

The "Ins and Outs" of Mechanical Filtration

All tap water contains unwanted particles and sediment that we'd rather not consume. Whether at home or in a restaurant, water from the tap always contains millions of particles, such as dirt and rust. Sometimes water even contains harmful particles, such as protozoan cysts, that can cause flu-like illnesses. Water filtration systems can remove most of these contaminants by using one of several filter types.

How does mechanical filtration work?

Water filters remove particles in two ways: through surface and depth filtration. Many particles are removed by surface filtration, a sieving process that traps large particles on the top or leading surface of the filter. Smaller particles pass through the surface layer and are subsequently removed through depth filtration. With depth filtration, smaller particles become trapped as they make their way through the increasingly smaller pores in a filter. Finally, the smallest particles and dissolved molecules are removed through a process called adsorption, in which particles are attracted to the filter medium's surface and held there by weak electrical forces.

A filtering medium can be regular and controlled, like a woven mesh screen, or irregular and porous, such as a sponge, a mat of fibers or a bed of granules. Only perfectly regular and strongly fixed filtering media are true "absolute" filters with 100 percent efficiency for a size range. The water treatment industry has adopted the definition of 99.9 percent removal of a given size as "absolute filtration."

Filters are rated according to the size of particles they can remove. The size of particles is measured in micro-meters or "microns" - one micron being equal to one-millionth of a meter or one-thousandth of a millimeter, the size of coal dust or baking flour. The smallest bacteria are about one-half micron in size, protozoan cysts are about 3 to 20 microns, and "dirt" can be more than 40 microns, which is the limit of normal, 20/20 vision.

Filter Maintenance

As filters remove particles from drinking water, they eventually fill up with trapped debris. When this happens, there are two possible outcomes: the filter will clog, or it will channel and dump. With clogging, debris builds up in the filter until no water can get through. This is the preferred occurrence since it forces the filter owner to replace the old filter with a new one without sacrificing the integrity of the processed drinking water. Although there is no true remedy to clogging, a filter can be made to last as long as possible by increasing its filtration surface area. Area is maximized through the use of pleats, plates, tubules, spirals, etc.

Channeling occurs whenever a filter is allowed to get clogged beyond the medium's dirt holding capacity, and there is sufficient water pressure available to take the filter to the breaking point. Eventually, somewhere, something "gives," and a crevasse opens up, allowing quantities of previously-filtered trash to "dump" into the effluent. This is both dangerous and unsanitary, and it should not happen. All filters that are certified by either NSF International or the Water Quality Association are tested to verify that turbidity will not channel and dump before the differential pressure ("delta-P") reaches 40 p.s.i. (pounds per square inch).

The way to prevent channeling and dumping is to backwash the system before either breakthrough or dumping occurs. Backwashing is a mechanical hydraulic process that uses reversed flow to break up debris and flush it out of the filter backwards. The required frequency of backwashing depends on the amount of accumulated debris, and can range from every week or so in residential applications to every day in busy foodservice operations. Note that not all types of filters are designed to be backwashed.

Filter Medium Types

There is a range of filter medium types available for "fine-filtration" down to the sub-micron size range. Sub-micron membrane fillers are plastic, cylindrical-shaped filters with accordion-like pleats that are commonly used in laboratories and work well in low-pressure situations. Ceramic "candle" filters are porous unglazed porcelain clay, cylindrical-shaped filters that are more susceptible to clogging because of their small surface area. Bonded carbon block filters are cylindrical shaped filters that utilize molded carbon for depth filtration.

Precoat filters use a powdered filter media, consisting mainly of diatomaceous earth or activated carbon, which is deposited on and retained by a rigid, yet permeable barrier, such as fabric. All of these fine-filter types are relatively free from channeling and dumping.

With a precoat filter, water first encounters the leading face of the "cake," which acts as a face filter by sieving out particles larger than the "pores" between the powder grains. As water passes through the cake, which acts as a depth filter, smaller particles are removed by entrapment, and sub-micron particles are removed by adsorption. Finally, virtually particle-free water then passes through the septum and to the outlet.

Everpure precoat filters use Micro-Pure a finely powdered proprietary activated carbon mix. Activated carbon's chemical makeup enables it to remove chlorine, many synthetic organic chemicals and the waste products of micro-organisms that produce off-tastes and mildew, fishy odors. Finely powdered carbon also has enhanced chemical kinetics and can withstand greater flow rates than granular carbon that is commonly used in filters.

Everpure precoat filters are certified for the mechanical filtration of protozoan cysts, such as *Cryptosporidium*, and turbidity. NSF International is an independent testing agency that sets product standards and certifies the performance of point-of-use (POU) drinking water systems.

For more than 60 years, Everpure has been a leading manufacturer of water filtration and treatment systems for foodservice and residential use, and offers a full line of systems to meet all water quality needs.