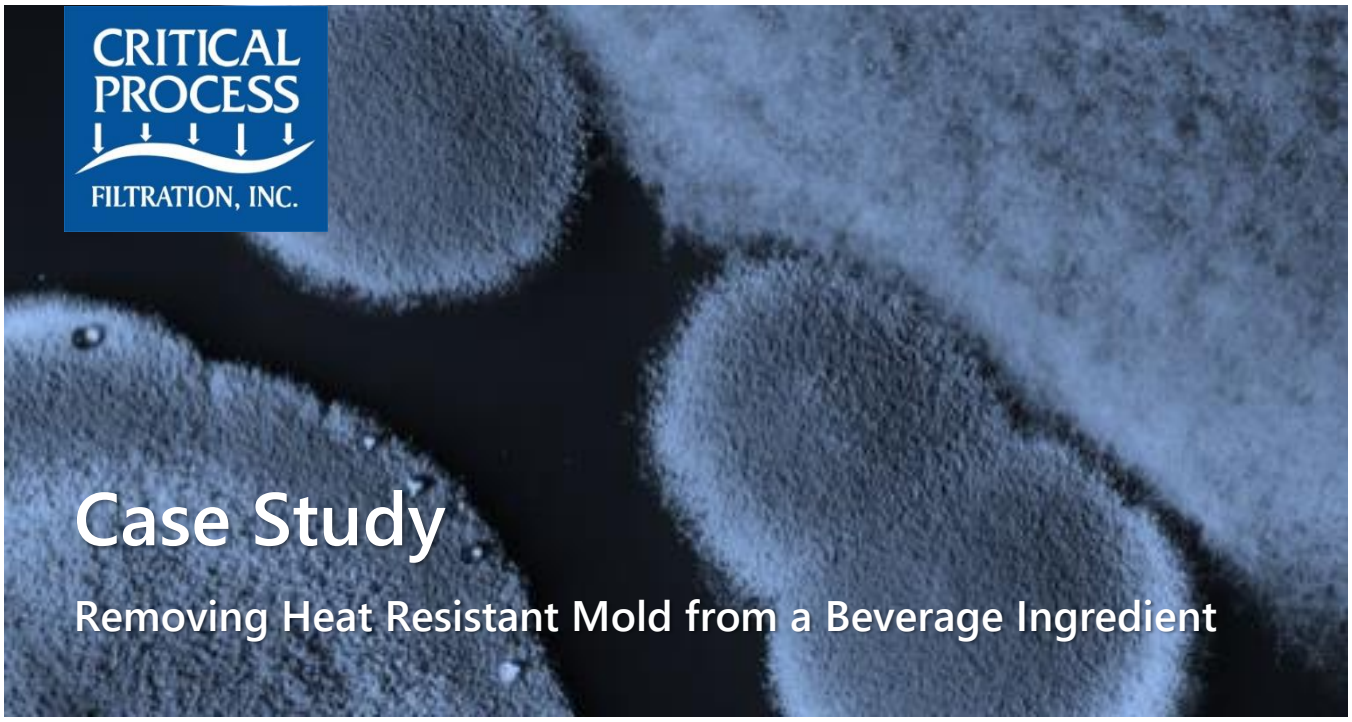

Background

A fruit juice processing company was looking to improve their production capability by acquiring a key ingredient from multiple vendors instead of a sole source. This ingredient was used in multiple facilities for high volume production (millions of gallons per year). Due to quality variations from vendor-to-vendor and even batch-to-batch from a given vendor, the company needed to design and implement a filtration system for this ingredient to make it consistent in all facilities.

The Filtration Challenge

In addition to varying particulate content, some batches contained a heat-resistant mold that could not be eliminated with pasteurization. Because there was no existing filtration process (the original ingredient did not need filtration), CPF's Technical Service Team needed to evaluate the ingredient's characteristics, and consider the customer's batch size, flow rate and other processing requirements before making recommendations for a new system.

Process Review

CPF Applications Engineers discussed the process with the customer to determine:

- The viscosity of the ingredient (higher than water)
- Processing temperature (controlled above ambient during the process)
- Particle size range and removal requirements
- Heat resistant mold size and removal requirements
- Target flow rate
- Target batch size
- Feed pressure and pressure drop requirements
- Specifications for the filtered ingredient (removal of heat resistant mold and particulates with no change to ingredient properties)

Based on these discussions, the CPF team decided on a Polyethersulfone (PES) membrane filter rated at a pore size slightly smaller than the heat resistant mold as the best option to achieve the specified removal. It was also decided to evaluate the use of a pre-filter before the PES membrane filter to optimize performance and minimize overall system operating cost.

Filtration Testing

The customer provided two 55-gallon drums of the ingredient so our Applications team could perform the testing required to specify a filtration system. All filtration testing was performed in CPF's Applications Lab. Filtered product was returned to the customer to confirm that the ingredient met customer specifications.

Flow Rate Testing

To determine the approximate size of the system required to meet customer's flow rate requirements, testing was performed as follows:

- The ingredient was placed in a temperature-controlled barrel as specified by the customer
- The ingredient was pumped through a PES membrane filter cartridge (0.65 m^2 filtration area; pore size as identified during the discussions with the customer)
- Flow rate, pressure drop and temperature were monitored and recorded throughout the test
- Test results showed that the PES membrane allowed for a high flow rate at the specified temperature and met the requirements for mold/particle removal, with no change in filter retention and no effect on the ingredient

Throughput Testing

To ensure the system could be properly sized to meet the customer's batch size requirement, and optimized for performance and operating costs, a series of throughput tests was performed.

- The temperature-controlled ingredient was pumped through lab scale filters (47 mm discs) at a constant flow rate
- Pressure increase was tracked and plotted as a function of volume filtered
- The throughput per unit filter area was determined by the volume filtered before reaching the customer specified pressure differential

Pre-filter Options

Multiple pre-filter options were tested in combination with the PES final filter to determine if adding a pre-filter would extend the life of the PES membrane filters, and reduce the number of final filters required. This data was used to determine the optimum combination of pre-filters / final filters required to meet customer's flow and batch size requirements while at the same time minimizing operating cost. This testing identified a fiberglass depth pre-filter that would: extend the life of the final filter by 2-3 times; reduce the final pressure differential by more than 60%; and reduce the number of filters required by more than a factor of 2.

Filter Option	Relative Volume Filtered	Final Pressure Differential (psid)
PES Membrane Filter Only	100 %	11
Fiberglass Depth / PES Final	248 %	4

To ensure the recommended options met customer performance requirements, filtrate was returned to the customer from both tests to verify mold/particle removal and the ingredient still met customer specifications.

System Implementation

Having met all specified goals, the customer chose to implement a system with Fiberglass Depth pre-filters and PES Membrane final filters, sized per CPF applications testing to meet flow rate and batch size requirements. A filtration skid was designed with:

- Automated steam sterilization
- Final filter integrity testing
- Filter rinse cycles
- Filter change alarms

Members of the Critical Process Technical Services team were on site to assist with installation of the equipment, train operators and other personnel, and oversee startup and implementation of the new filtration process.

The customer has had no further issues with heat-resistant mold in their process, and the filtration system operates to expectations with minimal maintenance or downtime.

Critical Process Filtration performs process evaluations, troubleshooting analyses, filter process development tests and application consulting every day. Contact us to discuss your filtration challenge.

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