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Technology and Costs

TECH 2021-8: Butadiene/Butylenes

Butadiene/Butylenes is one in a series of reports published as part of NexantECA's 2021 Technoeconomics – Energy & Chemicals (TECH) program.

Overview

Butadiene and butylenes are components of mixed C_4 streams, which are produced as byproducts in steam crackers and refinery FCC units. Components of the C_4 stream are mainly consumed in the production of synthetic rubber (butadiene), polyethylene comonomer (butene-1), specialty chemicals, engineering plastics, and solvents.

More than 85 percent of the mixed C4 stream is used for the production of butadiene, with the remainder used for metathesis, recycle co-cracking, and other products. Mixed C4 and butadiene shortages resulted in high butadiene prices in 2011/12, which led to increased interest in on-purpose routes to butadiene, but most of these routes are not economical.

This TECH report provides an updated overview of the technological, economic, and market aspects for butadiene, isobutylene, and butene-1. The following issues are addressed in this report:

- What are the major technologies for butadiene, isobutylene, and butene-1 production and how do they differ? Which technologies are available for license?
- How do the process economics compare across processes and different geographic regions?
- What is the current market environment for butadiene and butene-1? How does its growth compare in different regions? Where will new capacity be added?

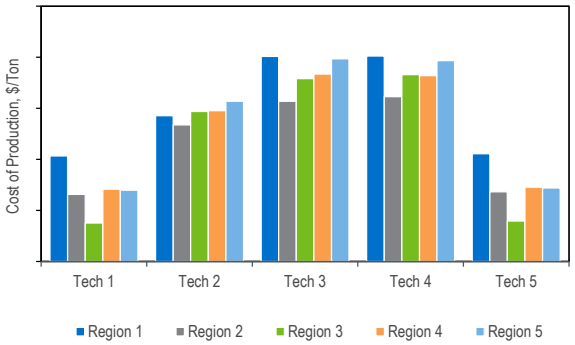
Commercial Technologies

The vast majority of butadiene is produced as a co-product of the steam cracking process and is recovered via extractive distillation from the mixed C_4 stream. Smaller amounts are produced via dehydrogenation processes. Isobutylene is produced from MTBE or TBA cracking and isobutane dehydrogenation, as well as cold acid extraction. The majority of butene-1 is produced by extractive distillation from mixed C_4 streams. A significant amount is also produced via ethylene dimerization, with a smaller amount from ethylene oligomerization (full-range alpha olefin processes).

Process Economics

Detailed cost of production estimates for various commercial processes for butadiene, butylene, and butene-1 are presented for USGC, coastal China, Middle East, Southeast Asia, and Western Europe locations. Estimates are also developed for an ethylene cracker with different options for processing the mixed C_4 stream and for producing butadiene and various byproducts for different upgrading configurations to derive maximum value for the mixed C_4 stream.

Regional Cost of Production Comparison for Butadiene Production



Commercial Overview

Global butadiene consumption was 11.3 million tons in 2020. The largest end-uses are butadiene rubber and SB rubber, which account for more than half of global consumption. Demand growth of 2.8 percent per year through 2025 is expected, with growth driven by the Asia Pacific region. Global butene-1 consumption was 2.3 million tons in 2020. The largest end-use is for polyethylene, which accounts for 90 percent of global consumption. Demand growth of 4.9 percent per year through 2025 is expected, with growth driven by the Asia Pacific region. An overview of the supply, demand, and trade of butadiene and butene-1 on a global and regional (North America, Western Europe, and Asia Pacific) basis is provided in this TECH report, including demand by derivative and a capacity list for each region.

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- Chemistry
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- Overview of product applications and markets for new as well as established products
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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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