Application Summary

Filtration for Soft Drink Production

Filters for Soft Drink Productions

Ingredients used in soft drinks can be from either internal or external sources. Regardless of the source, bottlers treat all ingredients as if they contain some form of contamination that might harm production processes and/or product quality.

The biggest issue with ingredients from outside sources is the unknown nature of the possible contamination. Even if the source of the ingredient has a reputation for quality and consistency, operators should guard against all possible scenarios. That means the possibility of unwanted particles, bacteria, or other microorganisms and chemical contamination. While cartridge filters cannot address possible chemical issues, they are a cost-effective method of controlling and removing unwanted particles and microorganisms. Assuring that the ingredients entering the bottling process are pure can only help process efficiency and improve product quality.

Bacteria, yeasts, molds, and other organisms can be found everywhere, even in soft drinks. They can find their way into the process through raw materials, sweeteners, the facility environment, and even packaging materials. Organisms can be partially controlled through cleaning and operating procedures, but no cleaning method can prevent environmental organisms from re-entering the equipment as soon as the cleaning process is completed.

Even though soft drinks seem like a nutrient-rich solution that is attractive to microorganisms, low pH drinks with high carbonation levels will kill most bacteria that get into the final package. A few bacteria may survive but are usually inhibited from growing because of the harsh environment.

Soft drinks that are not carbonated and have less acidic pH levels, such as sports drinks or flavored waters, lack protection against spoilage organisms. Therefore, barriers such as filters should be installed to block contamination of the drinks by bacteria and other organisms.

Food Safety Practices

Several regulations regarding the safe production of food and beverage products have been in place for many years. There are also industry practices, often treated as regulatory requirements, that help assure food safety. Taken together, they provide guidance on the best ways to produce safe and good-tasting products.

Three acronyms are frequently seen associated with soft drinks and other food and beverage production. They are Good Manufacturing Practice (GMP), Good Hygienic Practice (GHP), and Hazard Analysis and Critical Control Point (HACCP). If these regulations and practices are followed, product contamination is highly unlikely. Part of each is the use of technologies such as filters to ensure against microorganisms entering the final product package

Filtration Goals

The abbreviated schematic in Figure 1 highlights the filters used for ingredient filtration before the ingredients enter the rest of the mixing and bottling process. These filters are designed to remove particles and microorganisms and also protect the ingredients from environmental contaminants while they are stored in tanks.

There are many possible filter configurations, and the actual filter systems used will depend on the

contaminants that are known to occur in specific ingredients. The filters shown perform the basic functions needed to remove contaminants from any soft drink ingredients.

The filters highlighted in Figure 1 perform three functions, particle control, microorganism and small particle control, and tank contents protection.

Filters for Particle Control

Unwanted particles in any ingredients could be almost any size. Larger particles, those larger than 1 to 5 microns, are easily removed using depth filtration.

Depth media in cartridge filters is found in two forms. The standard depth filter is a self-supporting tube made using a polymer, most often polypropylene. The tube is formed using the melt-blown or nano-spun process.

The other form of depth filter uses pleated flat sheet media, most often made with polypropylene or fiberglass. Polypropylene is the most widely used material for water and chemical filtration, but fiberglass has better filter efficiency and generally allows higher flows and throughput than polypropylene in most applications.

Standard depth filters will capture a range of particle sizes through the thickness of the media. Pleated media filters have the advantage of a large surface area that can hold a higher quantity of particles on that surface than the standard depth filters

Organisms of Concern

Yeasts are the most common organism found in carbonated beverages because they can tolerate low pH and carbonation. Molds cannot grow in carbonated beverages but may be found in sports drinks and other non-carbonated drinks. Bacteria can also contaminate soft drinks, especially those having some natural fruit juice as an ingredient. In particular, lactic acid bacteria (LAB) can be carried by the fruit juice into the process. Even non-carbonated drinks that are pasteurized can have thermo-acidophilic bacteria (TAB) remain in the product and cause spoilage.

More information on the types of organisms that might be found in soft drinks can be found in an article by Dorota Kregiel of the Institute of Fermentation Technology and Microbiology in Lodz, Poland. The article, titled “Health Safety of Soft Drinks: Contents, Containers, and Microorganisms”, can be accessed at http://dx.doi.org/10.1155/2015/128697.

Choosing the Bacteria Removal Filter

The most critical filters in Figure 1 are the final, “Sterilizing” filters (housings marked 4). These filters remove the target organisms. The goal is to remove whatever might create flavor, aroma or safety issues while also preserving the flavor and aroma of the final product. However, the system shown has filters before the final filter. These filters are explained below, but their role is to control the level of organisms from all potential sources as well as extend the life of the final filter by capturing particles and larger organisms that might prematurely clog that final filter.

The filters used to capture microorganisms are almost always membrane filters with pore size ratings of 0.45 microns or 0.22 microns. Processors may choose the smaller pore size to assure capture of all bacteria, including the vegetative forms of some species, but there is a risk that some flavor or aesthetic elements of the product will also be captured by membranes with 0.22-micron pores. For that reason, 0.45-micron membranes are used by many bottlers.

Protecting Bacteria Removal Filters

The filter housings marked 1 and 3 in Figure 1 hold prefilters that remove larger particles and reduce the amount of organic content in ingredients as well as the final product. Housing 1 usually contains depth media-based filters to remove sediment and visible particles. Housing 3 is most often a “bioburden reduction” membrane filter designed to capture most, but not all bacteria and reduce the bacterial load that must be removed by the final filter. The filters are chosen based on the particle and organic content that must be removed. Highly loaded liquids may use multiple stages of prefilters, though only 2 stages are shown here.

Filters for Bioburden and Small Particle Control

The next level of filtration for ingredients is the removal of smaller particles and some bacteria or other organisms. This process of "bioburden control" is performed by membrane-based filters. The filter performance requirements are determined by the level of particle and microorganism purity required by the rest of the process. If the process requires only a reduced bioburden load, then a filter with a pore size rating of 0.45, 0.65, or even 0.85 microns might be used, based on what is believed to be in the ingredients. However, if a process requires that an ingredient be "bacteria-free", then the filter pore size will probably be 0.22 microns or perhaps even 0.10 microns.

Tank Vent Filters

The tanks used in production systems, even tanks made of stainless steel, are not designed for elevated pressure or vacuum. Either will cause structural bulging or tank implosion. That is why air is allowed to flow into and out of the tank during emptying or filling, to avoid pressurizing the tank or causing a vacuum condition. The air or gas entering the tank is filtered to prevent environmental particles and bacteria from contaminating the liquid inside the tank. Figure 1 on the previous page shows the tank vent filters on the tops of tanks.

Filters used for liquid applications are usually made of materials that attract water – are 'hydrophilic' – and allow the easy flow of liquids through the media or membrane. For air filtration, it is critical that the media remain dry. If the media becomes wet and the pores are filled with liquid, then the required airflow is restricted and the pressure or vacuum inside the tank can reach critical levels and cause tank failure. The various media used for air filters are 'hydrophobic' – they repel water – and resist wetting from water vapor.

As with the bioburden control filters, vent filter performance targets are determined by operating conditions and expected contaminants. Most vent filters are designed to prevent bacteria, molds and wild yeasts from entering the tanks, so the pore sizes are usually 0.22 microns.

Choosing the Right Filters

The Critical Process Filtration Technical Services team can assist in evaluating your winemaking filtration needs, and conduct testing as necessary to identify the optimal solution for your process. Filtration recommendations will be made based on fluid compatibility, flow rate requirements, process sanitation and sterilization methods, removal requirements and test data from our Applications Lab. Testing can also be performed at your facility if your wine is not amenable to shipping.

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