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Vinyl Acetate

PERP 2011-6

Report Abstract
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Nexant

Vinyl Acetate

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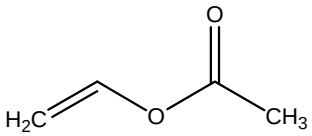
INTRODUCTION

Vinyl acetate monomer (VAM) is a colorless flammable liquid.



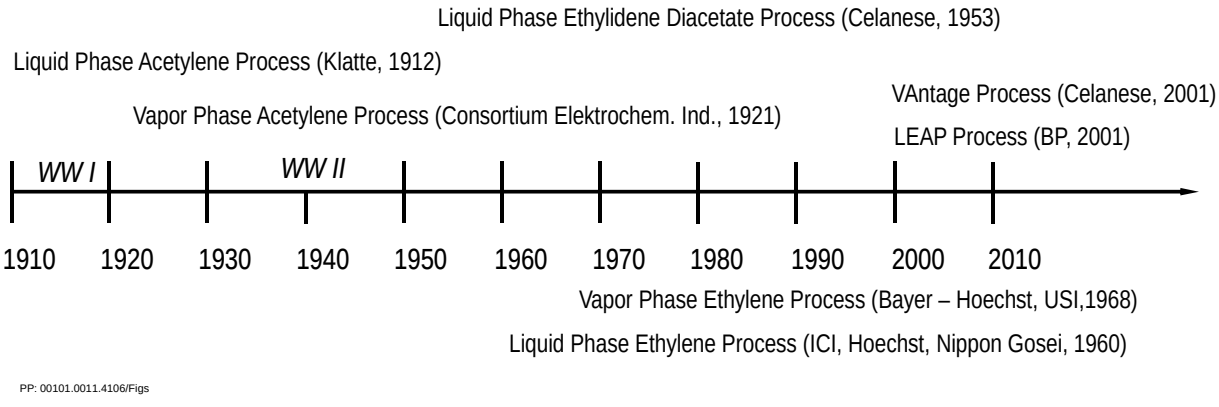
VAM is an important commodity chemical with a wide range of commercial end-use products. Most of VAM is consumed in the production of polyvinyl acetate, obtained from the polymerization of VAM, and polyvinyl alcohol, obtained through hydrolysis of polyvinyl acetate. Polyvinyl acetate end products include paints, adhesives, and coating films; remarkably popular products are wood glue and chewing gum. Polyvinyl alcohol end products are mostly films and adhesives. More than half of VAM global production is concentrated in Asia Pacific. The largest producers are Celanese, Dairen Chemical, Dow LyondellBasell, and Sinopec.

Despite past concerns on a re-classification of VAM carcinogenic properties to level 2 (human risk), and consequent regulation of consumer products produced from VAM based polymers, the Canadian Government coupled with the EU accepted that there is a threshold for carcinogenicity of vinyl acetate monomer. This is an important legal outcome since a re-classification would narrow the range of VAM consumer end-products.

TECHNOLOGY

The industrial process for the manufacture of VAM has evolved over the last century, and a summary of this evolution is illustrated below.

Figure 1 Summary of VAM Evolution



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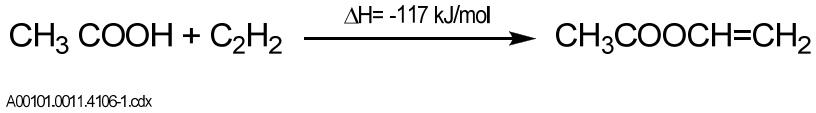
Currently, the two main commercial routes to produce vinyl acetate are an acetylene-based route and an ethylene-based route. These processes are discussed in detail in Sections 3 of the report;

and in Section 4 specific commercial technologies are discussed, highlighting Celanese VAntage™ and INEOS Leading Edge Acetoxylation Process (LEAP) technologies.

- Commercial Acetylene-Based Process (Vapor Phase)

The process is based on the reaction of acetic acid with acetylene, using a zinc acetate catalyst impregnated on charcoal:



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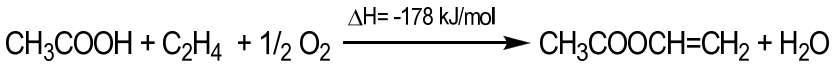
The reaction is usually performed in a fixed bed reactor with typical operating conditions 180 to 210 °C and 1 to 1.4 bar. About 20 percent of the world-wide installed capacity is based on this process and most of the plants employing this process are in China.

- Commercial Ethylene-Based Process (Vapor Phase)

The process is based on the reaction of acetic acid with ethylene in the presence of oxygen (i.e., acetoxylation of ethylene) using a palladium based catalyst:



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The reaction is usually performed in a multi-tubular bed reactor with typical operating conditions 160 to 180 °C and 5 to 8 bar. The vapor phase ethylene process currently dominates VAM production.

- Developing Processes

Alternative routes to VAM under various stages of development are reviewed in Section 5 of this report:

- Renewable Feedstock Based Technologies (Section 5.1)
- Acetic Acid Based Process (Section 5.2)
- Ethane Based Process (Section 5.3)
- Historical (Ethylidene Diacetate Based) Process (Section 5.4)

PROCESS ECONOMICS

The report includes detailed cost of production estimates for the following:

- Production of VAM from (calcium carbide derived) acetylene and acetic acid (China location basis)
- Production of VAM from ethylene, acetic acid, and oxygen, using Celanese VAntage™ Technology (China, N.W. Europe and USGC location bases)

- Production of VAM from ethylene, acetic acid, and oxygen, using INEOS LEAP Technology (China, N.W. Europe and USGC location bases)

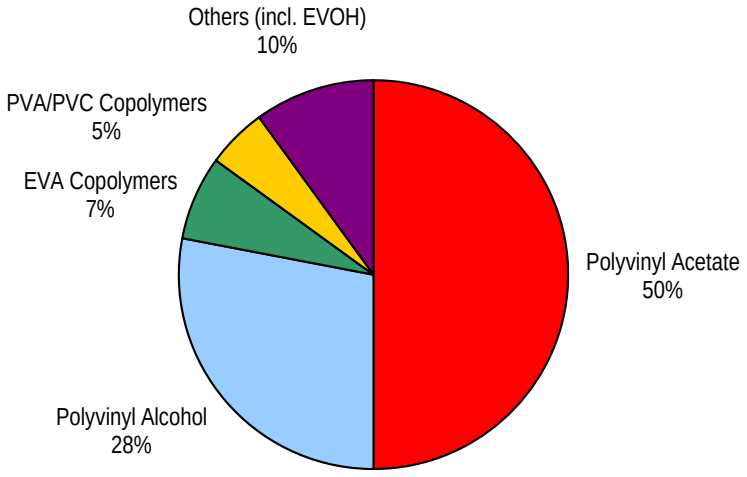
Sensitivity analyses to assess the impact of variation in feedstock prices and plant scale on VAM cost of production are included.

The detailed cost tables given in this report include a breakdown of the cost of production in terms of raw materials, utilities consumed (electrical energy, cooling water, fuel etc.), direct and allocated fixed costs, by unit consumption and per metric ton and annually, as well as contribution of depreciation to arrive at a cost estimate. Capital costs are broken down according to inside battery limits (ISBL), outside battery limits (OSBL), other project costs, and working capital.

COMMERCIAL MARKET REVIEW

Vinyl acetate monomer (VAM) is a highly versatile and important intermediate used in a wide range of end products, particularly in the coatings and adhesives markets. The figure below summarizes the major applications.

Figure 2 Global VAM Demand by End-Use, 2011



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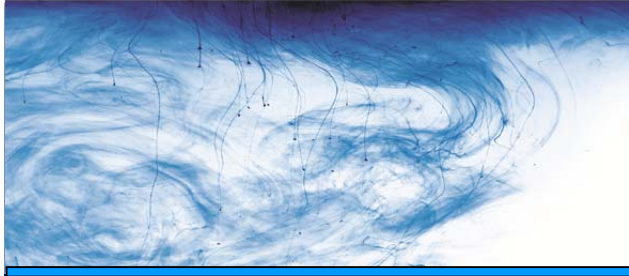
The report includes market analysis as follows:

- Global supply, demand and trade data is given and discussed
- A list giving all production plants known to Nexant showing specific plant capacities, owning company, location and annual tonnage produced
- A list giving all future capacity additions that Nexant is aware of up to the year 2014, also showing specific plant capacities, owning company, location and annual tonnage produced, as well as expected start-up date

- In addition, supply, demand and trade data is given and discussed according to key regions, i.e., North America, Europe, Asia Pacific, and the Middle East.



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