**Water Filter Media Facts**

**Charcoal: (***https://www.waterfiltersfast.com*)

The charcoal used in water filters isn’t the same as your average barbecue bricks. Water filters use what is known as activated charcoal, which is usually pressed into a solid block or sold as loose beads.

Charcoal activation is achieved through a process of superheating the charcoal without oxygen at temperatures over 1000F. Then the charcoal is chemically treated with argon and nitrogen, followed by a second round of superheating with the addition of oxygen and steam to create a porous structure. The porous structure of the activated charcoal is the key factor that makes charcoal water filters so effective.

Activated charcoal works through the process of adsorption. Adsorption, as opposed to absorption, binds these impurities chemically, rather than physically. The pores in activated charcoal increase the surface area of the charcoal up to an extraordinary 2000 square meters per gram, which drastically improves its adsorption efficiency.

The reason that activated charcoal makes such a great material for water filters is that it is natural and effective at removing many toxins from the water, such as volatile organic compounds and chlorine, without the use of chemicals or stripping the water of salts and minerals. As you may remember from chemistry class, carbon-based organic impurities in the water are attracted to the carbon in the charcoal, which readily bonds to these impurities. However, other compounds, depending on their molecular weight and polarity, are not attracted to the carbon, and so pass through the filter.

Because the process results in bonds being formed between compounds, and the impurities are kept in the filter, charcoal filters need to be replaced once all the pores have been filled. Fortunately, maintaining and replacing charcoal filters is easy and cheap to do, making charcoal filters a popular choice for many households.

**Marble Rock:** (*https://sciencing.com/benefits-effects-limestone-7840800.html*)

As a sedimentary rock, limestone consists of the mineral calcite, shellfish fossils and other shallow-sea creatures, clay, chert, silt and dolomite. Limestone’s uses are many, based on the desired effect it creates. Manufacturers use limestone for making glass. They also use it in building materials such as travertine and other decorative tiles. Gardeners put it on the lawn, contractors construct buildings and roads with it, and water treatment professionals insert it to neutralize acidic water.

Plants aren’t the only ones that benefit from limestone. Pond liming, a customary practice in the southeastern United States, increases nutrient availability for both fish and plants in the pond. It also provides a shield against the fluctuations in the water’s acidity each day. Most farmers and rural homeowners add it to a pond’s bottom to sterilize it prior to adding fish.

For homes in rural communities, many wells have acidic water that also contain high amounts of iron or ferrous byproducts. Acidic water plays havoc with copper pipes over time, which is why many people opt for water treatment tanks that contain limestone and other sands or minerals. They act as a base for changing the water’s pH content as well as help to remove iron and its byproducts from the water. Water treatment tanks with automatic timers regularly backflush the nasty water collected by the limestone and other sands at the bottom of the tank and lift the sand during backflush to loosen and remove the sediments. Limestone sands and other filtration media must be changed and recharged periodically based on the water’s constituents to keep the water’s pH level at a neutral 7.0. This is best for drinking water and copper pipes.

**River Rock:** (https://fullserviceaquatics.com/uncategorized/gravel-for-pond-filtration/)

The grain size should be anywhere from 3/8” to ¾” if being used for filtration as opposed to aesthetics. And the grain should be rounded/tumbled, not containing an angular appearance or sharp edges (like marble chips or construction gravel). All gravel should be washed before going into the pond, and even a second rinse after install is not a bad idea. A typical gravel filtration bed should be about 2” thick for optimum results.

There is the obvious aesthetic value, but how about as a filter. Gravel filtration ushered in a new wave of popularity in aquarium keeping many decades ago and made keeping the home aquarium much easier and prettier. If you are using gravel in your pond you must treat it and consider it as a form of filtration because whether you intend it or not, it is going to function as a filter. The mechanics of any type of filtration is simply removal. Gravel will capture and remove debris, particles, and sediments from the water in your pond and deposit that material in between its grains of gravel where it can now be further broken down by millions of microbes (beneficial bacteria) that grow on the surface of the gravel bed that is filtering your water. So gravel has an almost immediate impact on water clarity, and then it goes to work on water quality. Of course, like any type of filter it needs to be cleaned or it loses its filtering ability. In most ponds cleaning your gravel annually will do a great job of maintaining it in top condition for filtration purposes.

**Pea Gravel:** (*https://nearsay.com/c/588650/141176/what-you-need-to-know-about-using-pea-gravel-for-drainage*)

Gravel is an ideal drainage solution for two primary reasons — weight and an impenetrable surface. The weight and coverage area provided by the material prevents erosion, and its solid, moisture-resistant design allows water to drain faster. As such, it prevents precipitation from pooling on the surface. While there are a variety of sizes and styles available, pea gravel is one of the most popular because its compact size creates a safe, walking-friendly finish.

Improving water quality almost always involves some sort of filtration process. Filtration barriers remove larger particles from water, including those formed by coagulation. This section is about the filtration process which can be used to improve the quality of rural water. An [animated version](http://www.agr.gc.ca/eng/science-and-innovation/agricultural-practices/water/ponds-and-dugouts/farm-surface-water-management/filtration-how-does-it-work-/?id=1189695164631#animation)of the filtration process is available below.

Filtration removes particles from water. All filtration systems are designed for specific water uses (for example household, drinking, agri-food sector, industrial, etc.). Two common types of filter media are: Sand / Gravel and Carbon. These filter media can be used in both conventional and biological filters.

**Conventional Rapid Filters**

* the filter media traps particles
* the flow of water is relatively fast

Layers of sand and gravel, arranged according to density and sand particle size, trap and strain particles in the water. Water flows relatively fast (5 to 30 metres per hour) through the layers. Filtered water is then collected in a pipe, and passed on to the next treatment process.



The sand and gravel traps

* small bugs or organisms
* algae
* zooplankton
* suspended dirt
* particles of "floc" formed by coagulation pre-treatment
* any other large particles in the water

Some organisms and dissolved matter pass through (for example bacteria, arsenic). Trapped particles build up in the filter media, and could eventually clog the filter or pass through as a dirty water mixture. Filters must always be cleaned by "backwashing" before this happens. Water (sometimes with air) is forced backwards through the filter to remove the particles. The dirty water is drained to waste. Once the filter is cleaned, the filter can operate normally again. After sand filtration, the water must be treated with additional processes including disinfection before it is safe to use as drinking or household water.

**SAND:** (http://www.nesc.wvu.edu/pdf/dw/publications/ontap/2009\_tb/slow\_sand\_filtration\_dwfsom40.pdf)

**Particulate solids capture mechanisms** Sand bed filters work by providing the particulate solids with many opportunities to be captured on the surface of a sand grain. As fluid flows through the porous sand along a tortuous route, the particulates come close to sand grains. They can be captured by one of several mechanisms:

* Direct collision
* Van der Waals or London force attraction
* Surface charge attraction
* Diffusion[[4]](https://en.wikipedia.org/wiki/Sand_filter#cite_note-Rushton-4)

In addition, particulate solids can be prevented from being captured by surface charge repulsion if the surface charge of the sand is of the same sign (positive or negative) as that of the particulate solid. Furthermore, it is possible to dislodge captured particulates although they may be re-captured at a greater depth within the bed. Finally, a sand grain that is already contaminated with particulate solids may become more attractive or repel addition particulate solids. This can occur if by adhering to the sand grain the particulate loses surface charge and becomes attractive to additional particulates or the opposite and surface charge is retained repelling further particulates from the sand grain.

In some applications it is necessary to pre-treat the effluent flowing into a sand bed to ensure that the particulate solids can be captured. This can be achieved by one of several methods:

* Adjusting the surface charge on the particles and the sand by changing the pH
* [Coagulation](https://en.wikipedia.org/wiki/Coagulation) – adding small, highly charged cations (aluminium 3+ or calcium 2+ are usually used)
* [Flocculation](https://en.wikipedia.org/wiki/Flocculation) – adding small amounts of charge polymer chains which either form a bridge between the particulate solids (making them bigger) or between the particulate solids and the sand.

**Coffee Filters:** (https://thesurvivalmom.com/reality-coffee-filters-preparedness-uses-hint-mostly-fail/)

There are a couple of important things to keep in mind about coffee filters when you consider them for preparedness or camping uses. However, coffee filters are very fragile when wet. Any abrasive use of them when wet will see them fall apart rapidly. Paper towels are designed to be absorbent, while coffee filters are designed to filter coffee, but with a typical pore size of 20 microns (or micrometers), they are not a particularly good filter in general.

When it comes to expedient uses, the best use for a coffee filter is for filtering water. While it cannot make water safe to drink on its own, it can be a component in filtering water. Wrapping a coffee filter on your intake tube of your water filter will help increase the lifespan of the filter by filtering out larger particles. You could also pre-filter the water by straining through one or two coffee filters into a container, and then filter that water with your water filter. **Keep in mind how easily the filter will rip and tear when wet.**

Another water filtration use for these are in an expedient water filter, made from charcoal, sand, and other local materials, where the coffee filter separates the different media and keeps it from falling through. However, because they are very fragile when wet, their effectiveness for this use is debatable. Any tears or other holes would render the filter achieved less effective. Keeping the layers separated is probably better achieved using cotton or nylon fabric, since they are more durable.