Manganese greensand and its substitute

These media are widely used in iron, manganese removal.

By Kenneth R. Zabel

Manganese greensand is a unique medium used in conjunction with a filtration system to oxidize, precipitate and remove iron, manganese and hydrogen sulfide. It also can be used when arsenic or radium are being removed by the co-precipitation process.

The product now known as manganese greensand was developed in the early 1950s. Its manufacturing process uses the ion exchange properties of its stabilized glauconite (greensand) substrate to form an active manganese oxide coating.

Found in many systems

Since the development of manganese greensand, thousands of systems large and small using this media have been installed throughout North America and Europe.

While it is not suitable for every iron and manganese application, manganese greensand, by design and operation, does possess great flexibility as an oxidizing filter media.

It has been incorporated into nearly all manufacturers' point-of-entry iron filters and has established itself as the one of the most popular technologies for iron and manganese removal from municipal and industrial well waters, as well as other waters containing these substances.

An attractive medium

Manganese greensand has qualities that, in some cases, offer advantages over other iron and manganese removal media:

- It has an optimum grain size and shape to retain oxidation precipitation products of iron and manganese.
- All grains have the same finite uniform coating, which is firmly attached.
- All manganese greensand is processed to exact specifications and tested prior to shipment.
- It has unequalled oxidation-reduction buffer capacity, and can tolerate a slight over- or underfeed of continuously fed oxidants.
- It provides high effluent water quality.
- Manganese oxide coating is not removed during backwashing or during the water-saving, but more physically demanding, air/water washing.
- Manganese greensand is not a proprietary medium of any equipment manufacturer.
- No detention time is normally required.

Demand outstripped supply

The fact that manganese greensand works so well eventually led to demand for it that was greater than production capability, resulting in spot shortages and long lead times. These gaps led to the development and introduction of several alternative media.

One synthetic product, often referred to by the trade name of Greensand Plus, is the only alternate media that is an exact replacement for manganese greensand.

It does not use glauconite as its base. Instead a special-density silica sand is used, and the active manganese oxide coating is thermally fused to this substrate. The result is a substitute product for manganese greensand that matches or exceeds manganese greensand in every operating and performance characteristic.

Using the substitute

In existing installations the substitute product can replace manganese greensand without any alterations to service rates, run lengths, backwash or air/water wash times or rates, or chemical feeds.

In new installations, it may be possible to use the substitute product in applications that manganese greensand could not handle, such as higher temperatures, low dissolved solids or low-silica waters. The substitute product also can be operated beyond the 10 pounds per square inch (psi) differential pressure limit that applies to manganese greensand.

The extended differential pressure limitation provides a large margin of error for system operations. If for some reason (fire or other emergency) it is necessary to operate past a 10 psi differential, crushing a media bed of the greensand substitute is not a concern.

As with nearly all filter media used today, both manganese greensand and its substitute product are ANSI/NSF 61 certified.

Operational Modes:

There are generally considered to be two methods of operation when using manganese greensand or its substitute, the Continuous Regeneration (CR) Process or the Intermittent Regeneration (IR) Process.

The CR process requires a continuous pre-feed of an oxidant, or a combination of oxidants, to the raw water prior to contact with the filter bed. Chlorine in combination with potassium or sodium permanganate have long been the favored oxidizers. However, if a chlorine residual is maintained, it can function as the sole oxidant. CR operation is preferred where iron removal is the main objective of the filter.

Estimation of Chlorine and permanganate dosage:

Mg/l Cl_2 = mg/l Fe

Mg/l $KMnO_4$ = (0.2 x mg/l Fe) + (2 x mg/l Mn)

Estimation of Chlorine only dosage:

Mg/l Cl_2 = (1 x mg/l Fe) + (3 x mg/l Mn)

The IR process is preferred when manganese is the predominant component to be removed. IR is a batch process where oxidation of the manganese occurs directly onto grains of the manganese greensand media. (Iron can also be removed via the IR process however the iron oxides can foul the media and reduce the oxidation capacity of the greensand media.) After treating the specified number of gallons, it will be necessary that the bed be regenerated with either a permanganate or a chlorine solution.

Kenneth R. Zabel is a principal with ZPT International Inc., Destin, FL, a company that provides special media for removal of iron, hydrogen sulfide, scale, trihalomethanes (THMs), arsenic, radium, and uranium from drinking water. He may be contacted at (850) 837-2619 or e-mail: ken@zptinternational.com.