



TECH 2022-5: Polyethylene Terephthalate (PET)

Polyethylene Terephthalate (PET) is one in a series of reports published as part of NexantECA's 2022 Technoeconomics – Energy & Chemicals (TECH) program.

Overview

Polyethylene Terephthalate (PET) is mainly divided into melt phase and bottle grade. Melt phase PET is often referred as polyester and is mainly used in textiles industry to produce clothing and upholstery while bottle grade PET is a higher molecular weight PET used to manufacture bottles and films.

PET is a highly transparent plastic and is chemically resistant towards oxygen, making it suitable for packaging consumable products. PET is also the most recycled plastic in the world making it highly attractive towards reduction of carbon emissions and the circular economy.

Prior to mid-1960, PET was widely produced by reacting dimethyl terephthalate (DMT) and monoethylene glycol (MEG). However, advancement in producing a high purity terephthalic acid called purified terephthalic acid (PTA) replaced DMT as the main raw material. Producing PET from PTA and MEG route is preferred due to faster reaction rates and lower consumption of raw materials. The production of PET is mainly divided into two key reactions which are esterification and polycondensation. For higher molecular weight/intrinsic viscosity PET for bottle grade usage, melt phase PET is subject to solid state polymerization (SSP).

This TECH report provides an overview of the conventional and developing technological, economic, and market aspects of PET. The following are the issues addressed in this report:

What are the two main conventional routes to produce PET?

- What are some of the strategic and business considerations surrounding PET production?
- What are some of the key technology developments for producing bio-based PET? How is recycled PET being produced from enzymatic recycling?
- How do the process economics for conventional PET processes compare across different global locations? How do production costs for integrated PTA and PET plants compare with a standalone PET plant?

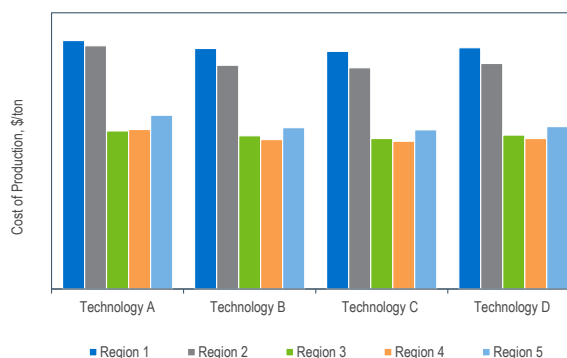
Commercial Technologies

PET licensors are divided into melt phase and solid state polymerization (SSP) where some licensors collaborate towards offering an integrated melt phase and solid state polymerization (SSP) solution. A description of reactor designs and process flow configurations are presented for major licensors.

Process Economics

Detailed cost of production estimates for the conventional route and three different licensor processes for the production of PET bottle grade are evaluated in USGC, Western Europe, Middle East, China and Southeast Asia. Additionally, a historical investment analysis is carried out on fossil-based PET, bio-based PET and recycled based PET for the USGC region.

PET Bottle Grade Production Costs



Commercial Overview

Global melt phase consumption grew by 9.5 percent to 99.8 million tons while bottle grade grew by 6.3 percent to 27 million tons in 2021, reflecting strong growth following suppressed markets affected by the COVID 19 pandemic. Across the past decade, capacity additions for both melt phase and bottle grade have been centered around China, with China accounting for 62 percent of global melt phase capacity and 36 percent of global bottle grade capacity.

Supply, demand and trade for both melt phase and bottle grade PET across major global regions are provided in this report.



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