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Technology and Costs

TECH: Xylenes - 2024

Xylenes is one in a series of reports published as part of NexantECA's 2024 Technoeconomics – Energy & Chemicals (TECH) program.

Overview

The xylene isomers, *meta*-xylene, *ortho*-xylene, and in particular *para*-xylene, are important chemical intermediates. *para*-Xylene has by far the largest market of the three isomers, with the largest use of *para*-xylene being its oxidation to make purified terephthalic acid (PTA), a raw material for polyester fiber and polyethylene terephthalate resin (PET).

In recent years, increased fuel efficiency, electrification of transportation and a growing regulatory environment in favor of lower carbon emissions from the automobile transportation sector has reduced demand for gasoline and the corresponding aromatics-based blending components. Gasoline usage is estimated to decrease further in the long term as carbon intensity reduction and net zero target timelines draw near. As a result, project developers and producers are shifting production from traditional gasoline blend components towards chemicals production, including aromatics such as xylenes.

This TECH report covers both commercial and developing technologies for producing xylenes and addresses questions such as:

- How are aromatic complexes integrated to increase *para*-xylene production?
- What are the recent technology and catalyst developments for *para*-xylene production?
- What new developments have emerged for producing renewable *para*-xylene?
- How does carbon intensity change for the different production routes to *para*-xylene?

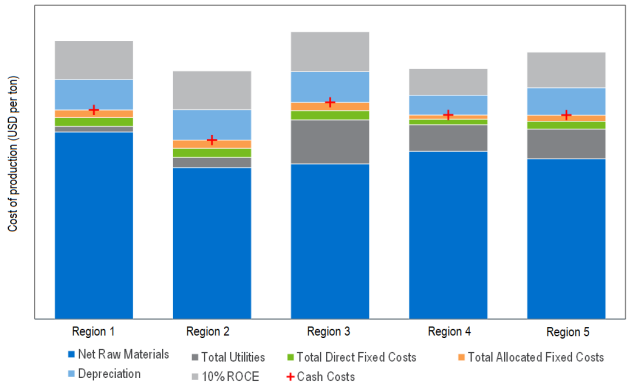
Commercial Technologies

Xylenes are produced as co-products in refinery catalytic reformers, olefins plants, and toluene disproportionation (TDP) units. Mixed xylenes are extracted from reformate or pyrolysis gasoline in an aromatics complex by fractionation. Additional xylenes can be produced in an aromatics complex by toluene disproportionation to xylenes and benzene. *para*-Xylene is recovered from mixed xylenes via selective adsorption or crystallization. Technologies developed by UOP, Axens, ExxonMobil, Lummus Technology/INEOS Aromatics, Sulzer Chemtech are described and analyzed, with a focus on recent developments.

Process Economics

Detailed cost of production estimates for various technologies are presented for the USGC, coastal China, Western Europe, South-East Asia, and Middle East locations. Estimates are developed for an integrated aromatics complex and for individual processes.

Reginal Cost of Production Comparison for an Integrated Aromatics Complex



Commercial Overview

para-Xylene is used almost exclusively in producing purified terephthalic acid (PTA), the main feedstock for polyethylene terephthalate (PET) resin and fibers. PET is one of the largest volume polymers in the world, resulting in significant PX demand compared to the other xylene isomers. *meta*-xylene is used for production of isophthalonitrile through oxidative ammonolysis of *meta*-xylene and is used for producing derivatives such as meta-xylenediamine (MXDA), meta-xylene nylon and 1:3 bis-(methylamine)-cyclohexane. *ortho*-Xylene is extracted from mixed xylenes by fractionation and is mainly used for the production of phthalic anhydride (PAN) as a plasticizer.

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The TECH program (formerly known as PERP) is globally recognized as the industry standard source of process evaluations of existing, new and emerging technologies of interest to the energy and chemical industries.

TECH's comprehensive studies include detailed technology analyses, process economics, as well as commercial overviews and industry trends. Reports typically cover:

- Trends in chemical technology
- Strategic/business overviews
- Process Technology:
- Chemistry
- Process flow diagrams and descriptions of established/conventional, new and emerging processes
- Process economics – comparative costs of production estimates for different technologies across various geographic regions
- Overview of product applications and markets for new as well as established products
- Regional analysis, including capacity tables of plants in each region
- Carbon intensity analysis, and regulatory and environmental issues where relevant

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- Cost of production tables in spreadsheet format
- Consultation time with the project team

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Technology and Costs comprises the Technoeconomics – Energy & Chemicals (TECH) program, the Biorenewable Insights program (BI), and the new Cost Curve Analysis. These programs provide comparative economics of different process routes and technologies in various geographic regions.

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