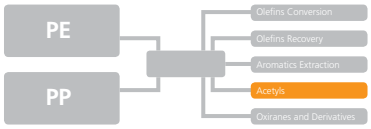


Licensed Chemical Technologies and Services

Vacido

Highly proven process technology for the production of vinyl acetate monomer through the reaction of acetic acid, oxygen and ethylene.

www.lyondellbasell.com/technology

Vacido plant – LyondellBasell, La Porte, Texas, USA

Vacido process technology by LyondellBasell is a fixed-bed tubular process utilizing a proprietary and highly efficient heterogeneous catalyst system for the efficient production and purification of high-quality vinyl acetate monomer (VAM).

The combination of an advantaged reactor system, best-in-class QVAM-2 catalyst, optimized energy utilization, and efficient product purification results in leading economics for *Vacido* process plants. The QVAM-2 catalyst in particular exhibits a superior life span, along with very high single-pass conversion rates, regeneration effectiveness, and a catalyst life up to three times longer than other market alternatives.

LyondellBasell has acquired extensive experience in the production and marketing of VAM; the company operates a world-scale *Vacido* plant in LaPorte, Texas, USA, with an annual capacity of 400 kt.

Key characteristics of *Vacido* process technology

Safety and environment

- LyondellBasell process technologies have a proven safety record, among the best in the industry
- Well-proven safety design criteria for piping and equipment in oxygen service
- Low-resource consumption at moderate operating conditions
- Reduced energy consumption through heat integration and an optimized purification process

Process technology

- Advantaged QVAM-2 catalyst technology
- High-purity VAM suitable for all applications
- Simple fixed-bed, tubular reaction system
- Proven ethylene acetoxylation reaction route
- Fully flexible design to meet local requirements, including integration with *Glacido* acetic acid process technology
- Extensive, continuous research is conducted to improve reaction catalysts and process design
- Expert technology services group with extensive hands-on experience for the life of the investment

Economics

- Simplified reactor, purification system and operations with proven plant availability exceeding 95 percent
- Annual capacities exceeding 400 KT
- Proprietary QVAM-2 catalyst delivering best-in-class operating and working-capital economics

Competitive capital costs

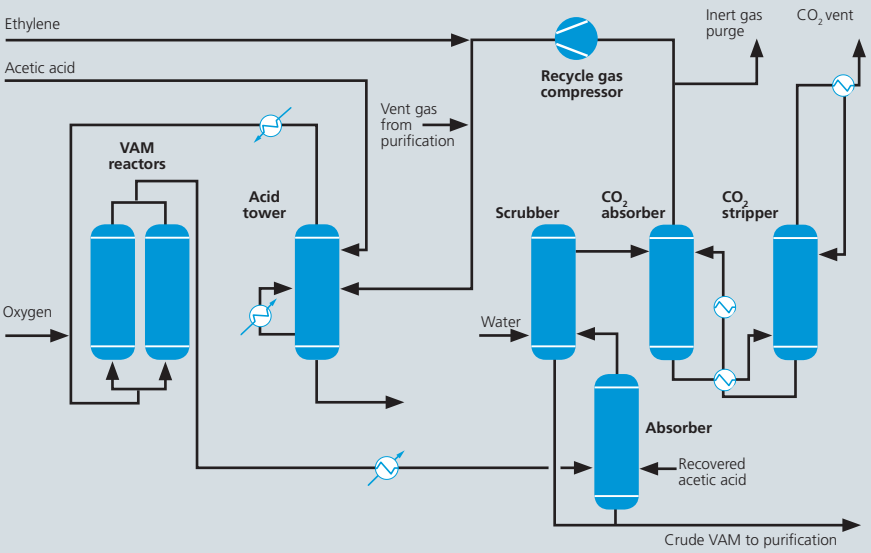
- Optimized purification section and energy integration
- Minimal maintenance requirements
- Automated process design with minimal manpower requirements

Vacido process description

Vacido technology involves the gas-phase reaction of acetic acid, oxygen and ethylene using the QVAM-2 palladium/gold heterogeneous catalyst within a fixed-bed tubular reactor. Reaction takes place at moderate conditions of 5.5 BarG and 150°C, with very high single-pass conversion rates exceeding 85 percent. Carbon dioxide, water and other side-products are recovered and recycled in the purification stage.

A dedicated engineering team with exceptional expertise in acetyls technologies customize the process design package (PDP) required for each specific investment and integration requirement.

Vacido simplified process flow diagram — Figure 1

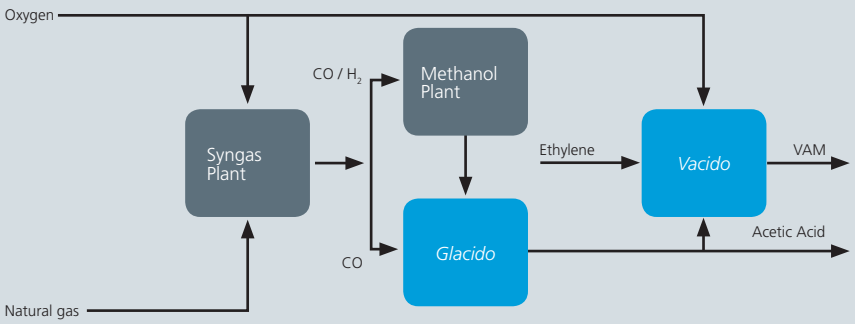


Vacido process – capabilities and performance

Since 1969, LyondellBasell has been investing in and continuously improving the research & development, manufacturing and marketing of VAM. The company's in-depth expertise has resulted in significant technology enhancements that are available for license.

VAM is an essential building block molecule used in a wide variety of industrial and consumer applications. *Vacido* technology manufactures purified VAM suitable for every VAM derivative, including polyvinyl acetate, polyvinyl alcohol, ethylene vinyl acetate copolymers, and ethylene vinyl alcohol copolymers. VAM derivatives are used in diverse applications such as emulsion polymers, resins, paints, adhesives, coatings, textiles, laminated safety glass, automotive plastic fuel tanks, and acrylic fibers.

Vacido and *Glacido* technologies – Integration process flow diagram — Figure 2



Together with the *Glacido* process technology for the production acetic acid, also available from LyondellBasell, a complete integrated solution can be configured. An example is illustrated in figure 2.

You can find out more about us by visting our website at: lyondellbasell.com/technology