PALL

Food and Beverage

Application Bulletin

Craft Brewery Preserves Image and Limits Losses with Pall's GeneDisc® System and Microbial Filtration

Overview

Although beer is restrictive to bacterial growth due to its low pH, ethanol concentration, and low oxygen content, the presence of certain beer spoilage bacteria including *Lactobacillus, Pediococcus, Pectinatus,* and *Megasphaera* can generate off-flavors, turbidity and acidity. Such quality deficiencies render the product unacceptable and often result in high economic losses and negative brand image.

Throughout the production process, undesirable microbial contamination must be prevented to achieve the required final beer quality. Such contamination may originate from ingredients (including yeast), air and water utilities coming into contact with the product, and the environment. Insufficient cleaning and sanitization of equipment may allow pockets of problematic microbial growth, which may continue to re-infect product.

Craft brewing techniques aim to satisfy growing consumer preferences for minimally processed products such as unpasteurized craft beers. While the absence of thermal treatment better preserves the beer flavor and nutrient profile, it creates the need for maintaining strict microbial control and effective quality monitoring at critical points in the process to ensure microbial stability and good shelf life.

When spoilage is detected, a quick diagnosis of the contamination source and microorganism type is of paramount importance for timely decision-making, implementation of corrective actions, and restoring production to its normal state.

The Challenge

A craft brewery ships 18,000 hectoliters of beer annually in an ever-increasing regional area. The product range consists of dark and pale lagers, pale and Scottish ales and seasonal beers.

The production process consists of beer production in multiple fermentors, followed by centrifugation, a simple particle filtration set-up to bright beer tanks, and packaging in bottles and kegs. Routine quality monitoring includes pulling samples from different stages of the process and using traditional culture methods to detect contamination.

Figure 1: The GeneDisc System: GeneDisc Cycler *(left)* and GeneDisc Beer Plate *(right)*

*Filtration. Separation. Solution.*SM

A situation arose one weekend in which agar culture plates of fermentor samples taken 48 and 72 hours after the beginning of fermentation indicated contamination after several days of incubation. Investigative action was immediately necessary to isolate and understand the cause while determining the best course of action for the fermentation batches in progress. Typical fermentation time ranges from 2-5 weeks depending on beer type, and the sooner decisions could be made on the dispensation of the batches, the sooner it would be possible to start new batches with minimal interruption to the brewery output.

Unfortunately typical culturing techniques at hand would have required a labor-intensive and lengthy process of several weeks to verify and interpret findings, identify the microorganism types involved, and provide location-specific contamination results from an array of sampling to correctly diagnose the issue.

The Solution

A Pall GeneDisc system was provided to the brewery to enable a more rapid investigation of the problem. The GeneDisc Rapid Microbiology System is a real-time PCR (polymerase chain reaction)-based platform which delivers qualitative, automatically interpreted, defined results (Figures 1-4) in as little as two hours after sampling and an enrichment step if necessary. For this customer application, an enrichment step was carried out, as there was the expectation of finding low levels of contamination. The GeneDisc PCR system was valuable due to the need to arrive at specific identification of the problematic microorganism(s), in order to effectively determine the corrective actions.

Within two days of pulling 18 samples in areas surrounding the fermentors and yeast slurry management, as well as plant cleaning (CIP) and rinse water, the GeneDisc results coupled with a detailed brewery walk-through identified the type of microorganism and cause of the contamination.

The samples from one fermentor showed presence of obligate beer spoiler *Lactobacillus brevis*, while samples from the other four fermentors did not show presence of beer spoilage bacteria; these were later confirmed to have the hygiene indicator bacteria *Bacillus*.

The source of the contamination was found to be in the fermentation area at a piping dead leg of six-inch length, which was not being properly cleaned in between batches. The piping piece had recently been installed at a revised air sparging point in the process. It was found that recent personnel

Figure 2: The GeneDisc System provides a simple to use method of rapid and simultaneous detection and identification of 21 major beer spoilage microorganisms.

changes had resulted in new operators handling the sparging set-up, which resulted in the troublesome installation.

On the third day after initiating the investigation, the piping detail was corrected, and plant management had made the decision on the dispensation of the affected batches. The batch with the obligate spoiler was discarded. The batches with the non-beer spoiler hygiene indicator bacteria were membrane-filtered at 0.45 micron with Pall Ultipor® N66 cartridge filters (ABN*NB*BW*), rendering the beer microbiologically stable. The Ultipor N66 membrane filtration solution was implemented as the final filtration step prior to bottling.

Ultipor N66 single open-end cartridge filters with pleated nylon media are validated for reliable, economical and efficient microbial stabilization in beer and other food and beverage applications. Installed in sanitary FBT filter housings, they can be sanitized repeatedly before and after every filtration batch with hot water or *in situ* steam, for longer service life.

The saved beer volume totaled 350 hectoliters or approximately 2% of the annual production. Far more important than this cost savings was the ability of the brewery to maintain most of their production output on schedule. Had they faced the need to redo all the affected batches, it would have set their production back two months, disrupting their promised supply to their customers and creating a negative image.

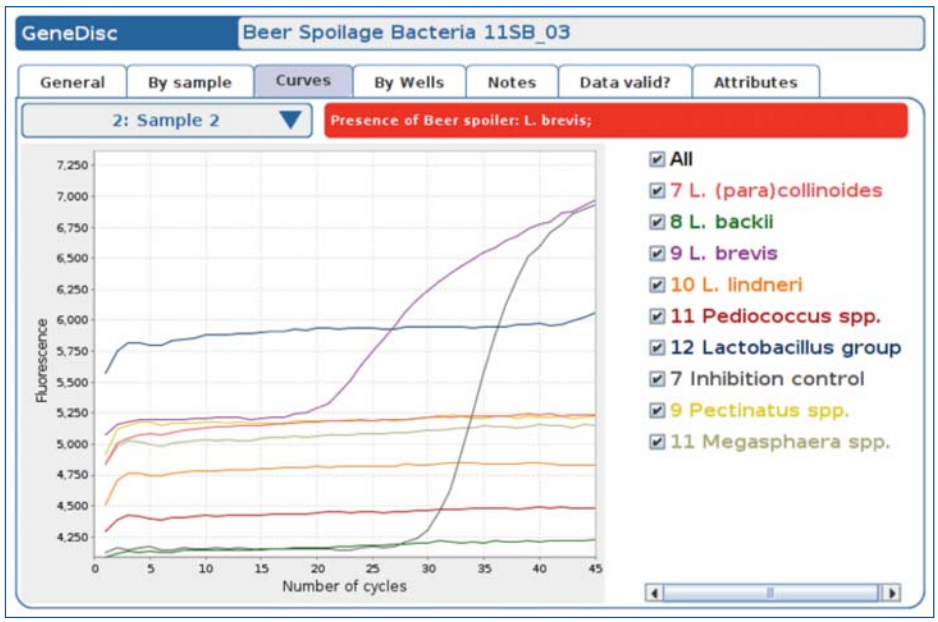
Figure 3: Minimally trained operators can achieve reliable and robust results due to automated results interpretation.

GeneDisc — Beer Spoilage Bacteria 11SB_03

General | By sample | Curves | By Wells | Notes | Data valid? | Attributes

Sector	Sample	Interpretation
1	Sample 1	Presence of Beer spoiler: L. brevis
2	Sample 2	Presence of Beer spoiler: L. brevis
3	Sample 3	Beer spoiler not detected
4	Sample 4	Beer spoiler not detected
5	Sample 5	Beer spoiler not detected
6	Sample 6	Beer spoiler not detected

Figure 4: Results interpretation includes PCR curves for optional visual control of reaction. An internal inhibition control for each sample ensures reliability of results.



The Benefits

The dual solution of the GeneDisc PCR System with the Ultipor N66 microbial reduction filter provided these benefits after spoilage detection:

- Rapid, informative and reliable root cause analysis of the contamination source and bacteria types involved
- Fast corrective action to eliminate the source of the problem and reduce negative impact
- Accelerated decision-making due to defined results, which enabled the brewery to selectively discard only one critical batch and quickly restore normal operation
- Correction of product quality with filtration, which enabled the brewery to save 2% of production while proactively eliminating future problems
- Limited economic losses
- Maintained craft brewery's reputation

Many craft breweries have implemented GeneDisc PCR-based monitoring as a diagnostic tool throughout their processes, using a testing program unique to each brewery. The system is suitable for identifying both spoilage bacteria and spoilage yeast. It fits into currently implemented test programs, hazard analysis plans and contamination troubleshooting. This user-friendly, cost-effective quality monitoring approach provides real-time results with proven benefits.

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.

Better Lives. Better Planet.SM

Pall Corporation

Pall Food and Beverage

25 Harbor Park Drive
Port Washington, NY 11050
+1 516 484 3600 telephone
+1 866 905 7255 toll free US

foodandbeverage@pall.com

Visit us on the Web at www.pall.com/foodandbev

Pall Corporation has offices and plants throughout the world. For Pall representatives in your area, please go to www.pall.com/contact

Please contact Pall Corporation to verify that the product conforms to your national legislation and/or regional regulatory requirements for water and food contact use.

Because of technological developments related to the products, systems, and/or services described herein, the data and procedures are subject to change without notice. Please consult your Pall representative or visit www.pall.com to verify that this information remains valid.

Filtration. Separation. Solution.SM

FBABGDFILEN November 2016