

Application Bulletin

Amino Acid Production is Enhanced with Crossflow MF



Customer Benefits

- Higher yields with improved quality
- Reduced energy consumption
- Less downtime and maintenance
- Modular design with CIP feature
- Lower disposal costs

Overview

Amino acids are the essential building blocks of all proteins. Many amino acids are specifically produced via fermentation processes. Obtaining optimum yields from fermentation broths is difficult especially when they contain high levels of suspended solids. Crossflow microfiltration (MF) using Koch Membrane Systems' (KMS) spiral wound elements has been effectively employed as a replacement for traditional clarification methods to provide high product recovery with gentle processing conditions. The improved and consistent filtrate quality also simplifies the downstream processing steps.

The Challenge

To increase amino acid yields and reduce operating expenses by replacing older clarification technologies such as centrifugation and rotary vacuum filtration with crossflow MF using polymeric spiral wound membranes.

The Solution

Modern amino acid production plants manufacture these compounds for a wide variety of industrial and consumer applications. It is critical to streamline the processing steps to ensure

that consistent, continuous production can be maintained.

An integral part of the post-fermentation process is the clarification step that provides a purified stream that is suitable for downstream processing. Centrifugation and diatomaceous earth (DE) vacuum filtration do not provide a completely clarified product and they are subject to upsets and suspended solids breakthrough. Yields from these types of equipment are low as well. DE has been cited as both a health hazard and disposal problem.

The preferred solution is to install a spiral crossflow MF system for optimization of energy consumption and floor space. The technology provides a continuous flow of clarified filtrate. At the end of the concentration step, diafiltration (water washing) is used to achieve amino acid yields as high as 98%. Crossflow MF systems feature automatic operation, clean-in-place design and modular construction. When used in accordance with manufacturer instructions, the polymeric membranes tolerate high temperatures up to 176° (80°C) and tough process conditions providing a life span of 12 months or more under typical operating conditions.

Maximizing Product Yield

Crossflow filtration permits a high concentration of suspended solids that minimizes waste disposal. KMS' spiral elements are manufactured with a wide range of feed spacers, allowing the end-user to tailor the production process to the feed stream. Additionally, tubular membranes can be employed to further concentrate the spiral system retentate thereby reducing the biomass volume by another 50-75 percent. When either of these methods is followed by diafiltration, recoveries of 95-98 percent are achievable with a minimum of water usage.

A typical crossflow MF process for fermentation broth clarification is shown in the schematic above. Feed material is continuously fed to the Process Tank and the membrane system operates to produce filtrate at the rate of feed to the tank (maintaining constant volume). After 18-36 hours, when the setpoint for suspended solids is



A KMS multi-stage amino acid crossflow microfiltration system equipped with eight-inch diameter housings for spiral wound membranes. Modular stages can be arranged to accommodate any production capacity and additional units are easily added for future expansion. Individual stages with Clean-in-Place design permit fast turnaround between production cycles.

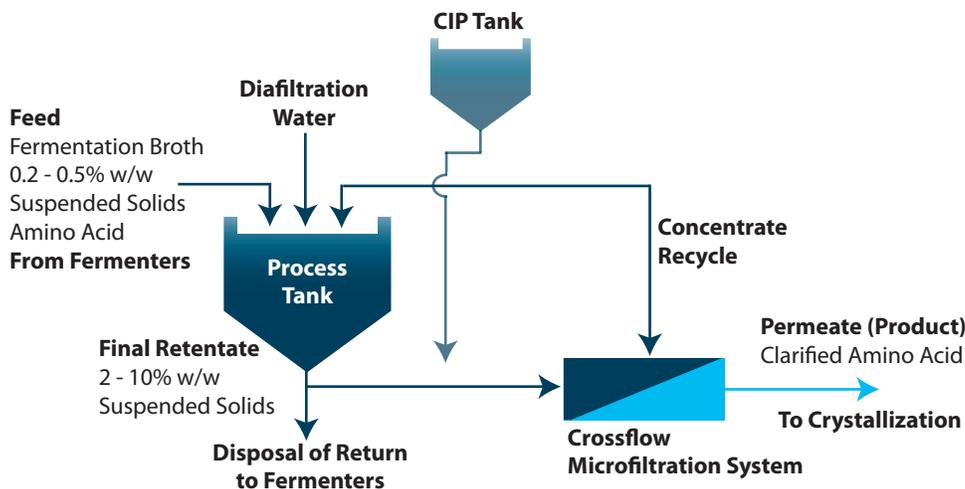
approached, feed is stopped and the tank is concentrated (batched down) to a preset level setpoint. Diafiltration water is then added to match the filtrate flow until the remaining amino acid compounds have been washed from the broth. The system is then drained and cleaned-in-place before returning to service. Often the system includes three or four parallel processing lines to allow CIP of one line while the other lines continue to operate in production mode.

Amino Acids Produced Using Crossflow MF

- Glutamic Acid
- Lysine
- Arginine
- Tryptophan
- Phenylalanine

Crossflow filtration with tighter membranes is also used for removal of endotoxins from pharmaceutical grade amino acids and reduction of impurities from acidified amino acid fermentation broths.

Process Flow Diagram



Flow schematic of a crossflow microfiltration system for amino acid recovery. Concentration proceeds until a predetermined suspended solids value is reached. Recovery then continues with the addition of water to diafilter (wash out) the remaining product.



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