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Bioethylene by Ethanol Dehydration

PEP Report 29L

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Abstract

The growing concerns about environmental carbon emissions and the resulting climate change issues have effected a concerted effort to reduce these emissions from the production of industrial chemicals and fuels. There is also an impetus to reduce the carbon emissions in a broader sense, including carbon emissions related to the production of feedstock, the so-called life-cycle carbon emissions. The use of bio-based feedstocks often results in lower carbon emissions than the use of petroleum-based feedstocks. Consequently, the use of bio-based processes is receiving increasing attention as a contributor to the decarbonization efforts in the industrial sector.

Ethylene is the cornerstone of the modern petrochemical industry. It has myriad end uses such as polyethylene (PE), polyvinyl chloride (PVC), ethylene glycol (EG), and others. Almost all ethylene is currently produced by thermal steam cracking of fossil-based feedstock such as naphtha, ethane, or propane. Bioethylene is produced from bio-based feedstock and is chemically identical to fossil-based ethylene. This report presents a technoeconomic analysis of three current industrial processes to produce bioethylene by ethanol dehydration. These processes are

- Ethanol dehydration process by Braskem
- ATol™ process by Axens
- Hummingbird™ process by TechnipFMC

All three processes result in significant reductions in carbon emissions compared with conventional industrial ethylene production. The most carbon-efficient bioethylene process leads to a reduction of more than 70%, relative to conventional light naphtha cracking.

The production economics assessment in this report is based on a US Gulf Coast location. However, an iPEP Navigator module (an Excel®-based computer costing model developed by IHS Markit) is attached with this report to allow a quick calculation of the process economics for three other major regions: Germany, Japan, and mainland China. The module also allows production economics to be reported in English or metric units in each region.

This technological and economic assessment is PEP's independent interpretation of the companies' commercial processes. It is based on information presented in open literature, such as patents or technical articles, and may not reflect in whole or in part of the actual plant configuration.

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