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Aromatics Upgrading Technologies

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Abstract

Transalkylation, disproportionation, alkylation, and dealkylation are the most widely used processes in a refinery complex for C_7, C_9, C_{10} aromatics upgrading, and xylene isomerization is used to increase the *para*-xylene content of streams from low to high. Many licensors and technology developers provide process technologies and proprietary catalysts for these processes, each with advantages and disadvantages over other technologies. In this report, the technological advancements and production economics are updated for the following three processes:

- The UOP Tatoray™ process for upgrading toluene, C_9, and C_{10} aromatics, by catalytic disproportionation and transalkylation, to a commercial grade mix of xylene product (>98 wt% C_8 content) and high-purity benzene by-product (>99.9 wt% purity)
- The UOP isomerization process for isomerizing xylenes in a *para*-xylene-lean stream to provide a *para*-xylene-rich stream, by converting *meta*- and *ortho*-xylenes to an equilibrium mixture of xylenes, with ethylbenzene either dealkylated to benzene or isomerized to xylenes.
- The CB&I Detol® process for converting a toluene-rich stream to high-purity benzene product.

This report also provides an industry review of *p*-xylene and benzene, including the market shares of various licensors for the selected processes, process PFDs, patent summaries, and an upfront Summary section.

For the process analyses, we evaluate and discuss patent and other non-proprietary information, particularly to extract key process conditions and parameters necessary to forming the design basis for each process. An Aspen simulation model is developed and engineering judgement is applied to define the detailed material and energy balances. Plant construction costs (CAPEX), including ISBL and OSBL costs, are estimated for each processes by individual equipment sizing and costing with the aid of IHS's proprietary software PEPCOST®. Operating costs are calculated based on unit consumption of raw materials, utilities, and direct costs as well as depreciation and return on investment.

Production economics presented in the report are based on cost data for the US Gulf Coast (USGC) region. However, an Excel-based data module iPEP NavigatorAromaticsUpgrading is included as an attachment to the electronic report, to allow our clients to convert the economics of the discussed upgrading processes to the corresponding economics in five other regions (Canada, China, Germany, Japan, and the Middle East).

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