



Design of Distillation Plants for High Purity Lactic Acid

Case Study

KEY FACTS

- Lactic acid purification is essential for food, pharmaceutical & biodegradable PLA applications
- Benefits:
 - Pure lactic acid: improved quality & performance
 - Ultrapure lactic acid: passes heat stability test
- Optimal purification process: multi-stage vacuum distillation



Application

Lactic acid is obtained by fermentation of carbohydrate-rich raw materials, such as glucose, sucrose, corn starch, or whey, followed by a series of purification processes. Purified lactic acid has a wide range of applications in the food, pharmaceutical, cosmetics, plastics and chemical industries.

Today, one of the most important applications for purified lactic acid is the production of polylactic acid (PLA) for the manufacture of bioplastic compounds and consumer goods. Using a feedstock derived from renewable sources of sugar, corn or wheat, lactic acid is obtained through fermentation and ultimately converted into bioplastics as a 100% bio-compostable material. The bio-compostability of plastics is one of the most important sustainability requirements worldwide. For this bioplastic production, we at VTA and UIC provide the process solution for the production of heat-stable lactic acid. The use of heat-stable lactic acid is crucial to avoid coloration during the downstream PLA polymerization process that converts lactic acid into plastic products.



Challenges

Lactic acid is often produced in a raw state that contains impurities such as residual sugars, proteins and peptides as well as some colored impurities.

In addition, the concentration of lactic acid is often insufficient for the application.

The main quality criteria for lactic acid are:

- Pass the heat stability test. The product is heated up to temperatures between 180 and 200 °C, without showing any effects such as a significant change in color (turning brown), a decrease in concentration or a change in odor, all of which indicate that decomposition reactions have taken place. Contaminated lactic acid fails heat stability tests. The results of heat stability tests help manufacturers to select the right quality of lactic acid for specific applications and ensure the safety and efficacy of the final products.
- Low concentrations of salts, heavy metals and organic acids
- Colorless appearance





Solution

Distillation is the process of choice for obtaining the highest yields of ultrapure lactic acid.

Distillation is carried out under vacuum to lower the boiling point and prevent thermal degradation.

The materials used in the distillation plant must be resistant to the corrosive properties of lactic acid. These are generally of the duplex family of stainless steels.

The key to achieving the highest purity is a multi-stage distillation process, designed to meet the specific requirements of the customer. A typical process design includes at least the following steps:

1. Crude lactic acid is supplied as an aqueous solution. Prior to vacuum distillation, the water must be removed by multi-stage falling film evaporation. The concentrate of this process is a solution containing up to 80 % lactic acid, which is used as feed for the next purification step.
2. This pre-concentrated solution is subject to thin film distillation, resulting in a water-free intermediate product.
3. As a final refining step, either short path distillation or column distillation using a thin film evaporator as a reboiler will result in high purity lactic acid. Short residence times are key in this step. Purity levels in excess of 99 % are achievable.

UIC and VTA experts draw on more than 70 years of experience to provide customized plants of all sizes for any distillation need. With two state-of-the-art technology centers we partner with our customers throughout the full process from determining the perfect distillation technology and parameters for each individual request to laboratory and pilot plant testing to the design, construction, and commissioning of industrial-scale distillation plants to after sales support.

Let us face your next distillation challenge together!



VTA and UIC are the partners for demanding process solutions of high-end thermal separation tasks. The distillation specialists offer small, standardized laboratory units up to tailor-made, skid-mounted industrial size facilities. Testing, engineering and manufacturing is performed in-house at the headquarters in Germany. VTA and UIC offer contract distillation on different toll processing plants. VTA and UIC are offering wiped and short path distillation equipment and process development for various industrial sectors with high boiling and thermal sensitive products.

Technologies

- Thin Film / Wiped Film Distillation
- Short Path Distillation
- Horizontal Thin Film Distillation
- Thin Film Drying
- Fractionation



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