Secondary Contaminants

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Dissolved Iron

Sources

Iron is naturally found in the earth's crust, and dissolved iron found in groundwater that is not exposed to oxygen. Water with ferrous iron is clear and colorless until oxygen is absorbed and reacts with the iron to form non-soluble ferric oxide (iron oxide or "red rust"). The iron in homes may be from the incoming water supply, or corrosion of steel piping components.

Concerns

Based on the U. S. Environmental Protection Agency, the secondary regulation limit for iron in drinking water is 0.3 mg/L. This number is strictly based on aesthetics (odor and taste) as iron is not considered a health risk. Iron is essential for good health because it helps blood to transport oxygen around the body. The reasoning for the limit on iron is that it stains and contaminates anything it touches leaving a gray, black, red-brown , or yellow-brown stain, and has an unpleasing odor and taste in drinking water. Iron may also promote the growth of iron bacteria (non-disease producing). They grow and multiply in water, then oxidize the iron to insoluble ferric state to make a thick rust colored slime or sludge on fittings or hoses. Organic iron combines with organic matter (tannins) to stain water. This form is usually found in shallow wells and surface water.

Remedies

Treatment of iron can include: aeration, filtration, adding chlorine bleach, hydrogen peroxide, or ozone, flushing, or cleaning by soaking iron stains in sodium metabisulfite (iron out or rust out).

Manganese

Sources

Manganese is a gray-white metal resembling iron. It is hard, very brittle, and has strong magnetic properties when in an external magnetic field. Naturally manganese is rarely found alone in water; it is usually dissolved along with iron. Manganese is important as an industrial alloy used as pigment. It also comes from natural deposits or deposited from airborne sources. Manganese was used in the "Wartime" nickel from 1942-1945, and in dollar coins minted since 2000.

Concerns

The U. S. Environmental Protection Agency recommends a limit of 0.05 mg/L (or parts per million) for aesthetics such as taste, discoloration, and staining of laundry and plumbing. Manganese deposits in plumbing cause black sediment and blackish turbidity. Also, manganese bacteria are often present which can cause clogs in piping. Manganese is an essential trace element needed by our bodies (found in grains and teas).

Remedies

The same removal techniques used with iron can be applied to manganese.

Hardness

Sources

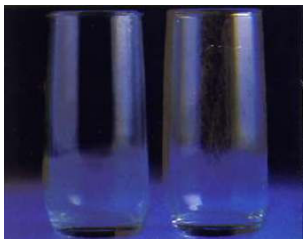
Hard water is high in dissolved minerals, specifically calcium and magnesium. The higher the amount of minerals, the higher the hardness of the water.

Concerns

Hardness is not a health risk, it actually contributes a small amount to the total calcium and manganese daily human requirements. It does however cause mineral build-up on fixtures, poor soap and detergent performance. Scale build-up of calcium and manganese may cause clogs in piping, and has been known to increase energy bills by up to 25%.

Remedies

Some tips to combat hardness are to choose soaps and detergents to match the hardness of your water; reduce the temperature of your boiler to ~55°C to reduce mineral deposits; and use white vinegar or rinse agents in your dishwasher to remove the film from dishes.



Acknowledgements

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Dissolved Sulfate

Sources

Sulfates (SO_4) are salts of sulfuric acid (H_2SO_4). They occur naturally in rain water, or man-made from industrial waste, battery acid, Epsom salts, plaster, some drugs, and algaecides. Many of the sulfate salts are highly soluble in water. Sulfates occur as microscopic particles from fossil fuel burning and can create acid rain. There are two types of bacteria associated with sulfate: sulfate reducing and sulfate oxidizing. Sulfate reducing bacteria live where there is little or no oxygen (such as deep wells, plumbing systems, water softeners, and water heaters), and they convert sulfate and other sulfur compounds to hydrogen sulfide gas (gives off a rotten egg smell). They are usually found in the hot water plumbing. Sulfur oxidizing bacteria convert sulfide to sulfate, making a dark slime that clogs piping, stains clothes, and blackens water (these are less common than the reducing bacteria).

Concerns

The Environmental Protection Agency set a secondary drinking water regulation maximum limit for sulfate at 250 mg/L (parts per million). This is because dissolved sulfate has a bitter or medicinal taste, it corrodes copper piping, it can cause extreme hardness, a scale can build up on piping, and it can have a laxative effect (30 grains per gallon or more are consumed when combined with calcium and magnesium).

Remedies

Treatment depends upon the form and quantities of sulfate, the amount of iron, manganese, and bacteria, and how much water must be treated. For a small amount of water, distillation and reverse osmosis; and ion exchange for large quantities. The last option is to find an alternative water source such as bottled water, or tapping into the city water system.

For more information please contact
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