



Application Bulletin

Cider Producer Maximizes Yield and Increases Capacity with the Oenoflow™ HS System

Overview

Filtration is a key operation in modern cider production to deliver visually bright and shelf stable product. Traditionally, cider clarification has been performed with diatomaceous earth or sheet based filtration technologies. However, with more favorable economics, easier operation and lower waste volumes, crossflow filtration systems like Pall's Oenoflow XL system have become more widely adopted over the past decade.

While the afore-mentioned clarification systems can concentrate to high solids levels, there is still a significant amount of recoverable alcohol in the yeast at the bottom of fermentation or maturation tanks and filtration system concentrates. With Pall's newest member of the Oenoflow family of systems, the HS system, cider producers can now recover high quality cider from these lees streams to gain up to 4% capacity with no additional capital investment.

The Challenge

A cider mill producing 20 million liters of cider per year uses an Oenoflow XL crossflow system for post fermentation clarification. After fermentation and maturation, the Oenoflow system clarifies the cider while concentrating the solids. Even after consistently concentrating up to 25% solids (v/v), the cider losses are in the range of 4%. The cider maker was looking for an economically reasonable way to increase yield.

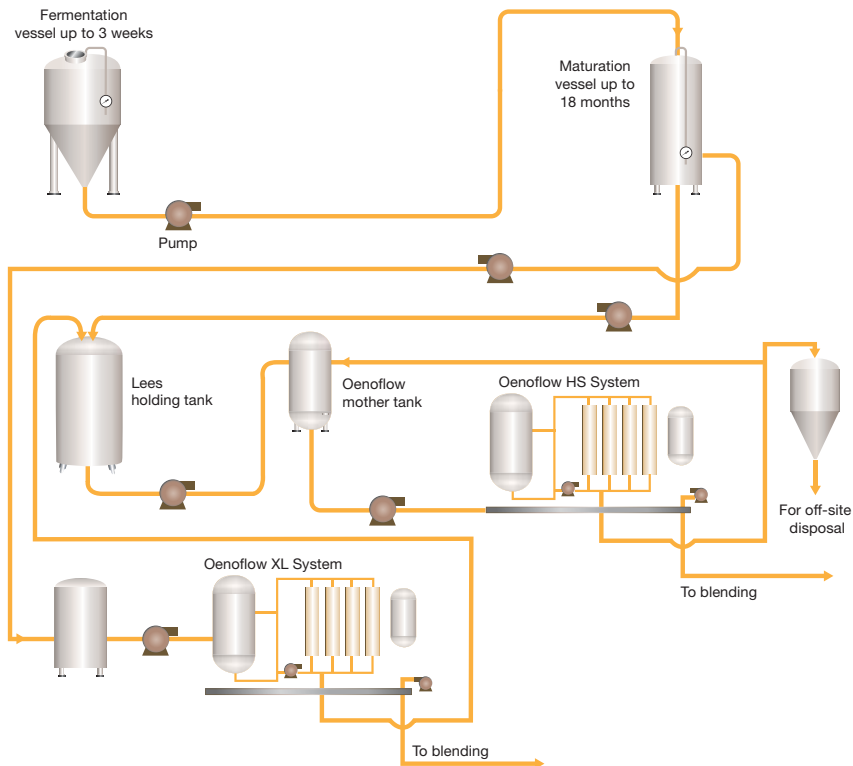
The Solution

To recover additional alcohol from the cider lees, the customer purchased Pall's new Oenoflow HS or **H**igh **S**olids system. The system employs hollow fiber membranes similar to those already used in their cider clarification application, however, the Oenoflow HS membranes have a wider internal fiber diameter to concentrate the solids up to about 70% by volume.

For the new process, after fermentation and maturation, the hard cider at 10% alcohol is filtered by the Oenoflow XL system while the tank bottoms



New Process Schematic



are sent to a lees holding tank that also serves as the feed supply for the Oenoflow HS system. The XL system filtrate or clarified cider is sent downstream for final blending to bottle strength while the concentrate is sent to the lees holding tank to be further concentrated by the HS system. The final HS system concentrate is sent for off-site disposal. A schematic is shown above.

The Oenoflow HS system design incorporates diafiltration, a process where water is added to the lees concentrate. Diafiltration “washes out” alcohol from the yeast to increase recovery and improves the return on investment. The resulting alcohol strength of the filtered cider batch is reduced, however, this helps to lower the water required for the downstream blending to bottle strength.

By implementing the Oenoflow HS system, the customer can reduce their cider losses from

800,000 liters to approximately 285,000 liters per year. With the cider at 10% strength, this means alcohol losses of 28,500 liters per year. By adding diafiltration, the alcohol losses can be further reduced to approximately 3,500 liters per year resulting in a system payback less than a year. Compare the losses for the process with and without the Oenoflow HS system in the tables below.

In addition to the added value from the recovered alcohol, the customer was able to realize further benefits. They increased their finished cider capacity without the need for additional capital investments like fermentation tanks and the associated equipment. Without diafiltration, the HS system alone increased capacity by 2.6%. Considering diafiltration, the cider capacity increased by 3.8%. The final concentrate or waste volumes were also reduced, therefore lowering the cost for off-site disposal.

Losses without the Oenoflow HS System

Annual volume fermented base	20,000,000 L
Initial solids loading	1%
Alcohol strength	0%
Alcohol volume @ 100%	2,000,000 L
Final solids loading in the lees	25%
Volume of lees	800,000 L
Alcohol content	10%
Volume of alcohol losses @ 100%	80,000 L
Percent loss	4%
Strength of final batch	10%
Volume of filtrate	19,200,000 L

Losses with the Oenoflow HS System

Annual lees volume	800,000 L	
Initial solids loading in the lees tank	25%	
Alcohol strength in the lees tank	10%	
Alcohol volume @ 100%	80,000 L	
Final solids loading in the lees	70%	
Volume of lees	285,714 L	
Diafiltrations	0	3
Alcohol content	10%	1%
Volume of alcohol losses @ 100%	28,571 L	3,571 L
Percent loss	36%	4%
Strength of final batch	10%	6%
Volume of filtrate	514,286 L	1,371,429 L



The Benefits

The benefits realized upon implementation of the Oenoflow HS system in this application include:

- Alcohol losses decreased from 80,000 liters per year to approximately 3,5000 liters per year
- 3.8% increase in finished cider capacity without additional capital investments like fermentation vessels and the associated equipment
- Attractive investment with payback less than 1 year
- Lower concentrate volumes for reduced off-site disposal costs
- Automated and controlled process

This case study has been replicated at other cider producers of similar scale with comparable economic drivers.

About Pall Corporation

Pall Corporation is a global filtration, separation and purification leader providing solutions to meet the critical fluid management needs of customers across the broad spectrum of life sciences and industry. We work with our customers to advance health, safety and environmentally responsible technologies. Pall Food & Beverage provides products and services to ensure product quality and maintain process reliability in beverage and food production. Our solutions also assist in consumer protection, waste minimization and reduction of operating costs.



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