

Pall Solution Delivers Consumer-safe, Shelf Stable Cold Brew Coffee

Overview

Cold brew coffee is one of the beverage industry's fastest growing consumer trends. In 2017, U.S sales of cold brew coffee jumped to \$38.1 million, a 370 % increase from \$8.1 million in sales in 2015.¹ Consumers like the subtler, less acidic alternative to traditional hot brewed coffee.

Cold brew as its name implies, is produced using cool water resulting in a lower extraction of oils and therefore a sweeter taste. At lower temperatures, extraction takes longer, up to 12 to 24 hours, and requires more than double the volume of coffee grinds. However, the cold brew concentrate base facilitates blending of on-trend specialty beverages often with higher caffeine levels.

While hot brew coffee has a low-risk for microbial contamination given the near boiling temperature and shorter production time, cold brew is more susceptible to bacteria growth including deadly *Clostridium botulinum*. Botulinum spores, found on most fresh food surfaces, according to the National Center for Home Food Preservation² are normally harmless, growing only in the absence of air. Sealed and canned cold brew, however, can be host for spore growth which is further amplified by the drink's low acidity.

In recent years, regulatory agencies like the Food and Drug Administration (FDA) are now setting stricter standards for low acid food (with typical pH greater than 4.6 and a water activity greater than 0.853) as a preventative measure. For example, all commercial processors of low-acid and acidified foods located in the United States and all processors in other countries who export low-acid canned food or acidified food products into the United States must register their processing plants with the FDA.³

Additionally, guidance from the FDA is now recommending that firms subject to the pathogen reduction provisions of the juice HACCP regulation incorporate validated control measures for all *C. botulinum* spores into their HACCP plans. These control should ensure that *C. botulinum* growth and toxin production will not occur should

the product be kept unrefrigerated in distribution or by consumers.⁴

The Challenge

With increasing demand, broadening distribution and news of recent industry recalls, a cold brew producer in the Midwest needed to implement a new production process. The target was to reduce contamination risk while maintaining the flavor characteristics without the requirement for refrigeration, following FDA guidance for low acid beverages as mentioned above. Additionally, with limited space at a facility already producing craft beer, the new equipment needed to be flexible, compact and easy to install.

The Solution

To meet requirements for product quality and economics, Pall Food & Beverage worked with the customer to develop an optimal solution. A three stage filtration train was implemented including particle removal, clarification and microbial stabilization prior to bottling. This combination provided a reproducible and consistent barrier for contaminant removal at ambient temperature.

Particle Removal

After brewing and extraction, Pall's 1 micron polypropylene bag filters were employed as a particle removal step to eliminate remaining coffee grinds (see figure 1). With the broad size and

Figure 1: Pall's Bag Filters





concentration of grinds, the high dirt holding capacity of bag filters offered a cost effective option to lower the suspended solids and improve the efficiency of the downstream processing steps. The filters additionally met the requirement for simple operation. The bags slide into a stainless steel filter housing and supporting basket for quick and easy installation and are positioned upright with solids accumulating inside the filters to facilitate disposal.

Clarification

For the second step of the filter train, Pall's SUPRAdisc™ II modules offered a modern approach for clarification and haze removal. Similar to traditional lenticular filters, SUPRAdisc II modules are constructed from filter sheets with a unique matrix of components that provide an excellent combination of depth filtration and adsorption. Contaminants are trapped on the surface and within the thickness of the cellulose sheet media, while haze forming oils adhere to filter aid impregnated within the sheet. To facilitate operation and handling, the media is assembled into a modular format that fits into an enclosed housing for sanitary operation.

The unique design of SUPRAdisc II modules differentiates them from classical lenticular modules. A double separator design provides

both upstream and downstream support for the filter media. The media is individually sealed and separated in between polypropylene plates resulting in optimal flow through the available surface area and a mechanically robust module (see figures 2-3). Flow is possible in either the forward or reverse direction. In applications with particle removal like coffee filtration, backflushing during cleaning and rinsing improves regeneration for increased service life. Additionally, with the separators acting as a cage, the media is not exposed which facilitates module handling and filter change-outs.

The enclosed design of the SUPRAdisc II technology provides many benefits. For small batch and specialty cold brewers, the closed assembly eliminates drip losses resulting in more recovered product (see figure 4). Also, when the batch is a complete, the customer can use nitrogen gas to push out most of the coffee remaining in the system to further increase yield.

One last benefit to this customer challenged with limited floor space was the flexibility to use their SUPRAdisc II assembly for beer filtration as well. With modules available in many different available grades, the housings can be fitted with modules suitable for beer. If not exhausted, used modules can be stored in preservative solution when not in use.

Figure 2: Unique Inside Outside Technology

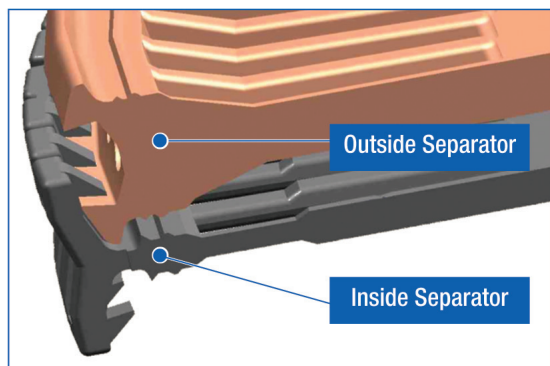


Figure 3: Pall SUPRAdisc II Module Figure

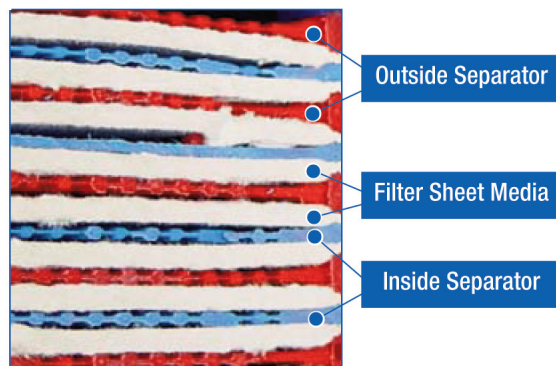


Figure 4: Pall SUPRAdisc II Housing





Microbial Stabilization

As the third and final filtration stage, the customer installed Pall's Fluorodyne® II, 0.2 µm sterilizing grade membrane filter directly upstream of the filler (see figure 5). These filters are constructed from two layers of 0.2 µm polyvinylidene fluoride (PVDF) membrane and designed to fit into sanitary housings to ensure effective microbial removal and assembly integrity.

Fluorodyne II filters are validated for sterility via bacterial challenge tests, demonstrating sterile effluent when challenged with at least 10^7 CFU *Brevundimonas diminuta* per cm^2 of effective filtration area.⁵ For a copy of the technical report from the validation studies, please contact a Pall representative. Additionally, for validation of a specific low acid food process like cold brew coffee for removal of *C. botulinum* spores, manufacturers should contact a representative of the FDA.

Figure 5: Fluorodyne II Final Membrane Cartridge Filter



The Benefits

By implementing a 3-stage filtration train from particle removal to sterilizing grade membrane filters, this cold brew coffee producer found an economical and easy-to-use solution to reduce risk of contamination and recall. The solution enabled production of high quality, shelf stable product that maintained flavor characteristics with the following benefits:

- Increased flexibility with easy to install process capable for use with both coffee and craft beer
- Reduced risk of contamination with reproducible, consistent removal barrier
- Distribution and storage without the need and added cost for refrigeration
- Compact equipment that fit limited floor space availability



References

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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, waste minimization and reduction of operating costs.



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