



ADVANCED WATER SYSTEMS GROUP

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Frequently Asked Questions (FAQs) About Residential Water Quality

What About Iron (Fe) Contamination in Water?

Red or brown stains often seen on bathroom fixtures and in toilets are very unsightly and difficult to clean up after. Such staining is often accompanied with fine sediment or particulate material that builds up over time. Sometimes the staining is yellow, brown or black as well.

In the Triangle area, especially in homes on wells, particulate material (sediment) and iron can be a major problem. Iron (Fe) in residential water supplies can represent a serious problem to the homeowner. An example of typical iron staining on bathroom tile is shown below. The EPA sets a maximum limit (MCL) for iron at 0.3 mg/L at which point staining, deposits or taste is a problem.



Figure 1. Typical iron staining on bathroom tiles.

Iron exists in two different forms (soluble and insoluble), which both cause staining even though they are treated very differently in residential water supplies.

Soluble iron, often called Fe-II (Fe^{2+}) or ferrous iron, is fully soluble in water. Being soluble, ferrous iron is invisible to the eye and cannot be filtered out. If water has ferrous iron, the homeowner may not even know it until red stains begin to appear in the toilet tanks and other places where water is stagnant for a period of time. This is because ferrous iron has a tendency to oxidize to the insoluble, or ferric state, as it comes in contact with air. Over time, the oxidized iron builds up a sediment layer. Removal of soluble, ferrous iron from water can be accomplished using a properly-designed water softener.

Insoluble iron, called Fe-III (Fe^{3+}) or ferric iron is like common rust (iron oxide) in water supplies, especially in wells, and is present as very fine particulate. Since ferric iron is a solid, it must be filtered out, like any other type of fine sediment or particulate that might be in the water. Because of oxidation, ferric iron commonly forms right inside your home and can be particularly unsightly in bathroom fixtures, on home siding, and elsewhere.

Sometimes oxidized Fe^{3+} iron forms very fine solid particles typically between 0.1 and 0.001 microns in diameter. This ultra-fine iron is often complexed with anions in the solution or organic material. The small size of these particles renders most conventional filters ineffective. Specialized Ultra-filters are effective at removing most of these very fine particulates.

Treatment for Iron and Particulate

In most natural waters, there is a combination of several types of iron. It is critical to know which types of iron are present in order to prescribe the correct treatment. There are three possible cases for Fe in residential water supplies:

Case 1: Ferrous Iron (Fe^{2+}) (dissolved)

If all the iron in the water is soluble, it is considered a "hardness mineral" and a water softener can be used just like with Ca^{2+} and Mg^{2+} . The ion exchange process works equally well for Fe^{2+} , as long as the water softener design is correct. Because iron clings more strongly to the resin, most water softeners cannot handle soluble iron over the long-term and become fouled out.

Single-tank systems that use hard, iron-bearing water for regeneration and cleaning soon suffer from iron fouling of the resin bed and damage to the valve. This happens as the trapped Fe^{2+} oxidizes inside the bed to insoluble Fe^{3+} and settles to the bottom. The Kinetico twin-tank softeners work well for ferrous iron removal because they regenerate using only soft, iron-free water and they also have "counter-current" flow during regeneration, which is more efficient at removing the Fe and the hardness minerals from loaded resin.



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Case 2: Ferric Iron (Fe^{3+}) (particulate)

Normal ferric iron is a type of fine particulate (rust) and often makes the water have color. Filtration is the best way to remove this as well as any other sand, mica, or sediment if present. The **Kinetico Super-Kit** cartridge filters can work well in many cases. But if the levels are high, a better type of filter is known as a backwashing filter, which has the ability to clean itself after reaching a certain level of sediment loading. Backwashing filters, like softeners, have in-service and backwashing cycles. The difference is that the filters use a different media and do not require any salt, only rinse water to wash the accumulated particulate down the drain.

Many times water supplies have a mixture of Ferrous (Fe^{2+}) and Ferric (Fe^{3+}) iron. In this case there are two options for dealing with the mixed iron content. One method calls for oxidation of the water to convert all the ferrous iron to ferric iron, followed by filtration. The oxidation step can be achieved by chemical injection, catalytic media, or by aeration. Once all the iron is in the Fe^{3+} state, it can be filtered.

The second and preferable method is to pass the water through a cartridge or backwashing filter first, followed by a water softener. This way both types of iron are dealt with separately, with the filter catching the ferric iron (and sediment) and the softener trapping the soluble ferrous iron. The added benefit of this method is that the hardness (Ca, Mg) is also removed by the softener, resulting in clean, soft, iron-free water in the home. (see the *FAQ sheet for Hardness*). This can be accomplished with a **Kinetico Combination System** in some cases.

Case 3: Ultra-fine Iron Oxides – Colloidal Iron

During testing, we often find that some fraction of iron oxide is ultra-fine in size and passes through conventional filters and never settles out. This is more common on shallow wells and on some chlorinated water supplies. To remove ultra-fine iron requires an Ultra-filtration (UF) system. The UF systems range from a basic 0.5 micron cartridge filter to specialized large cartridge filters that go down to 0.2 microns to self-cleaning polymeric membrane type systems specially designed to remove ultra-fine particles down to 0.02 microns.

The **Kinetico Mach** series of backwashing filters offer distinct advantages over other types of conventional filtration systems. That is, they are non-electric, twin-tank, on-demand

systems, just like their water softeners. The media inside the backwashing filter is a patented ceramic formulation called *Macrolite*[®]. This media has a high capacity for oxidized iron and other fine particulate down to about 5 microns in size. It is chemically inert and has a fast clean-up time.

The **Kinetico Combination System** is a unique combination filter/softener system that marries the Kinetico state-of-the-art filtration and softening systems into a single piece of equipment. In the **Combination System**, the twin-tank system is actually a four-tank system, with each "tank" being a two-tank stack. In each stack, the upper tank contains the *Macrolite*[®] filtration media and the lower tank holds the ion exchange media. The **Combination System** is a perfect choice for many applications. Because the media beds are smaller in volume than separate backwashing filters and softeners, the capacity of the combination systems is slightly more restricted. The actual water quality dictates whether or not this system is applicable to a given source water.

The **Kinetico Backwashing Filters** boast the following features:

KINETICO BACKWASHING FILTER ADVANTAGES

- Non-electric fully automatic control valve-driven by water flow and pressure. No timers!
- Parallel service flow - increases contact time with media and lengthens media life
- Metered, demand-operated - provides continuous 24/7 supply of clean filtered water
- Countercurrent backwashing flow using only filtered water- increases efficiency, water quality, and the life of the media bed
- Efficient cleaning cycles use less time and less water. Backwashes with filtered water.
- Effective filtration of particles down to 5 microns.

Call Today for a **FREE On-Site Water Test**

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