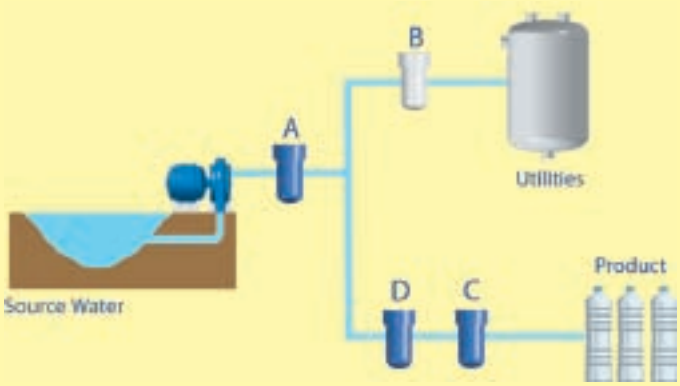
Pore decisions

Choosing the right filters for a beverage plant.



By Lisa M. Madsen, Ph.D

When talking about beverages, water isn't just an ingredient — it's *the* ingredient. Put quite simply, if you don't have water, you don't have an alcoholic beverage or soft drink.

Taking it a step further, if you don't have high-quality water, you won't have a high-quality beverage. Regardless of the beverage produced, water is a critical raw material in producing what every marketer strives for — a unique product signature.

For more information:

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Common water constituents and their potential effects

	Beer	Bottled Water	Juice	Soft Drinks	Tea
Hardness	pH affects bitterness	Moderate hardness impacts taste	Can cause post precipitation and hazing	Can cause precipitates	Affects taste
Iron	Inhibits yeast, may cause gray discoloration and haze	"Tin" taste, affects plant fixtures and appearance	Affects taste and may cause clouding or hazing	Affects plant fixtures and product taste	Can be chelated by tea and later precipitation
Calcium		Calcium hardness has positive taste effects	Undesirable in clear juices	Can cause precipitation	Negatively impacts taste
Copper		Toxic at higher concentrations	May accelerate oxidation	N/A	Can be chelated by tea
Magnesium		Toxic at higher concentrations	Can cause post-bottling effects	Can cause precipitation	Negatively impacts taste
Manganese	Inhibits yeast, may cause gray discoloration and haze	Affects product appearance and plant fixtures	Creates a "speckled" effect	Affects plant fixtures and product taste	Can cause precipitation
Nitrate		Water is likely polluted, negative impact on taste and appearance	Negatively impacts taste, health concerns	Negatively impacts taste, health concerns	Negatively impacts taste, health concerns

More than just equipment, beverage manufacturers and dealers servicing this market niche must be able to make educated decisions to meet the filtration and separations needs throughout the beverage production process.

Expertise of this type integrates treatment methods to allow companies to reduce total cost, enable new processes or products, and meet regulatory requirements.

Water quality challenges

Apart from the obvious health concerns, water quality is critical to the taste and appearance of any beverage.

In the beverage universe, a truly unique product signature is the painstaking result of a precise combination of liquid ingredients including flavors, additives, sweeteners, enhancers and water.

As the basis of any beverage, fluctuations in water quality affect taste, appearance and even safety. It can also affect the efficient operation of any bottling or production facility.

Feed water content and quality can vary according to raw water source and pretreatment. Since incoming water comes from many sources including municipal, groundwater, surface water and springs, it presents a plethora of challenges.

Waterborne cysts, oocysts, bacteria and viruses can contaminate source water, bringing with them serious health implications. Undesirable metals and salts can affect the taste, color and uniformity of the product.

The challenge, of course, is to remove all variability regardless of the source, as well as provide low-SDI feed water for downstream processes.

By ensuring the integrity of their processes and ingredients, manufacturers will realize the repeatable consistency required of successful products.

Benefits of membrane technology

- Lower overall production costs;
- Precise separation forms absolute barriers to unsafe and undesired components;
- Automated operation translates to low maintenance;
- Increased uptime;
- More throughput/production per square foot/meter of plant space;
- Capable of handling a high degree of variability in both the quality and quantity of feedwater;
- Modular design offers the most cost-effective capital expansion;
- Compact, modular designs maximize available space;
- Biological control;
- Extremely high rejection rates of dissolved organics and inorganics; and
- High recovery rates.

— L.M.

Cost vs. quality

Many filtration processes of varying removal capabilities go into the production of a beverage, and for different reasons.

The rule of thumb is that fine filtration is used to control quality; coarse filtration is used to control economics. As would be expected, the finer the filter, the more it costs.

It's important to remember that while water is the most important resource in beverage production, not all the water used in a plant goes into the product. In fact, up to 75 percent of plant water may go into running utilities or other plant processes.

Beverage manufacturers may want fine filters and the highest quality water for their product, and cost-effective coarse filters or other treatment for their plant operation.

Coarse filters are also commonly used as pre-filters, which extend the life of the finer filters housed downstream.

Fine filtration is accomplished by different filtration technologies:

Fine depth filters

Fine depth filters have particle removal ratings less than 10 microns (μm) and the ratings are established by slightly different methods than for coarse filters. This class of fine filters does not always retain microbial pathogens like *Cryptosporidium* or *E. coli* efficiently.

Membrane filters

Membrane filters, however, are designed to provide a validated removal of microbes and often have a correlated integrity test that can be performed to confirm effluent quality.

Quality control of water during production of beverages is critical. However, if incoming plant water is treated for general use, additional filtration for beverages will have longer life, thereby providing improved plant economics.

Membrane water treatment

Benefits of crossflow membrane filtration include product consistency, process and plant efficiency and maximization of throughput per square foot of footprint. With optimal use of space, efficiency and product consistency can be increased significantly.

Advancements in membrane process technology have led to its increasing acceptance for the removal of bacteria, particles, dissolved salts and natural organic material which, if allowed to pass through, can impart undesirable

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colors, tastes and odors to the water.

In the long run, when compared to conventional chemical treatment, membrane filtration will deliver lower overall production costs, fewer processing steps and a higher yield. Also, the customer can realize a higher degree of permeate selectivity and greater flexibility in handling feed liquids with different specifications and fluctuations in viscosity.

A membrane filtration system, due to its modular design, is easy to expand step-by-step, so that capacity always fits actual needs.

There are four pressure-driven membrane processes:

1. Microfiltration (MF);
2. Ultrafiltration (UF);
3. Nanofiltration (NF); and
4. Reverse osmosis (RO).

• ***Cartridge microfiltration (MF)*** routinely removes particles and microbes larger than 0.1 microns to around 1 micron in size.

• ***Crossflow microfiltration (MF)*** has a molecular weight cut-off (MWCO) between 300,000 and 1,000,000. This process separates particles with a size less than 0.2 μm.

• ***Ultrafiltration (UF)*** uses a membrane with a MWCO between 500 and 300,000. This process separates compounds in the range of 0.0001 to 0.1 μm.

• ***Nanofiltration (NF)*** offers separation qualities between ultrafiltration and reverse osmosis. They require a lower working pressure and give higher flux than RO membranes, but have a lower salt separation capability

• ***Reverse osmosis (RO)*** uses the most impermeable membrane. These membranes have a MWCO of less than 500 and require high pressure. □

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