average, annually. The highly reliable rotary valve design has greater than 99.9% process availability. The UOP rotary valve has been engineered for ruggedness and reliability and has been proven by more than 161 operating

valves world-wide. These valves are used in all of UOP's Sorbex technologies.

**Most economic design** - single train capability exceeds 1000 KMTA PX capacity, allowing customers to benefit from economies of scale. UOP's vast design and commercial operating experience allow for designs of new units that have the lowest capital and operating costs available to the industry.

## Economics

**Basis:** 700 KMTA *para*-xylene production  
99.9 wt-% purity

### Estimated Erected Cost, US\$ MM

(2006 US Gulf coast basis, Inside battery limits only)

Xylene Column	37
Parex™ Unit	57

### Estimated Utility Consumption

Electric Power, kW	5376
Medium Pressure Steam, MT/hr	10.6
Cooling Water, m <sup>3</sup> /h	37
Fuel Fired, mmkcal/hr	154

## Commercial Experience

The first commercial Parex unit came on stream in 1971. As of 2006 UOP has licensed 88 Parex units, of which 75 units are in operation and the remaining units are in various stages of design and construction. Parex units range in size from 21,000 MTA to 1,600,000 MTA *para*-xylene.

In the 35 years since its commercialization, UOP's substantial investment in the Parex process has produced the benefits listed above. UOP's commitment to technology leadership in the aromatics production industry has resulted in approximately 18 million MTA of Parex capacity being brought on stream. An additional 8 to 9 million MTA of capacity is currently in design and construction.

## For more information

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

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