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Why you should lotus® your water

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The nation's water infrastructure is in a state of neglect and disrepair. Towns, townships and other local agencies supply the public with drinking water and they also collect, treat and dispose of wastewater and storm water runoff.

Impact on drinking water safety

Pipes and plants built to bring clean and safe water to homes and remove wastewater continue to come to the end of their useful life. As older systems deteriorate and federal water quality rules tighten, local budgets simply cannot keep pace. Water infrastructure needs are large and

unprecedented. In cities large and small, water mains have broken, sewers have overflowed and contaminants have crept into our drinking water. The best municipal water treatment facilities in the world are worthless if we cannot guarantee the safe delivery of drinking water into our homes.



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We assume that when we turn on our tap that we are getting clean, safe drinking water. Unfortunately, that is often not the case. Regardless of the origin, tap water is still vulnerable to a variety of impurities.



Water Quality Problems

Three general categories can describe water quality: physical, biological and chemical. The effects on water quality in each category are described below.

PHYSICAL

Taste, odor, turbidity and color are the principal physical properties of water that are noticed by the user. These characteristics may indicate possible health hazards and therefore should not be ignored.

Problem: Taste and Odor

Taste and odor can affect the quality of water by tainting certain foods and vegetables and by reducing the palatability of foods cooked in water. The main sources of odor- and taste-bearing substances are harmless organic materials like iron bacteria and certain inorganic chemical constituents such as hydrogen sulfide.

Acidic (low pH) water can leach copper out of pipes causing a metallic taste, especially when the water is not flushed from the pipes frequently.

Most taste and odor problems are solved by eliminating the substances that cause the problem. Treatment techniques include activated carbon filtration and/or oxidation using chlorination, potassium permanganate, ozonation or aeration.

Problem: Turbidity and Color

Turbidity is a visual haziness in water caused by the presence of insoluble suspended particles. Turbidity is undesirable for health as well as for aesthetic reasons because turbidity can interfere with disinfectants and can "piggy back" microorganisms.

Treatments for turbidity and color usually involve settling or filtration.

BIOLOGICAL

All natural waters, regardless of source, are likely to contain some microorganisms. Microorganisms are too small to be seen without a microscope, and include viruses, bacteria and protozoa. Some types of bacteria cause disease and some impart taste, odor, or turbidity to water.

Domestic waste water, feedlots,

Contaminants such as fertilizers, asbestos, cyanides, pesticides and industrial chemicals may leach into ground water through the soil or into any tap water from plumbing pipes.



surface runoff and other pollution sources may sometimes contaminate ground water. In these situations, ground water is impacted when the soil zone receives more of the nutrient compounds than it can use (short contact times). The excess may be carried down to the ground water or washed into nearby ponds or streams.

Problem: Pathogenic Organisms

Pathogenic (disease-causing) organisms occurring in water range from ultra-small viruses to microscopic bacteria to relatively large protozoa. Bacteriologic and protozoan pathogens are known to cause typhoid, dysentery, cholera and some types of gastroenteritis. Viruses can cause human maladies including polio, infectious hepatitis and some forms of gastroenteritis.

Biological contaminants are most effectively eliminated by disinfecting water through oxidation (e.g., chlorine disinfection or ozonation), filtration, or ultraviolet irradiation.

For each method the equipment must be specifically designed for the intended use and properly maintained. Regular bacterial analysis of the treated water is needed to ensure that adequate treatment occurs. Filtration is more effective in controlling bacteriological impacts when used in conjunction with ozonation or irradiation treatment. A chemical disinfectant should be effective on many types of pathogens, regardless of their quantity, and it should be able to kill all pathogens within a reasonable contact time. The chemical should also be safe and easy to handle and it should not make the water toxic or unpalatable. In addition, the concentration of disinfectant in the water should be easy to monitor and the disinfection should provide residual protection against possible recontamination.

CHEMICAL

Man-made causes for dissolved constituents in ground water include all forms of pollution. Disposal of industrial wastes into ground and

The water may leave the municipal supply in good condition but leaks or loose fittings in pipes along the way can contribute to the unhealthy condition of the water when it reaches us.



surface water sources is a contributor to the occurrence of chemicals in water. Chemical fertilizers, petroleum products (waste oil, gasoline, etc.), pesticides and synthetic detergents also contaminate some water supplies, as do buried wastes.

Problem: Iron

Small amounts of dissolved iron in drinking water present no concerns, but high levels of iron can cause rusty stains to form on laundry and appliances. Potatoes boiled in iron-rich water turn black, and iron combines with the tannins in tea and coffee to form a black, inky appearance and an unpalatable metallic taste.

Problem: Manganese

Iron and manganese are often reported together because they share similar traits and treatment techniques. Manganese concentrations of more than 0.5 mg/L may impart a bitter, metallic taste to foods and water and may precipitate to form noxious deposits on foods during cooking

and black stains on plumbing fixtures and laundry. Iron and manganese may be removed by a water softener if measures are taken to prevent resin fouling or ozonation-filtration techniques.

Problem: Chloride

Although chloride is only a minor constituent in the earth's crust, it is a major dissolved substance in some waters. High chloride concentrations in water are more common in arid and coastal regions than in humid areas. One of the best removal techniques for excess chloride is reverse osmosis.

Problem: Industrial chemicals

This is a general term for a broad range of hazardous or regulated substances and waste products that are not naturally occurring. They may end up in the ground water supply if they are improperly handled. A few examples of these types of materials include organic compounds (e.g., benzene, MTBE), heavy metals (e.g., cadmium, chromium, lead, mercury, etc.), pesticides and herbicides, polychlorinated biphenyls (PCBs),

Water filtration alone is not always enough.

Some chemical contaminants and most pathogens pass right through the filter and into your drinking water.

petroleum hydrocarbon fuels, and polycyclic aromatic hydrocarbons (PAHs). The treatment of these and similar types of chemical pollution should be considered on a case-by-case, site-specific basis so that the most appropriate solution is implemented. It is important to determine the source of these contaminants before a solution is chosen. Treatment methods may include activated carbon filtration, aeration, ion-exchange, neutralization and others, including combinations of these methods.

The 5 Ways to Protect

The following section describes treatment methods commonly used by homeowners to provide safe drinking water for their family.

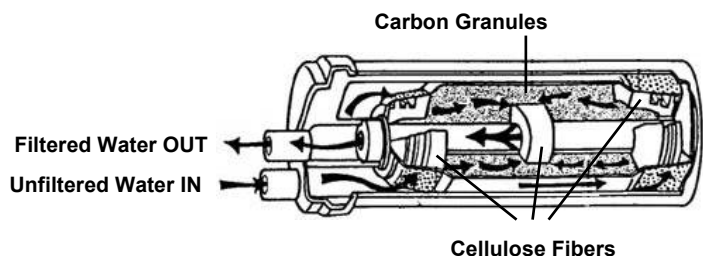
1 ACTIVATED CARBON

Activated Carbon Filtration systems involve the adsorption (adhesion) of one material on the surface of a second solid substance based on opposing electrical charges of each material. These systems are widely used to eliminate certain hazardous compounds related to industrial wastes, chemicals and pesticides. This treatment method can also remove unpleasant tastes and odors caused by decaying organic matter, dissolved gases and residual chlorine. Adsorption filtration does not treat microorganisms and should also include a method of chemical disinfection or oxidation. It is recommended that water be chlorinated or ozonated before passing through an activated carbon filter.

Faucet Mount Carbon Block Filter



Carbon Block Filter



2 ULTRAVIOLET

Ultraviolet light provides bacterial killing action much the same way sunlight helps kill bacteria. The ultraviolet unit consists of one or more ultraviolet lamps usually enclosed in a quartz sleeve, around which the water flows. The lamps are similar to fluorescent lamps, while the quartz sleeve surrounding each lamp protects the lamp from the cooling action of water. The killing effect of the lamp is reduced when the lamp temperature is lowered. Water passes in a relatively thin layer around the lamp since the germicidal action of ultraviolet

irradiation depends on the intensity of the light, depth of exposure and contact time. Water flow must be regulated to ensure that all organisms receive adequate exposure. Turbidity and minute traces of iron compounds reduce the light's transmission. Therefore, the water should be pre-filtered so that untreated organisms do not slip by. Based on the available research literature, it appears that although exceptional for disinfection of small microorganisms such as bacteria and viruses, UV doses required to inactivate larger protozoa such as *Giardia* and *Cryptosporidium* are several times higher.

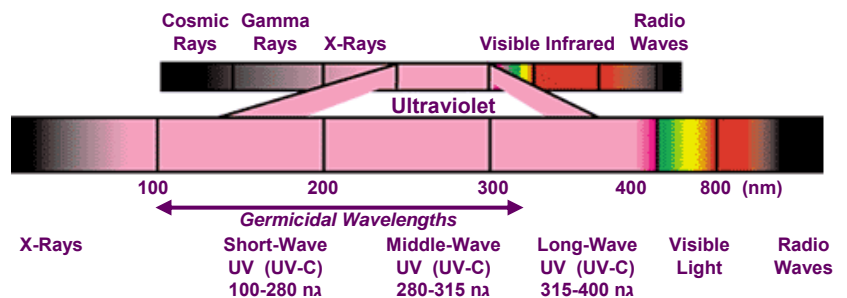
Periodic cleaning and replacement of the high intensity ultraviolet source lamp is required.

Replacement kits run around \$200 per year.

UV System



Ultraviolet Light Spectrum



3 OZONE

Ozonation uses ozone as an oxidizing agent. Ozone is an unstable form of oxygen having three atoms per molecule rather than the two atoms typical of atmospheric oxygen. As such, ozone is more reactive than oxygen and is therefore a powerful oxidizing agent. The ozonation system involves passing dry, clean air through a special form of high-voltage electric discharge. The mixture of air and ozone is passed through

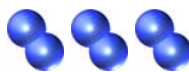
the water to be treated. Ozonation can strip water of iron, manganese, and sulfur by oxidizing them into insoluble compounds. The lotus® Water Treatment System™ first ozonates the water by employing the same technology used by multi-million dollar water treatment plants to eliminate up to 99.99 percent of bacteria and viruses. lotus® then employs a custom formulated carbon-block filter to capture any remaining contaminants and excess ozone.

Ozone kills up to 99.99% of bacteria such as E.coli O157:H7 that can sometimes seep into your drinking water supply.

How Ozone works

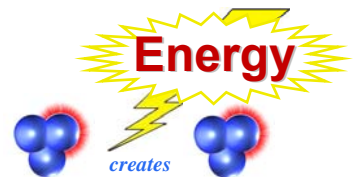


Water Treatment System™



Ordinary Oxygen O₂

plus

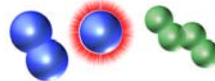


Extraordinary Ozone O₃

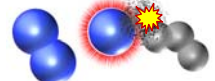
Ozone's power as a sanitizing agent comes from its unstable molecular structure – the third oxygen atoms (O) tend to consistently break apart from the ozone molecules (O₃) creating a powerful sanitizing force ... In fact, ozone is over **50% stronger** and **3,000 times faster acting** than bleach and reverts back to oxygen once the sanitizing is done.



Ozone O₃



Ozone O₃ attacks



Ozone O₃ kills

When you expose bacteria in water to ozone they begin absorbing ozone molecules immediately. Those ozone molecules (O₃) break apart within seconds, and when they do the bacteria literally explode leaving only oxygen (O₂) and purified water behind.

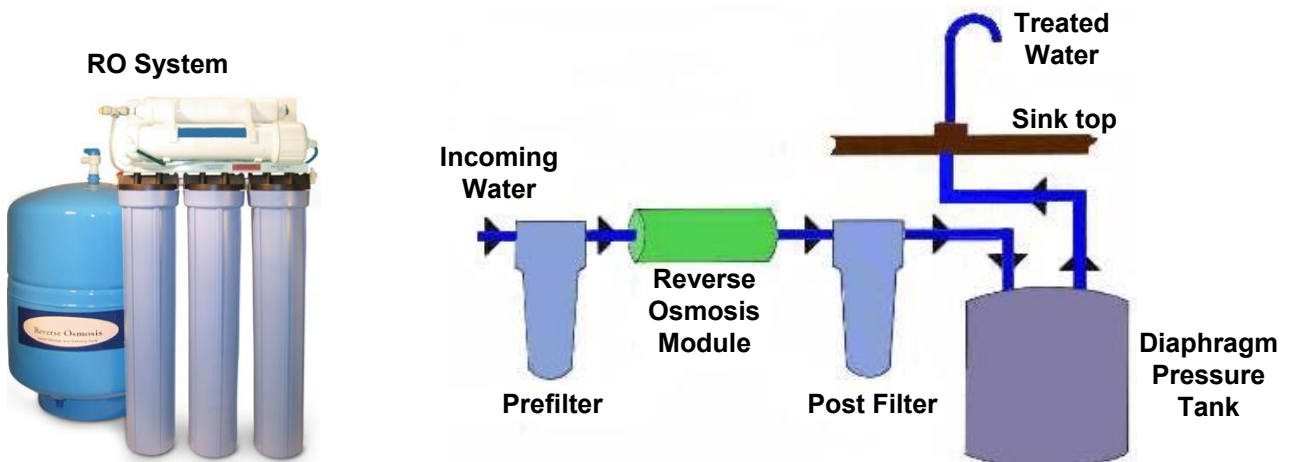
4 REVERSE OSMOSIS

Reverse Osmosis methods employ a unit divided into two chambers by a semi-permeable membrane. One of the chambers contains "raw" water with undesirable constituent(s) (e.g., salt). Reverse osmosis involves the application of pressure to the side of the chamber containing the "raw" water. This forces the water to leave the contaminated chamber and flow through the treatment membrane into the "treated" water chamber, leaving the unwanted minerals behind, which are then rinsed to the drain. The membrane filters the water on a molecular scale.

Reverse osmosis provides partially de-mineralized water. The process is effective for removing many substances, including sulfate and chloride, and it generally leaves the water free of mineral and biological foulants. However, pre-filtration or other treatment may be needed for the system to work properly. Unfortunately, this process also removes the minerals that help make the water taste good, so reverse osmosis water ends up tasting bland. The removed substances are disposed of in approximately one to three gallons of water which are wasted for every one gallon that is produced.

Most reverse osmosis filters will remove bacteria, however, they will also remove the "good" minerals which leaves water tasting bland.

Point of Use Reverse Osmosis System



Only 12 percent of “custom” plastic bottles, a category dominated by water, were recycled in 2003. That’s 40 million bottles per day that went into the trash or became litter.



5 BOTTLED WATER

Sales of bottled water in this country have exploded in recent years, largely as a result of a public perception of purity driven by advertisements and packaging labels featuring pristine glaciers and crystal-clear mountain springs. But bottled water sold in the United States is not necessarily cleaner or safer than most tap water, according to a four-year scientific study recently made public by the Natural Resources Defense Council (NRDC). NRDC's study included testing of more than 1,000 bottles of 103 brands of bottled water. While most of the tested waters were found to be of high quality, some brands were contaminated: about one-third of the waters tested contained levels of contamination - including synthetic organic chemicals, bacteria, and arsenic - in at least one sample that exceeded allowable limits under either state or bottled water industry standards or guidelines. Ironically, public concern about

tap water quality is at least partly responsible for the growth in bottled water sales, which have grown by 500 percent in the past 5 years. This bonanza is also fueled by marketing designed to convince the public of bottled water's purity and safety; marketing so successful that people spend from 240 to over 10,000 times more per gallon for bottled water than they typically do for tap water. In fact, about one-fourth of bottled water is actually bottled tap water, according to government and industry estimates. FDA rules allow bottlers to call their product "spring water" even though it may be brought to the surface using a pumped well and treated with chemicals. Also, the actual source of water isn't always made clear - some bottled water marketing is misleading, implying that the water comes from a pristine source when it doesn't. In 1995, the FDA issued labeling rules to prevent misleading claims, but while the rules do prohibit some of the most deceptive labeling practices, they haven't eliminated the issue.



Comparison

	ONE	TWO	THREE	FOUR	FIVE
	Carbon Filter Alone	Ultraviolet w/ Carbon Filter	Ozone w/ Carbon Filter	Reverse-Osmosis w/ Carbon Filter	Bottled Water Alone
Typical System Cost	\$39.99	\$1,199.00	\$199.99	\$199.99	\$3.59 for 12 x 12 fl oz
Consumables Cost	\$19.99	\$198.00	\$39.99	\$100.00	\$0.30 per bottle
Annual Costs ¹	\$72.96	\$198.00	\$39.99	\$100.00	\$1,164.76

ENVIRONMENTALLY FRIENDLY ²

Carbon Filter Alone	Ultraviolet w/ Carbon Filter	Ozone w/ Carbon Filter	Reverse-Osmosis w/ Carbon Filter	Bottled Water Alone
YES	YES	YES	YES	NO

REDUCTIONS ³

	Carbon Filter Alone	Ultraviolet w/ Carbon Filter	Ozone w/ Carbon Filter	Reverse-Osmosis w/ Carbon Filter	Bottled Water Alone
Aesthetic Effects					
Chlorine	YES	YES	YES	YES	CAN BE
Particulate	YES	YES	YES	YES	CAN BE
Health Effects (Toxin)					
Lead	YES	YES	YES	YES	CAN BE
Lindane	YES	YES	YES	YES	CAN BE
Mercury	YES	YES	YES	YES	CAN BE
MTBE	YES	YES	YES	YES	CAN BE
2,4-D	YES	YES	YES	YES	CAN BE
Health Effects (Pathogen)					
Cryptosporidium	CAN BE	CAN BE	99.99%	99.0% +	CAN BE
Escherichia Coli	NO	99.99%	99.99%	99.0% +	CAN BE
E. Coli 0157:H7	NO	99.99%	99.99%	99.0% +	CAN BE
Giardia	CAN BE	CAN BE	99.99%	99.0% +	CAN BE
Listeria monocytogenes	NO	99.99%	99.99%	99.0% +	CAN BE
Salmonella typhimurium	NO	99.99%	99.99%	99.0% +	CAN BE
Staphylococcus aureus	NO	99.99%	99.75%	99.0% +	CAN BE
Yersina enterocolitica	NO	99.99%	99.99%	99.0% +	CAN BE

¹ Excluding system cost, based on consumption of 365 gallons of drinking water per year.

² In 2003, only 12% of "custom" plastic bottles, a category dominated by water, were recycled. As a result, 40 million bottles per day went into the trash or became litter.

³ When used as instructed with visibly clear water.

 EFFECTIVE

 NOT EFFECTIVE

Sources

American Ground Water Trust, Natural Resources Defense Council, Environmental Protection Agency



Courtesy of the Lotus Water Treatment System

"Utilizing the latest in Ozone and Activated Carbon Filter Technology"



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