

I Am Iron, Man

By Mark Unger

Safe and effective treatment for the 'troublesome trio'

I have four children under 10 years old, so as you can imagine, my house is filled with excitement—wrestling, roughhousing and playing sports. One of my favorite activities is to play superheroes with the boys. It has been a blast to see my sons enjoy many of the same superheroes I loved as a boy: Superman, Spiderman, Batman, the Hulk, Wolverine, Captain America and many more. Ultimately, the boys like every hero and the special powers or cool gadgets they use to defeat bad guys, but our household favorite has to be Iron Man.

Tony Stark is Iron Man. He is a wealthy, ingenious engineer who developed a suit of armor that allows him to fly and various weapons to assist in defeating his foes. If you have seen the recent Iron Man movies, you know that he is always working on a new gadget or suit modification and ends up using it before it has been thoroughly tested in his laboratory. This makes for a suspenseful movie, but does not work very well in the residential water treatment industry.

In the world of residential water treatment, the superheroes are the dealers and specialists and the villains they face each day are the contaminants that threaten

homeowners' drinking water. Our heroes cannot afford to try an unproven product or just hope something will work. These heroes need safe and reliable products they can trust to perform and treat their clients' problem water.

Water treatment dealers' greatest foes are aesthetic, taste/odor and nuisance contaminants, which affect many public and private water supplies. These villains torment homeowners and dealers by leaving stains, smells and tastes in the water they contaminate. The most common of these nuisance contaminants is iron, which plagues many homes around the world. Fear not, for this enemy can be easily controlled or defeated once we understand more about it and the special gadgets available for its treatment.

Formidable Foes

Iron is one of the most common naturally occurring elements and it makes up about 5% of the Earth's crust. Therefore, almost all surface water and groundwater supplies contain a measurable amount of iron. It is considered a nuisance above 0.3 mg/L, when reddish brown- or rust-colored staining of laundry and plumbing fixtures occurs. Iron can be present in water supplies in four basic forms:

1. Ferrous (Fe^{2+} , clear-water iron, dissolved iron or soluble iron);
2. Ferric (Fe^{3+} , oxidized iron, iron oxide, insoluble iron, precipitated iron, red-water iron or rust);
3. Organic iron (iron bacteria or chelated iron); or
4. Colloidal iron (dispersed iron).

Iron can be found alone, but usually is present with one or two evil henchmen: manganese and hydrogen sulfide. Together, these contaminants have been dubbed "the troublesome trio." Manganese is an element less commonly found in groundwater, but when it is found, it is usually in combination with iron but in lesser concentrations. Manganese is noticeable at concentrations above 0.05 mg/L, when black staining of laundry and plumbing fixtures occurs.

Hydrogen sulfide is a corrosive and flammable gas often dissolved in well water and accompanied by iron and low pH. Its rotten egg scent can be detected by smell in water with concentrations as low as 0.5 mg/L.

Defeating the troublesome trio depends on many factors, but usually can be accomplished by using aeration or chemical (chlorine, hydrogen peroxide, potassium permanganate, ozone, etc.) oxidation plus filtration. If the situation allows, ion exchange also may be effective in reducing dissolved iron and manganese.

Safe Systems

There are many systems available in the marketplace that claim reduction of iron, manganese and hydrogen sulfide. However, the only way to know for certain that the system is safe for contact with drinking water, will not leak when installed in the home and can reduce one, two or all of these contaminants is to look for a system tested and certified to NSF/ANSI Standard 42 for iron, manganese and/or hydrogen sulfide reduction.

Table 1. Certification Test Parameters

	Iron	Manganese	Hydrogen Sulfide
Influent Challenge (mg/L)	3-5	1-2	0.9-1.1
Maximum Effluent (mg/L)	0.3	0.05	0.05
Sample Points (% of reduction capacity)	Initial, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100 and 110	Initial, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100 and 110	Initial, 20, 40, 60, 80 and 100

Material safety (or extraction) testing ensures that all the materials and components of a system that contact drinking water do not impart harmful contaminants back into the drinking water. Contaminants that extract into the drinking water are evaluated by toxicologists to ensure that they are safe for human consumption.

Structural integrity testing ensures that a system will not leak or fail when subjected to potential in-field pressure events, such as water hammer and pressure surges. Cycle testing simulates a lifetime of water hammer events by cycling pressures from 0 to 150 psi for 100,000 cycles (in most cases). Hydrostatic testing is conducted at three times the system's maximum rated pressure or 300 psi (whichever is greater) and the system must maintain structural integrity for 15 minutes.

Chemical reduction testing for iron, manganese and hydrogen sulfide is conducted on plumbed-in, faucet-mount, pour-through and point-of-entry systems. Products are tested in duplicate (except for point-of-entry systems, which test one product) and have challenge water passed through them at the manufacturer's rated service flow rate. Challenge water is cycled through the systems at either 10% on and 90% off (two minutes flowing, then 18 minutes resting), 50% on and 50% off (10 minutes flowing, then 10 minutes resting), or 100% flowing (point-of-entry systems) for 16 hours, followed by 8 hours of rest (under pressure). The parameters of the iron, manganese and hydrogen sulfide tests are displayed in Table 1.

The Water Quality Assn. (WQA) also allows manufacturers to choose a higher influent concentration for testing, because the NSF/ANSI 42 influent challenge can be too low to be beneficial for many U.S. water supplies. For example, iron testing may be performed at an influent challenge of 10 mg/L, but still be required to reduce iron to below 0.3 mg/L in order to make the iron reduction claim. In this case the product's literature would indicate the higher influent challenge level used for testing.

Systems that utilize regeneration as part of the operating cycle (e.g., a manganese greensand filter with potassium permanganate regeneration) must successfully complete a minimum of three regeneration/operating cycles at or below the standard's requirements in order to be

eligible to make the chemical reduction claim. Systems that utilize backwashing instead of regeneration are required to be backwashed according to the manufacturer's recommended interval at least once at the midpoint of the chemical reduction test.

Be someone's superhero today and

save them from iron or any member of the troublesome trio. With plenty of systems certified to NSF/ANSI 42 for iron, manganese and/or hydrogen sulfide removal, there is no need for anyone to pull a Tony Stark and try to be a hero by using an unproven product. *wqp*

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