

Iron and manganese removal:

- Iron and Manganese salts are generally found together in well water or anaerobic reservoir waters, in invisible dissolved state.
- When exposed to air, these reduced forms slowly transform to insoluble visible oxidized ferric iron and manganic manganese.
- The reddish tinge in water is due to the presence of iron and brownish tinge due to manganese. When their concentration exceed 0.3mg/l, they become objectionable due to the following reasons:

(i) Cause discolouration of clothes- due to deposition of red/brown colour oxides of iron/manganese.

(ii) Cause incrustation of water pipes- due to deposition of ferric hydroxide and manganese oxide.

Remedy: Periodic flushing of small distribution pipes may be effect in removing accumulation of rust particles.

(iii) Cause unpleasant taste and odour.

(iv) Cause troubles in various manufacturing processes.

(v) Promotes growth of bacteria (Crenothrix) in water mains. Elimination iron bacteria is difficult and expensive.

(vi) Sulphate iron cause acidity and corrosive action on iron and brass.

The iron and manganese may be present in water either in combination with organ matter or without such combination and the treatment differs accordingly:-

1. Iron and Manganese without combination with organic matter.

- They can be easily removed by aeration followed by coagulation, sedimentation and filtration.

Aeration → coagulation → sedimentation → filtration

- The different methods of aeration/ aerators adopted are:

(a) Cascade aerators

(b) Spray nozzles

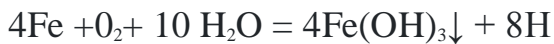
(c) Trickling beds

(d) Diffused aeration

Note: The different types of aerators are discussed in the previous section.

- By aeration, the soluble ferrous and manganese compounds present in water are oxidized into insoluble ferric and manganic compounds, which can be sedimented out easily.
- The precipitated floc can be made to settle down in settling tanks or be further removed in gravity or pressure filters.

The following reaction takes place :

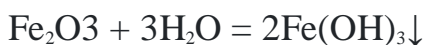
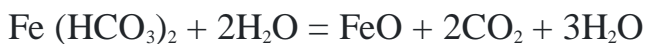


1mg of Fe requires 0.14mg of O₂.

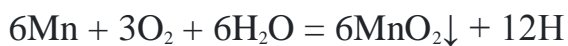
A reaction period of about 5 minutes or less, at a pH of 7 to 7.5, and 0.14mg of oxygen is required to convert 1mg of ferrous iron to ferric hydroxide.

The amount of oxygen required for the oxidation of ferrous iron is only about 0.14 part per part of iron, so that slight agitation with air is sufficient.

When iron is present as ferrous bicarbonate:



In case of manganese,



1 mg of Mn requires 0.29 mg of O₂

Manganese removal requires a pH adjustment upto 9.4 to 9.6.

The oxidation can be accelerated by addition of alkaline substances such as lime, soda ash or caustic soda.

2. Iron and Manganese bound with organic matter:

- It is difficult to break the bond between them to cause their removal.

- The bond is broken by adding lime, and thereby increasing the pH of water to 8.5 to 9 so that iron and manganese can be precipitated; or by adding chlorine or potassium permanganate. Once the bond is broken, they can be removed by the aeration procedure as follow.
- Alternatively, the aerated water is allowed to trickle over contact beds of coke, gravel, crushed pyrolusite, followed by sedimentation and filtration.
- If organic acids are present; aeration, dosage with lime, sedimentation and filtration are effective.

3. Manganese Zeolite:

This method is adopted when water does not contain large amount of iron or dioxide. As raw water passes through the bed of zeolite, the iron and manganese are oxidised to insoluble hydrated oxides that are removed by filtration. After the zeolite becomes exhausted, it is regenerated by backwashing with potassium permanganate.

