Abstract

Process Economics Program Report 2I

ETHYLENE GLYCOL

(September 2009)

This ethylene glycol (EG) report is a supplement to three previous Process Economics Program (PEP) reports — PEP Report 2F, Ethylene Oxide & Ethylene Glycol (1997); PEP Report 70B, Ethylene Glycol (1978); and PEP Report 70A, Ethylene Glycol (1975). The report examines research work and technical developments taking place in the ethylene glycol (EG) manufacturing technologies since the issuance of last report in 1997. The evaluation especially includes techno-economic analysis of those EG technologies that were commercialized in the past twelve years.

The following two newly commercialized EG technologies are evaluated:

- Shell OMEGA® (Only MEG Advanced) Technology
- Dow METEOR® (Most Effective Technology for Ethylene Oxide Reactions) Technology

Shell OMEGA® technology is a two-step process in which EG is produced from ethylene oxide (EO) via ethylene carbonate (EC), the latter being produced as an intermediate product. EO, for this process, is produced through the conventional EO technology of Shell, using a proprietary Ag-based, promoted catalyst. Ethylene conversion is 10 to 15% and EO selectivity is 90%. EC is produced from EO using a phosphonium halide catalyst. The overall result of the two-step process is that MEG yield in ethylene glycols product is extremely high (99–99.5%). This is the main advantage of this new technology that it selectively produces MEG and minimizes the production of di-ethylene and tri-ethylene glycols. According to Shell, higher growth rate in MEG demand than for DEG was a major factor for the commercialization of technology.

Our evaluation indicates that Shell technology may give a 15% saving in the total capital investment cost for a $ 400 thousand metric ton/annum MEG plant.

Dow METEOR® technology is a single-step process in which EG is directly produced from EO by a thermal hydrolysis process. EO, for this process, is produced through the conventional EO technology, using a proprietary Ag-based, promoted catalyst. Ethylene conversion is 8 to 13% and EO selectivity is 89%. The overall MEG yield in the ethylene glycols product is about 90 to 93%. The hallmark of the METEOR® technology is that it principally based on a simplified process structure involving fewer process steps, less major equipment, and smaller plot plan as compared to the conventional EG plant of same capacity.

Our evaluation indicates that Dow technology may give an 11% saving in the total capital investment cost for a $ 400 thousand metric ton/annum EG plant.
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