Protecting the Quality of Beer – Filters That Remove Spoilage Organisms

The alcohol, low oxygen content, relatively low pH, hops extracts (alpha-acids) and dissolved carbon dioxide in beer inhibit the growth of pathogenic bacteria. That is why beer has been a safe drinking alternative for so many centuries. However, there are microorganisms that can survive and even thrive in beer and spoil the flavor and aroma of any good brew.

Beer can be spoiled by bacteria or wild yeasts. The most mentioned spoilage bacteria in beer are Lactobacilli and Pediococci. Other possible spoilage bacteria are Pectinatus and Megasphaera species.1 If wild yeasts such as Saccharomyces cerevisiae or Candida pelliculosa find their way into the brewing process they can cause off flavors and higher attenuation.2 Lactic acid bacteria (LAB) can provide some benefits to the brewer. They can create desirable compounds and even inhibit the growth of molds during the brewing process.3

There are many other microorganisms ranging from bacteria and yeasts to molds and spore formers that can also contaminate a brewing process and cause quality issues. Some of these bacteria may be beneficial during the process, but they can cause spoilage issues if they remain in the beer after packaging.

Choosing the Stabilization Filter

The most critical filter in Figure 1 is the Final Stabilization Filter (housing 4) – the one that removes the microorganisms discussed above. The most commonly used filter is membrane based with either a 0.65 or 0.45 micron pore size. These will remove both bacteria and yeasts2. Brewers may choose the smaller pore size to assure capture of all bacteria, including the vegetative forms of some species that may survive in the beer, but there is a risk that some flavor or color elements of the brew will also be captured by membranes with 0.45 micron pores. For that reason, 0.65 micron membranes may be used for darker or heavier beers. The brewer should test filters in their beer before choosing a micron rating or material to be sure that the filters will remove the target organisms and also preserve beer flavor and color.
Protecting Stabilization Filters

The system shown in Figure 1 has a single filter before the final stabilization filter. This filter is called a clarification filter, but it can also be used to control the level of organisms that need to be captured by the final filter. The clarification filter should be chosen with the aim of extending the life of the final filter. Brewmasters and plant operators evaluate the size and number of particles and organisms in the bright beer, then choose the filter that will remove particles and larger organisms that might prematurely clog that final filter.

The filter housing marked 3 in Figure 1 holds this clarification filter. The filter is often a depth media based filter to remove sediment and visible particles. However, depending on the particle and organic load, the filter chosen may be a “bioburden reduction” membrane filter designed to capture most, but not all spoilage organisms and reduce the bacterial load that must be removed by the final filter.

Some operators may choose to add a filtration step here, especially if the particle load is high. If a 2-stage clarification process is installed, it is usually a depth media filter for particle reduction followed by a membrane filter to reduce the bacteria load.

Preventing Contamination of Stored Product

Process gas filters (housings marked 2 in Figure 1) are also critical to the quality of the packaged beer. These hydrophobic membrane filters keep particles and bacteria that may be carried by process gas from entering tanks as they are emptied or from being deposited in bottles as they are filled.

Safeguarding Filling Operations

The filter housings marked 5 and 6 on the right side of Figure 1 are not used to filter beer but to filter container wash and rinse water. Process water systems may contain bacteria, so these filters are used to make sure that waterborne organisms cannot be accidentally introduced during the final packaging of the beer.

Filter Options

All of the filters chosen need to tolerate any heat sterilization or sanitization processes used (hot water or steam).

The table below shows the filter media options from Critical Process Filtration. All are available in cartridges and also in capsules for research systems or laboratory applications.

Contact Critical Process Filtration for help determining the best filter options for you.

Filter Options for Beer Stabilization and Process Gas Filtration

<table>
<thead>
<tr>
<th>Process Area</th>
<th>Filter Application</th>
<th>Filtration Function</th>
<th>Critical Process Media*</th>
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</thead>
<tbody>
<tr>
<td>Clarification</td>
<td>Remove Turbidity/Haze</td>
<td>Remove particles and large microorganisms</td>
<td>MB, NS, PD, GD</td>
</tr>
<tr>
<td>Bioburden Reduction</td>
<td>Remove most bacteria and yeasts</td>
<td></td>
<td>CWPS, PS, PVWL</td>
</tr>
<tr>
<td>Bacteria Removal (Sterilizing)</td>
<td>Remove all bacteria and yeasts</td>
<td></td>
<td>PS</td>
</tr>
<tr>
<td>Process Gas Filtration</td>
<td>Prevent bacteria from entering tanks when liquid is drawn from them and from entering bottles during filling</td>
<td></td>
<td>PVWB, TM</td>
</tr>
</tbody>
</table>

*Media Codes
MB = Melt-Blown Polypropylene Depth Media
PD = Pleated Polypropylene Depth Media
PVWB = High Capacity Hydrophobic PVDF Membrane
NS = Nano-Spun Polypropylene Depth Media
CWPS = High Capacity PES Membrane
PVWL = High Capacity Hydrophilic PVDF Membrane
PS = Polyethersulfone Membrane
GD = Pleated Fiberglass Depth Media
TM = PTFE Membrane

References

Visit our website or contact us for more information and to access data sheets on all of our products.