AGRI-FACTS
Practical Information for Alberta's Agriculture Industry

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Alternatives for Iron Removal

An iron problem is characterized by the red-brown staining of bathroom fixtures and laundry. In well water, iron usually occurs in its ferrous state.

The water is clear when drawn, but once exposed to air, the iron often changes into a ferric (oxidized) state, especially when the water is heated. The water turns red and forms insoluble "rust" particles. Some iron is bound to organic matter and is harder to remove.

Staining can be caused by as little as 0.3 milligrams per litre (mg/L). Depending on the iron concentration, there are several solutions to this aggravating water problem.

Iron bacteria

Iron staining can be the direct result of an infestation of iron bacteria. Although these bacteria do not present a health hazard, they increase the staining of fixtures, can clog pipes and valves, and can make the water unpalatable. The best control is often accomplished by shock chlorination. More aggressive methods are also available from licensed water well contractors.

Iron problems can be addressed several ways

Shock chlorination is the direct treatment of a well and water system with a 200 mg/L solution of chlorine bleach. This strong chlorine solution is held in the well and water system for at least 8 hours, and up to 48 hours, before being flushed out. Shock chlorination won't solve the problem permanently, but it will usually keep the bacteria in check if done properly. This procedure should be carried out before selecting iron removal equipment.

Shock chlorination in spring and fall is recommended for the continued successful operation of water treatment equipment. See the factsheet *Shock Chlorination and Control of Iron Bacteria*, Agdex 716 (D12).

Air injection

Air injection with filtration uses the oxygen in the air to oxidize the iron in the water. A small venturi-type air injector is installed between the pump and pressure tank to draw the air into the water. The iron can oxidize to form rust particles that are then strained out by a filter.

These filters have worked very well in many homes in Alberta. Some companies selling these units claim iron removal capability up to 30 mg/L of iron. High iron situations often require extra equipment, such as retention tanks, air release valves and air mixing devices. Iron that is bound to organic matter, however, usually does not filter out so easily.

Conditions for use include adequate pump and well capacity for backwash and air injector operation, adequate time for iron to oxidize before passing through the filter and proper adjustment of the air injector. Cold water temperatures, low pH and organically-bound iron can cause problems for air injection iron filters.

Manganese greensand iron filter

The manganese greensand iron filter used to be the most common iron removal device. It can be used successfully for iron concentrations up to approximately 6 mg/L. Iron is oxidized by a coating on the surface of manganese greensand bead media. The greensand must be regenerated periodically with potassium permanganate to replenish the oxidant on the surface of the manganese greensand.

Continued successful operation requires an availability at least 20 L per minute (5 gal/min) flow for proper backwash for a smaller unit, a pH above 7, and regular regeneration. Backwash flow needs to be maintained for a minimum of 10 minutes to an optimum time of 30 to 40 minutes. Failure to regenerate often enough can ruin the filter media.

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Water softener

A water softener will generally remove up to 3 mg/L of iron. The iron must be in the ferrous (clear water) state, or the iron will damage the softener resin. Care must be taken if a softener is used to remove iron because iron tends to clog and foul the softener resin. A resin cleaning compound must be used regularly to protect the resin. The most common resin cleaning compounds contain sodium hydrosulfite or phosphoric acid. Some water softener salt contains a resin cleaner.

Chlorination-filtration

Another system for iron removal is chlorination. Chlorination and filtration can remove high concentrations of iron, iron bacteria and hydrogen sulfide gas that may be produced by the iron bacteria. The iron is oxidized by the chlorine. A sediment filter is used to remove the rust particles, and an activated carbon filter is used to remove excess chlorine. The pH of the water must be above seven.

Aeration, settling and filtration

High levels of iron can be removed from water by spraying the water into a storage cistern. The iron is oxidized by spraying it through the air. Some of the resulting iron particles are settled out in the cistern; the rest are filtered out by re-pumping through a sediment filter. This alternative is particularly useful where the well has a low capacity.

Iron that is bound to organic matter is more difficult to remove with air, and a system with a powerful oxidant is recommended. Treatment equipment that requires regeneration, such as iron filters, water softeners, and chlorination-filtration, needs at least 20 L per minute (4.4 gal/min) flow for proper operation.

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For further information

Agricultural Water Specialists can be contacted through the Alberta Ag-Info Centre by calling toll free: 310-FARM (3276).

Additional information on water quality and water treatment is available on Agriculture and Rural Development's website at www.agriculture.alberta.ca

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