



Final Beer Filtration Using Sartocool® PS 0.65 µm



Application Note

Cost reduction
by using Sartocool® PS
(0.65 µm) for yeast
cell retention

#9

#1

#2

#3

#4

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Abstract

Reasonable filtration costs and reliable process conditions are the main requirements from the brewing industry. Sartorius Stedim Biotech was asked to provide a new benchmark for the final filtration step upstream of the bottling machine. Customer requirements for this project are:

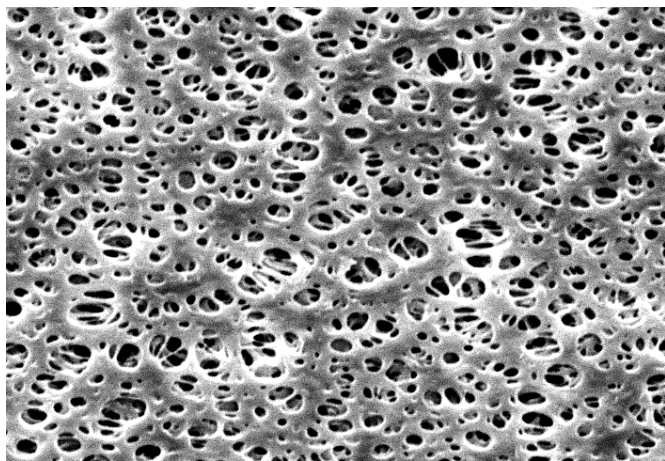
- Extended Service Life Performance
- Minimizing Filtration Cost to Minimum
- Reduction down times costs

Filtration studies were performed onsite at a Brewing Company in Japan. Best results were achieved with the product Sartocool® PS 0.65 µm. Based on the test results a β-side test with forty-eight membrane filter cartridges was performed at one bottling plant in Japan.

Finally the competitor's PES product formerly used in the filtration step has been replaced with Sartocool® PS 0.65 µm. Sartocool® PS installed upstream of the bottling machine has become state of the art for the Brewing Companies in Japan.

Background

The filtration line upstream of the filling machine consists of a prefilter (polypropylene depth filter) and a final membrane filter (PES membrane). The final filtration step upstream of bottling



Picture 1: Structure Sartocool® PS Membrane.
The membrane convinced by an asymmetrical configuration. Resulting to the membrane structure highest service life performance has been achieved without any negative influences by β- glucan.

must ensure that the beer is free of yeast cells to guarantee a beer shelf life of several months. The filtration process has to be performed without affecting the taste or the odor of the beer itself and, on the other hand, filtration costs need to be kept under control.

Application

To ensure that all beer brands attain the company's high quality standards, all beer must be filtered upstream of the bottling machine. The customers requirements are as follows:

- Beer must be free of yeast cells.
- Its taste and odor may not be affected by filtration.
- Filtration costs must be kept within an acceptable range.
- The filtration process and integrity testing must be reliable.

The brewery plants are equipped with fully automated filtration lines. Each of these lines consists of a prefilter housing and a membrane filter housing. Daily filtration processes are controlled automatically by PLC software. Regular sterilization cycles with hot water are performed to ensure optimal process conditions. Following sterilization, the membrane filters are integrity-tested and the test results are documented in a process database. Regeneration with caustic soda and citric acid is performed at regular intervals to increase the total throughput of the membrane filter cartridges. This additional regeneration step ensures reliable process conditions and keeps filtration costs low.

Product

Sartocool® PS filter 0.65 µm cartridges feature a single-layer polyethersulfone membrane (PES). Based on the membrane structure an extended total throughput and high flow rates are achieved.

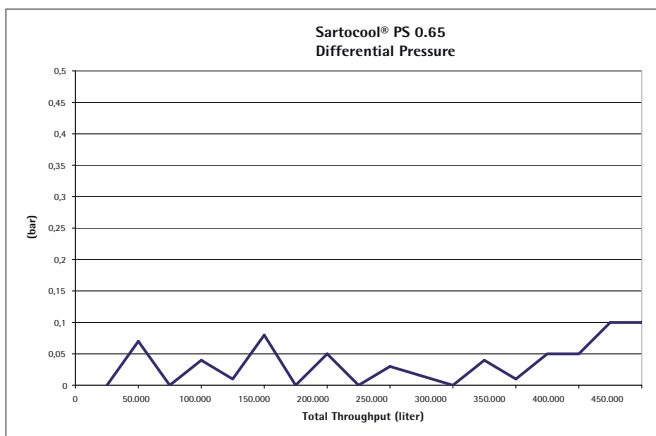
The key features of a PES membrane, which is used in Sartocool® PS, is its excellent chemical compatibility with caustic and acic CIP solutions over the entire pH range of 1 to 14. Using caustic, which is available in any plant, ensures effective regeneration of Sartocool® PS, extending the service life. Moreover, regeneration lowers filtration costs.

The integrity of Sartocool® PS membrane filter cartridges can be easily checked by performing an integrity test before and after filtration. In combination with a regular sterilization process, the highest microbiological standards are achieved. The microbiological retention rate for *Saccharomyces cerevisiae* yielded a log reduction value (LRV) of ≥ 7 .

Results | Filtration Costs

The Japanese Brewing Company selected one bottling plant for the initial β-side test using the Sartorius Stedim Biotech filter cartridges. Forty-eight Sartocool® PS 0.65 µm membrane filter cartridges were installed in one filter housing. The objective of the trial run was to raise the benchmark for the total throughput up another notch. Up until the trial run was due to take place, the plant's total throughput had been around 300,000 liters of beer per cartridge.

The test run with Sartocool® PS was performed over several weeks. During the initial trial, no pressure increase was determined. This phenomenon is based on the cartridges' specific membrane asymmetry. The B-side test at the bottling plant confirmed the results obtained by the company's R&D center. At the end of the filtration trial, the total throughput attained with Sartocool® PS was approximately 500,000 liters of beer per cartridge. This means that Sartocool® PS achieved an increase of 60% in total throughput, considerably outperforming the company's former benchmark. Accordingly, Sartocool® PS cut filtration costs as it does not have to be changed so often. During the entire run, all beer batches were checked for their microbiological quality and other quality-relevant parameters. However, none of the batches showed any contamination with yeast cells, and each batch was released for sale. All of the customer requirements were successfully met and a new filtration benchmark was defined for brewing company.



Graph 1: To increase the total throughput regeneration cycles were performed with caustic soda. After every cycle the differential pressure revert back close to zero bar. The membrane was regenerated and the build-up blockage compounds were successful removed. That 's an indicator about the positive regeneration effect. The total throughput for the filter cartridges has been enhanced accordingly.

Integrity Testing

Membrane filter cartridges are regularly integrity-tested to ensure that they will continue to perform properly under process conditions even after undergoing multiple sterilization and regeneration cycles and to prevent microbiological contamination.

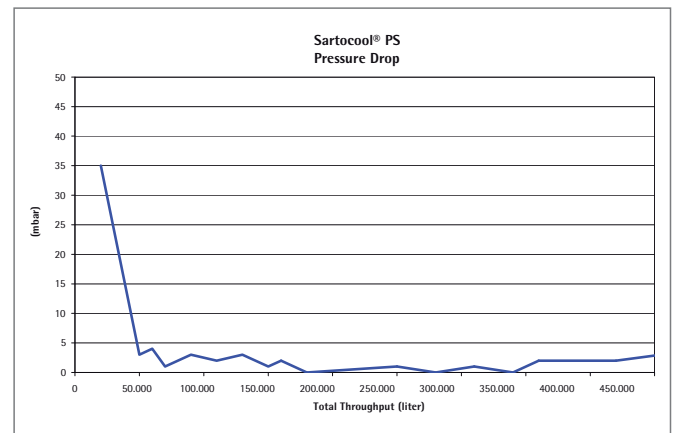
An integrity test must be performed after sterilization of the filter cartridges and of the system before starting a filling process to guarantee that the entire production lot will be free of yeast cells.

Conclusion

Based on the good cooperation among the Japanese Brewing Company, AlfaLaval and Sartorius Stedim Biotech on the highly successful completion of the trial filtration runs, Sartocool® PS filter cartridges were installed at the end of the filtration trial runs at all of the other brewery plants in Japan. The outstanding results achieved during first run have been confirmed since then. So far, Sartocool® PS has garnered nearly 100% of market share at the Japanese Brewing Company, which therefore no longer uses the competitor products.

Sartocool® PS membrane filter cartridges provide improved operating reliability. The pressure drop increased only at the end of the filtration trial. The filtration process with Sartocool® PS runs smoothly without entailing any interruption of the filling process. From ongoing test trials at other brewery companies we expected equal feedback and as well additional turn over in the future.

The enormous increase in the total throughput has had a strong impact on reducing filtration costs for the Japanese Brewing Company. The customer is highly satisfied with its new filtration process and the consistently excellent quality of the beer produced thanks to Sartocool® PS.



Graph 2: The pressure drop, results from the regular performed integrity test, were stable over several weeks until the membrane filter cartridges were replaced. Until the end of the B-side test no increase of the pressure drop was detected. That's the indicator for a robust membrane filter cartridge, which is used in a long term application. Pressure shocks and regeneration cycles have no negative influence on the product performance.

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