NebGuide

University of Nebraska–Lincoln Extension, Institute of Agriculture and Natural Resources

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G1492
(Revised December 2013)

Drinking Water Treatment: Sediment Filtration

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Sediment filters remove suspended matter such as sand, silt, loose scale, clay, or organic material from the water. Untreated water passes through a filter medium, which traps suspended matter on the surface or within the filter. This NebGuide discusses the principles, processes, and requirements of cartridge sediment filtration systems for the household user.

Contaminants removed from water by cartridge sediment filtration

A cartridge sediment filter removes suspended material such as sand, silt, loose scale, clay, or organic material from water. These materials can be the cause of turbidity or cloudiness in the water. Sediment filters also can remove insoluble (not dissolvable) or suspended iron and manganese.

Sediment filters often are used in combination with another drinking water treatment method for removal of contaminants such as dissolved iron, manganese, or hydrogen sulfide. For instance, sediment filters often are used after aeration, ozonation, or chlorination. These treatments oxidize dissolved iron, manganese, or hydrogen sulfide into solid particles that the filter then traps. Sediment filters also are used as pretreatment for other processes such as activated carbon (AC) filtration and reverse osmosis (RO) to increase their effectiveness. NebGuides explaining each of these processes are listed at the end of this document and can be obtained from your local University of Nebraska–Lincoln Extension office.

Contaminants not removed by sediment filtration

No one piece of treatment equipment manages all contaminants. All treatment methods have limitations, and often, situations require a combination of treatment processes to effectively treat the water. Sediment filters alone do not effectively remove dissolved organic or inorganic material that may be harmful. They do not effectively remove nitrate, heavy metals, pesticides, or trihalomethanes (byproducts sometimes formed during drinking water chlorination). Cartridge sediment filters are not generally recommended for removing microbial contaminants. Occasionally drinking water may contain very fine suspended material, sometimes referred to as "flour sand," or very fine clay particles, which may be too small to be removed by typical sediment filtration but may be more effectively removed by another process such as microfiltration. See the section on treatment principles later in this guide for further discussion. Also, refer to the Extension Circular, *Drinking Water Treatment: An Overview* (EC703) for a discussion of possible water quality problems and appropriate treatments for these contaminants.

Water testing

Regardless of the water treatment system being considered, the water first should be tested to determine what substances are present. Public water systems routinely are tested for contaminants. Water utilities are required to publish Consumer Confidence Reports (CCRs), which inform consumers about the source of the water, contaminants that are present, potential health effects of those contaminants, and methods of treatment used by the utility. Depending on the population served by the utility, CCRs may be mailed, published in newspapers, or posted on the Internet. A copy of the CCR can be obtained by contacting the local water utility. Public supplies must conform to federal standards established by the Safe Drinking Water Act. If contaminants exceed the Maximum Contaminant Level (MCL), the water must be treated to correct the problem and/or another source of water suitable for drinking must be provided.

In contrast, monitoring private water systems is the responsibility of the homeowner. Therefore, contamination is more likely to go undetected in a private water supply. Knowledge of what contaminants may be present in the water should guide the testing, since it is not economically feasible to test for all possible contaminants. It is essential to know what contaminants are present, their quantities,

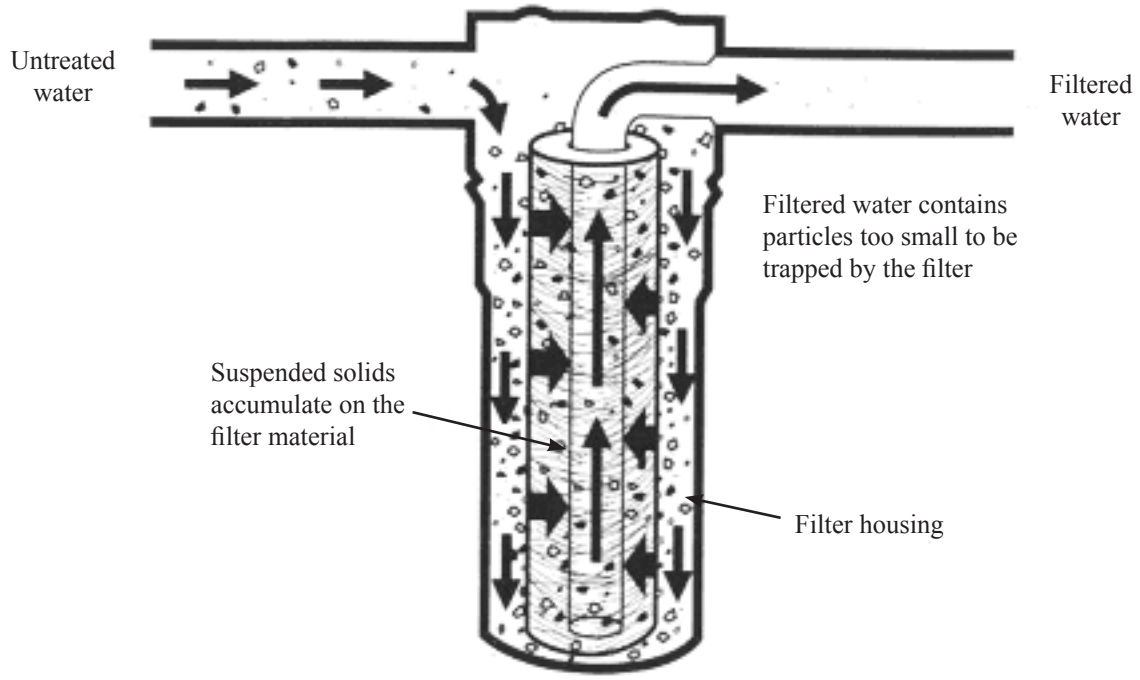

Figure 1. The sediment filtration process. From Wagenet, L., K. Mancl, and M. Sailus, 1995. "*Home Water Treatment*," Northeast Regional Agricultural Engineering Service, Cooperative Extension, Ithaca, N.Y.

and reasons for removal (e.g., to reduce contaminants posing health risks, to remove tastes or odors, etc.) prior to selecting treatment methods or equipment. Refer to the NebGuide *Drinking Water: Testing for Quality* (G907) for testing information.

Treatment principles and equipment

Cartridge sediment filters are generally Point-of-Use (POU) devices that can be installed under the sink, attached to a tap, or used as a pre-filter for other water treatment processes to increase their effectiveness and longevity. In some cases in which sediment may be an issue with water-using appliances such as washing machines, dishwashers, or hot water heaters, sediment filters may be Point-of-Entry (POE) devices that treat all water at its entry point into the home. In this situation, POE media filters or multimedia filters often are used. Consult a water treatment professional for guidance on these filters.

Sediment filters consist of a housing, usually plastic, surrounding the filter medium. The filter medium can be made from a variety of materials. Common materials are paper, ceramic, polypropylene, acrylic fiber, glass fiber, polyester, spun cellulose, and rayon. Wrapping or corrugating the material creates a larger filter surface area for contact with untreated water.

In the sediment filtration process, pressure from the water line forces the water through the media or fiber wraps of the medium into the inner cylinder, which leads out of the filter to the water line. Contaminants strained from the water are retained on the surface of the medium or are trapped within it.

The size of particles retained depends on the pore size or the space between media fibers or granules. Most filters list an average pore size and are rated by the manufacturer according to the smallest particle they can trap. For example, a 10 micron (ten thousandths of a millimeter) filter would trap contaminants 10 microns in diameter or larger. Check the filter rating before purchase since many filters are only rated for particles 20 microns in diameter or larger. Filters with this rating may not effectively remove some silt particles, which generally range from 2.0-50 microns. However, they would trap sand particles that generally range in size from 50 microns to 2 millimeters.

Filter ratings may additionally be rated as either "nominal" or "absolute." Those rated "nominal" should trap approximately 85 percent of particles equal to the pore size rating, while those rated "absolute" should trap approximately 99.9 percent.

Filter pore sizes that are larger than a targeted contaminant will allow that contaminant to pass through. For example, some very fine suspended material, sometimes referred to as "flour sand," is too fine to be removed by many cartridge sediment filters. Some clay particles, which generally range from 0.2-2.0 microns, are also too small to be removed by typical cartridge sediment filtration. A microfiltration process that uses a membrane with smaller pore sizes to remove particles of 0.02-2.0 microns may be more effective in such a situation. Microfiltration removes small amounts of suspended material and is not intended for removing a large load of material.

If the pore size of the filter medium is too small or if the concentration of suspended solids in the water is too high, the filter may easily clog and require frequent replacement. In general, the largest rating size that will remove the intended contaminants will require the least maintenance. *Figure 1* shows the sediment filtration process.

Water flow through a filter is greatest when a new or replacement cartridge is installed. As trapped material accumulates in the filter, it increases its effectiveness by assisting in the filtration process. Water flow gradually

decreases as trapped material continues to accumulate. Eventually, the filter medium must be replaced. When a noticeable drop in water flow through the filter occurs, clean or replace the cartridge. Some cartridge filters are rated according to the number of gallons of water they can treat. While this may be a helpful guideline, differences in the type and amount of contaminants in the water make it difficult to accurately predict how much water a filter will effectively treat.

Selection Requirements

When selecting a sediment filtration device, you should determine the flow rate produced *at household water pressure* (30 pounds per square inch is typical household water pressure), the estimated amount of water treated before maintenance, and the desired water quality. The manufacturer should provide information on the initial flow rate through the device at a given water pressure.

Plastic housings for different filters often look about the same. The filter material in the housing determines the filter's function and effectiveness. Information on this material should be examined completely to be certain the correct type of filter is being purchased. In some cases, bacteria can accumulate on filters, particularly those with a paper medium. Though these bacteria may not cause illness, they can contribute to other water quality problems such as offensive taste or odor and corrosion. If bacterial growth occurs on a paper media filter, consider using a filter with a nonbiodegradable media material.

Federal, state, or local laws do not regulate sediment filtration POU and POE home systems. The industry is self-regulated. The NSF (formerly known as the National Sanitation Foundation) and the Water Quality Association (WQA) evaluate performance, construction, advertising, and operation manual information.

The NSF program establishes performance standards that must be met for endorsement and certification. The WQA program uses the same NSF standards and provides equivalent American National Standards Institute (ANSI) accredited product certifications. WQA certified products carry the Water Quality Association Gold Seal. Though these certifications and validations should not be the only criteria for choosing a sediment filtration system, they are helpful to ensure effectiveness of the system.

Other important guidelines for consumers purchasing drinking water treatment equipment are discussed in the NebGuide *Drinking Water Treatment: What You Need to Know When Selecting Water Treatment Equipment* (G1488). The NebGuide series on drinking water treatment focuses on contaminants most likely to be encountered in Nebraska drinking water supplies. It is possible that some water supplies may contain contaminants not addressed here, such as cryptosporidium, giardia, hexavalent chromium and others; these are less likely to be removed by conventional cartridge filters.

Summary

Drinking water treatment using sediment filtration is one option for a homeowner to treat home water problems. Sediment filtration is an effective method for reducing turbidity in water caused by the presence of suspended solids such as sand, silt, or clay. Sediment filters are also commonly used in combination with other processes such as activated carbon filtration, aeration, ozonation, or chlorination. Selecting a sediment filtration unit should be based on water analysis and assessment of the individual homeowner's needs and situation. Regular replacement of the filter/cartridge is a critical factor in maintaining effectiveness and reducing bacterial contamination of the filter. The NSF and the WQA test and certify products, and this certification can help guide selection.

Acknowledgment

The authors wish to acknowledge the contribution of former UNL Extension engineer Jodi Kocher, who collaborated with them in the previous version of this NebGuide.

This publication has been peer reviewed.

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Drinking Water
2003-2008, Revised December 2013