Abstract
Process Economics Program Report 15C
VINYL ACETATE MONOMER
(October 2012)

Vinyl acetate production from the acetoxylation of ethylene was developed and commercialized starting with the liquid-phase process. Because of equipment corrosion associated with the liquid-phase process, a vapor-phase acetoxylation technology was developed and commercialized in the 1970s. In vapor-phase acetoxylation, vinyl acetate monomer (VAM) is produced in the gas phase by reacting acetic acid, oxygen, and ethylene in the presence of an alumina- or silica-supported palladium catalyst in conjunction with gold along with an alkali metal. The acetoxylation of ethylene is carried out in a fixed-bed tubular reactor. Several companies have modified the vapor-phase acetoxylation process for their own manufacturing facilities. Licensed processes vary primarily in the preparation and composition of the catalyst, while some incorporate different separation schemes. Recently, a fluidized-bed reactor-based technology has become available using the same chemistry.

This report reviews the market conditions with a description of the major VAM markets and a list of the world VAM producers, along with their estimated plant capacities. The focus of this report is on recent improvements in technologies for vinyl acetate production and recovery since PEP Report 15B, Vinyl Acetate was issued in 1996. This report presents a comparative evaluation of commercial processes for producing vinyl acetate. Each vapor-phase design includes an acetoxylation reaction section, a recycle gas recovery section, and a vinyl acetate recovery section. The following process configurations were evaluated:

- The conventional Bayer vapor-phase process. The Bayer process, which is utilized in most VAM plants currently in operation, is presented for two different gold/palladium (Au/Pd) catalyst compositions and performance attributes, per-pass conversion and selectivity.
- The fluidized-bed reactor process, in which the reactants in the gas phase are contacted continuously over small-sized supported catalytic particles under fluidized conditions. The design is based on patents assigned to BP/Standard Oil.
- The vapor-phase acetoxylation process based on a separation scheme which results in higher energy efficiency. The design is based on recent patents assigned to Celanese.
- The acetylene-based VAM process. This process has attracted renewed interest in light of the increasing acetylene-based VAM capacity in China. The process is based on calcium carbide as the starting raw material.

Our analysis shows that recent advancements in the vapor-phase process have lower product values than conventional technologies, while the acetylene-based route has a slightly higher product value but remains competitive.
VINYL ACETATE MONOMER

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October 2012

Santa Clara, California 95054
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  - Polyvinyl Acetates (Isolated)
  - Polyvinyl Alcohol
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- Ethylene-Vinyl Alcohol Resins
- Ethylene-Vinyl Acetate Copolymers
- Other

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