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Toluene Methylation Process by GT-TolAlkSM Technology

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Abstract

Mixed xylenes are the second-most-important aromatic product in terms of world consumption for chemicals manufacture, ranking behind benzene and ahead of toluene. Global demand for xylene isomers has been continuously increasing, with para-xylene leading the way. During 2010–15, consumption of mixed xylenes increased by about 18% (3.4% average annual growth). The high demand for xylene isomers has created incentives for technology researchers to continue advancement work on various aspects and areas of the technologies. Improvements in catalyst performance are one of the prominent features of that work.

Catalyst innovations have significantly improved the processes for on-purpose production of xylenes. Examples of those innovations include processes such as toluene disproportionation, toluene transalkylation, and xylene isomerization. A relatively new commercial development is the toluene alkylation process, in which mixed xylene is produced by reacting toluene and methanol in the presence of a ZSM-5 catalyst.

This review presents a technoeconomic evaluation of the above-mentioned technology, branded as GT-TolAlkSM, which was developed by GTC Technology US, LLC, a US company headquartered in Houston, Texas. The production of mixed xylene using a toluene methylation process is one of the advanced methods developed by GTC via a toluene alkylation route. Sinopec Yangzi Petrochemical (China) has also independently developed and constructed that country's first toluene methanol alkylation plant, with the capacity to produce 200,000 metric tons per annum (MTPA) of para-xylene. That plant was successfully commissioned in December 2012. GTC won the first global application of toluene alkylation technology for a 280,000 MTPA toluene alkylation unit in China in January 2015.

The technoeconomic evaluation in this review includes estimated capital and production cost estimates, showing the details of important process cost parameters such as battery limits and off-sites costs, variable cost, plant cash cost, plant gate cost, production cost, etc. A brief market overview summarizes the global producing companies, as well as consumption and price details of mixed xylenes.

We prepared this review using information derived from public domain information sources (mainly patents). We also received some data of nonconfidential nature from the licensor (GTC Technology US, LLC) through private communications. Process design was done primarily through Aspen Plus[®] simulations. Plant and process economics (capex and opex) were worked out using IHS proprietary PEPCOST software, using in places our own design judgments based on operational experience.

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