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Technology and Costs

TECH 2019S8: Dimethyl Carbonate

Dimethyl Carbonate is one in a series of reports published as part of Nexant's 2019 Technoeconomics – Energy & Chemicals (TECH) program.

Overview

Dimethyl carbonate (DMC) is an environmentally friendly and versatile chemical that exhibits a high reactivity. It is also a fast evaporating solvent that is VOC exempt in several regions. DMC has increased in production volume as its uses have evolved from specialty uses to larger-scale use as an intermediate in phosgene-free polycarbonate processes. An interesting development has been the use of DMC as an electrolyte solvent for lithium ion batteries.

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

- What are the major technologies for DMC production? Who are the major technology holders? What are some of the developing or alternative technologies?
- How do the process economics compare across processes and different geographic regions?
- What is the major application for DMC? How does growth compare in different regions? Where is most of the supply centered? Which regions have merchant DMC?

Production Technologies

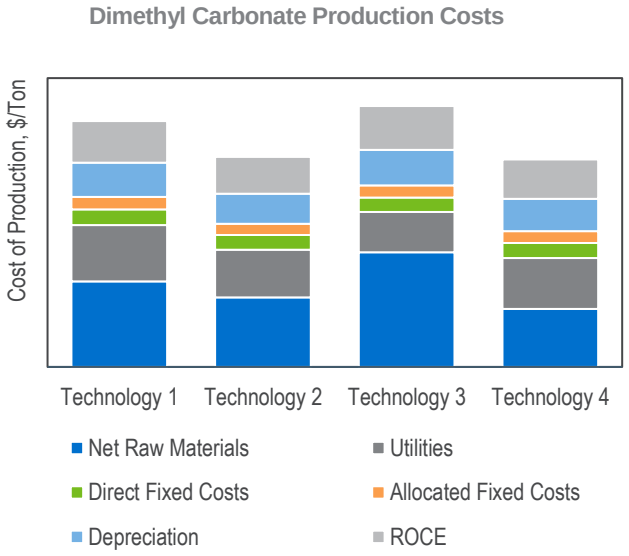
The traditional route to dimethyl carbonate involved the use of phosgene ($COCl_2$). This route has the disadvantage of safety issues related to handling highly toxic phosgene (which is a former war gas and heavily regulated in most countries) and the environmental problem of disposing of sodium chloride byproduct. The use of phosgene as a raw material limited the industrial production of DMC. As a result, technology developers focused their efforts on non-phosgene processes for synthesis of DMC.

Various routes to DMC have been developed such as the phosgenation of methanol, the oxidative carbonylation of methanol (liquid or vapor phase), urea methanolysis, transesterification of methanol and cyclic carbonate, and the direct synthesis from methanol and carbon dioxide. Within these routes, phosgenation, transesterification, and the oxidative carbonylation of methanol have been commercialized. The phosgene route is no longer employed. Currently, the majority of the DMC plants in operation use the transesterification route. A small number of plants use the methanol oxidative carbonylation route.

Process technology for DMC is available for license. Yet, some licensors do not license to third parties or seem to license to third parties on a case by case basis.

Process Economics

Detailed cost of production estimates for various technologies are presented for USGC, Western Europe, China, and Japan locations. Estimates are developed for four production routes to DMC. Sensitivity analyses on economy scale and feed pricing are also presented.



Commercial Overview

Global DMC consumption was approximately 786 thousand tons in 2018, with solvent production being the largest end-use. The DMC market is greatly influenced by the automobile, building & construction, electric & electronics, and pharmaceutical sectors. Demand is expected to grow close to 6 percent annually driven by China (the largest DMC consuming country globally). The available merchant DMC market is limited and some regions even lack DMC production plants.

An overview of the supply, demand, and trade of DMC on a global and regional (North America, Europe, Asia Pacific, and Rest of the World) basis is provided in this report.

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- Overview of product applications and markets for new as well as established products
- Regional supply and demand balances for product, including capacity tables of plants in each region
- Regulatory and environmental issues where relevant

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Technology and Costs comprises the Technoeconomics – Energy & Chemicals (TECH) program (formerly known as PERP), the Biorenewable Insights program (BI), the Sector Technology Analysis, 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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