

# Iron in Drinking Water

Iron can be a troublesome chemical in water supplies. Making up at least 5 percent of the earth's crust, iron is one of the earth's most plentiful resources. Rainwater as it infiltrates the soil and underlying geologic formations dissolves iron, causing it to seep into aquifers that serve as sources of groundwater for wells. Although present in drinking water, iron is seldom found at concentrations greater than 10 milligrams per liter (mg/L) or 10 parts per million. However, as little as 0.3 mg/l can cause water to turn a reddish brown color.

Iron is mainly present in water in two forms: either the soluble ferrous iron or the insoluble ferric iron. Water containing ferrous iron is clear and colorless because the iron is completely dissolved. When exposed to air in the pressure tank or atmosphere, the water turns cloudy and a reddish brown substance begins to form. This sediment is the oxidized or ferric form of iron that will not dissolve in water.

## Health

Iron is not hazardous to health, but it is considered a secondary or aesthetic contaminant. Essential for good health, iron helps transport oxygen in the blood. Most tap water in the United States supplies approximately 5 percent of the dietary requirement for iron.

## Taste and Food

Dissolved ferrous iron gives water a disagreeable metallic taste. When the iron combines with tea, coffee and other beverages, it produces an inky, black appearance and a harsh, unacceptable taste. Vegetables cooked in water containing excessive iron turn dark and look unappealing.

## Stains and Deposits

Concentrations of iron as low as 0.3 mg/L will leave reddish brown stains on fixtures, tableware and laundry that are very hard to remove. When these deposits break loose from water piping, rusty water will flow through the faucet.

## Iron Bacteria

When iron exists along with certain kinds of bacteria, a smelly biofilm can form. To survive, the bacteria use the iron, leaving behind a reddish brown or yellow slime that can clog plumbing and cause an offensive odor. This slime or sludge is noticeable in the toilet tank when the lid is removed. The organisms occur naturally in shallow soils and groundwater, and they may be introduced into a well or water system when it is constructed or repaired.

## Organic Iron and Tannins

Iron can combine with different naturally-occurring organic acids or tannins. Organic iron occurs when iron combines with an organic acid. Water with this type of iron is usually yellow or brown, but may be colorless. As natural organics produced by vegetation, tannins can stain water a tea color. In coffee or tea, tannins produce a brown color and react with iron to form a black residue.

Organic iron and tannins are more frequently found in shallow wells, or wells under the influence of surface water.

## Test Your Water

If there is an iron problem with the water supply, the first step is to determine the source. The source of iron may be from the corrosion of iron or steel pipes or other components of the plumbing system where the acidity of the water, measured as pH, is below 6.5.

A laboratory analysis of water to determine the extent of the iron problem and possible treatment solutions should begin with tests for iron concentration, iron bacteria, pH, alkalinity, and hardness. A water sample kit can be obtained from a certified laboratory. The laboratory’s instructions for collecting the water sample should be followed. Collect the sample as close to the well as possible.

If the source of water is a public water system and you experience iron-related problems, it is important to contact a utility official to determine whether the red water is from the public system or from the home’s plumbing or piping.

## Well Construction

One alternative in solving an iron problem may be to construct a new water well, eliminating the need for treatment. Depending on local land conditions, it is sometimes possible to extend a “well casing” or “screen” deeper into the groundwater and avoid the water with high iron levels. An Illinois licensed water well contractor, knowledgeable about the quality of groundwater, can be contacted to discuss options.

### Treatment Methods for Various Forms of Iron

Symptoms	Form of Iron	Treatment Methods	Considerations
Tap water is first clear and colorless. After standing, reddish brown particles appear and settle to bottom of glass.	Dissolved ferrous iron	Aeration/Filtration	Temperature dependent
		Water softener	Hardness must be calculated and increased sodium concentration should be checked if users(s) on restricted sodium diet. System must be airtight.
		Chlorination/Filtration	Use of chlorine liquid or pellets. Requires frequent monitoring and proper water pressure. May require lengthy contact time.
		Manganese Greensand/Filtration <sup>1</sup>	Adequate pressure
		Catalytic filtration <sup>2</sup>	Dissolved oxygen, alkalinity, organic matter, chlorination, polyphosphate, and temperature limitations

		Ozonation	Cost
		Sequestering (adding chemical agents to water to keep iron to an insoluble, filterable form)	Method may not prevent staining and may require removal of sequestering agents and iron. Test for agents before choosing another treatment device.
Tap water appears rusty or has a red or yellow color. After standing, particles settle to bottom.	Insoluble red water ferric iron	Manganese Greensand/Filtration <sup>1</sup>	Adequate pressure
		Catalytic filtration <sup>2</sup>	Dissolved oxygen, alkalinity, organic matter, chlorination, polyphosphate, and temperature limitations
		Chlorination/Filtration	Use of chlorine liquid or pellets. Requires frequent monitoring and proper water pressure.
Water tank, toilet tank and plumbing have reddish brown or yellow gelatinous slime or sludge present. Odor may be objectionable.	Iron bacteria	Shock chlorination; consider following with continuous chlorination.	Chlorine products must be suitable for drinking water. Method requires long contact time for adequate treatment.
Water containing organic iron is usually yellow or brown color, but may be colorless. Tannins stain water a tea color.	Organic iron and tannins <sup>3</sup>	Water softener	First, treat for organics (activated carbon). Check for corrosive properties. System must be airtight.
		Manganese Greensand/Filtration <sup>1</sup>	First, treat for organics. Maintain adequate pressure.
		Ozonation	Cost

1. Manganese Greensand: A naturally occurring mineral or manufactured material, treated with potassium permanganate that is capable of removing iron; it absorbs dissolved iron and requires chemical regeneration.
2. Catalytic Filtration: A granular filter medium that enhances the reaction between oxygen and iron and then filters the insoluble iron.
3. Since organic iron and tannins can slow or prevent iron oxidation, water softeners, aeration systems, and iron filters may not work satisfactorily. One option may be chemical oxidation followed by filtration.