

Robust Sterile Air Filtration Reduces Fermentation Cost of Ownership

Overview

Food and feed ingredient producers using fermentation as the basis of their process face pressures from food manufacturers for lower pricing and increased output without compromising quality. These fermentations are among the most challenging in the industry with 35 to 350 m³ (1,236 to 12,360 ft³) fermentor batches followed by complex purification steps. Reaching yield targets is a key factor for competitive advantage. One microbial contamination can lead to yield decrease or even complete fermentation batch loss. Contamination may also result in capacity loss and increased cleaning costs that may jeopardize overall profitability of the plant.

Contamination control of all process fluids makes the difference. The purity of compressed air, used at up to hundreds of standard cubic meters per minute, is critical during seed, propagation and production fermentation.

The Challenge

A major amino acid producer needed to improve fermentor contamination control while lowering operating costs. Due to insufficient protection of their production fermentors, they had experienced million dollar losses due to batch contamination.

Bacteria selected for the production of amino acids can be highly sensitive not only to microbial, but also to bacteriophage (bacterial virus) contamination. The treatment of fermentor inlet air is a critical control point (CCP), where microbial sterility of air and freedom from phages is a determinant parameter to protect the yield. To protect the fermentor contents, sterilizing grade membrane air filters additionally validated for high levels of phage removal were required.

A significant consideration was filtration operating costs, especially as they related to cost per sterilization cycle. Due to the need for repeated *in situ* steam sterilization cycles, it was important for the customer to understand the degree of mechanical resistance and life expectancy of the filters as well as the nature of other filter performance claims.



Emflon PFW filter cartridge

The Solution

Pall Corporation offers expertise and capabilities in sterile air filtration for food ingredient fermentations, with its Emflon® filter cartridges. They have been proven cost-effective in numerous installations around the globe due to their reliability and efficiency.

For high volume air applications, the hydrophobic polytetrafluoroethylene (PTFE) membrane of the Emflon PFW cartridge provides the sterilizing grade filtration characterized by extremely high titer reductions for microorganisms and phages required to prevent contamination risk.

The comprehensive and rigorous validation program of the Emflon PFW filter, described in a Technical Performance Document, was the basis of discussions to demonstrate filter performance and reliability. Test methods, sample sizes and results regarding liquid challenge testing, aerosol challenge testing with bacteria, spores, phages, and sodium chloride particles at various conditions



(forward and reverse flow, high humidity), and mechanical resistance under normal operating and multi-cycle steaming conditions illustrated the robustness of the performance claims. Subsequent customer steam sterilization tests confirmed the high strength of Emflon PFW.

Cost per sterilization cycle is directly influenced by multi-cycle steaming performance. Multi-cycle steaming tests are a routine part of sterilizing grade gas filter validation. Emflon PFW is validated for 165 1-hour steaming cycles at 140 °C (284 °F) in the forward direction. Such performance claims are the outcome of rigorous testing on multiple production filters, involving various test parameters designed to prove the mechanical resistance of the filters.

Further contributing to lowering the cost of ownership is the large filtration surface area, at 0.8 m² (8.6 ft²) per 10 inch cartridge. This results in low initial pressure drop, which leads directly to compressor energy savings as well as longer filter life.

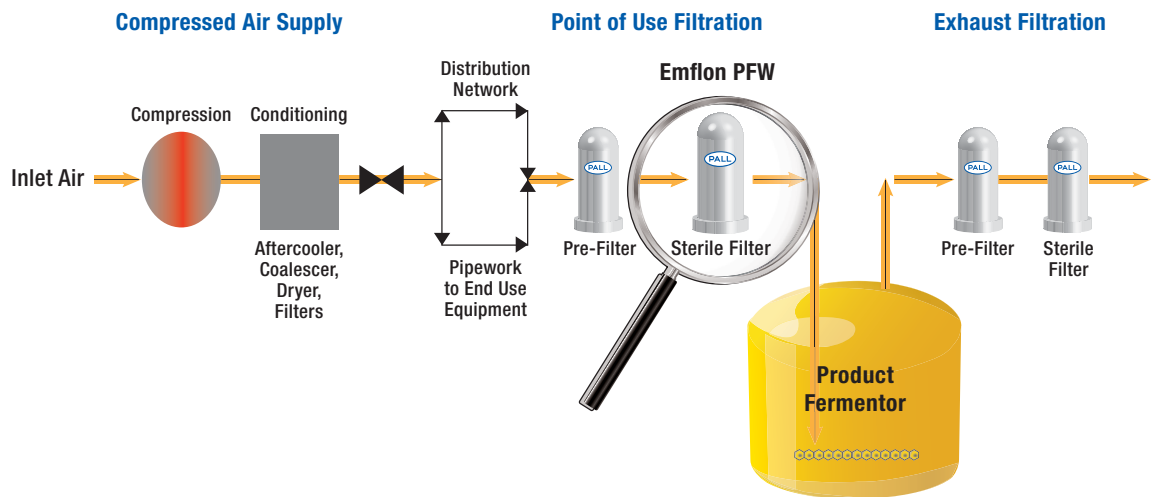
In addition to the benefits of the Emflon PFW cartridge, Pall Scientific and Laboratory Services ran customized validation studies on specific bacteriophages critical to some of the customer's products. Air line design audits and recommendations for sterilization procedures and integrity tests completed the service offering.

The Benefits

The combination of exceptional product features and Pall's strong technical services translated into cost-saving benefits for the customer at a critical control point in their process.

- Minimized risk of contamination and reliable product protection, resulting in improved fermentation yield
- Lowered cost of ownership due to high filter mechanical resistance during multiple steaming cycles
- Compressor energy savings due to high flow rates and low pressure drop
- Rigorous performance validation to support quality assurance program
- Customized laboratory studies for bacteriophage removal performance
- Market-dedicated service expertise to optimize the air filtration process

Figure 1: Schematic of compressed air pipework to fermentor and exhaust





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 and 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, the reduction of operating costs and waste minimization.



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