Filtration

The filtration process of activated carbon is simple in principle, but complex in action. The principle is that water is passed through the activated carbon and the carbon traps the contaminants. This may be accomplished through gravity-based systems, such as a filter pitcher, or under pressure as in faucet-mounted or high-pressure systems. The actual trapping of contaminants relies on a number of factors, including physical and chemical properties of the carbon, duration of filtration, water temperature and PH, and the degree of contamination.

Underlying Factors

The first major filtration action that activated carbon performs is called adsorption. Adsorption is a function of physical attraction between contaminants and the carbon. Activated carbon is very porous, which provides, proportionally, a very large surface area. As water passes through the carbon, the contaminants get caught in the pores. In general, this process is most efficient when the contaminants are large organic molecules.

Another filtration action, which does not depend on surface area, is called catalytic reduction. This process functions through an ion exchange process. Activated carbon can be produced to have a mild, positive electrical charge. As the water passes through the activated carbon, the positively charged ions in the carbon provide an attractive force for negatively charged contaminants. The contaminants are pulled in and held by the opposing charges. This type of filtration works better for chemicals used to disinfect water, such as chlorine.

Time, Temperature and pH

The total duration of filtration time plays a role in the overall effectiveness of the filters. The more time that the water spends in contact with the carbon, the better the result. The diminished return on faster filtration can be offset by increasing the amount of carbon, which is frequently done with high-pressure systems. Higher levels of contamination can result in a reduction in filtration quality with some filters. A final factor is the temperature and overall pH of the water. Colder water with lower levels of pH tend to result in a higher quality of filtration than warmer water with higher pH.

Active, or activated, carbon water filters are used to remove contaminants from water. In most cases, this filtration is done on water intended for drinking or cooking purposes, though it may be applied to all the water in a system if the contamination levels are very high. The activated carbon itself is produced from a variety of sources, including coal, peanut shells, coconut shells and wood. While all activated carbon filters perform essentially the same function, total volume and quality of contamination removal may vary depending on the carbon source and the activation process. These types of filters remove contaminants such as pesticides, chlorine, industrial solvents, radon and volatile organic compounds (VOCs).

Several factors influence the effectiveness of activated charcoal. The pore size and distribution varies depending on the source of the carbon and the manufacturing process. Large organic molecules are absorbed better than smaller ones. Adsorption tends to increase as pH and temperature decrease. Contaminants are also removed more effectively if they are in contact with the activated charcoal for a longer time, so flow rate through the charcoal affects filtration.