IRON ELIMINATION

GE 5

Simple in theory, solving an iron elimination problem must be compulsorily subjected to measurements and on-site testing, otherwise very serious discrepancies may result therefrom.

Iron may be present in water either in solid form (oxides or hydroxides) or in dissolved form.

Eliminating solid iron

Solid iron can be easily eliminated by cartridge or granulous material filtering.

Iron oxides are generally very easily filtered and little clogging.

Filtering bed filters are preferably the dual layer type simply washed by water back-flow.

Hydroxides are very easily filtered but highly clogging.

Eliminating dissolved iron

Dissolved iron can be eliminated by using very different techniques in accordance with the form of iron contained in water:

- **mineral iron** : it then appears as ferrous iron (Fe2+ ions) in low oxygen waters or as ferric iron (Fe3+ ions) in low pH waters.
- **organic iron** : iron atoms are complexed within organic molecules (more especially humic acids).

The purpose of the treatment is to change soluble iron into mineral ferric iron (by oxidising the ferrous iron or the organic fraction), then to precipitate it as hydroxide by setting the pH to a value ranging from 7.2 to 8.2.

Oxidation of organic materials and ferrous iron

Oxidation of the mineral ferrous iron is easily performed by the dissolved oxygen, either by mere exposure to air (it is then possible to concurrently eliminate the CO_2 in excess if applicable) or in a pressurised tank loaded with a granulous contact material (most often volcanic lava) after injection of compressed air.

Oxidation of organic materials combined to iron requires the use of powerful oxidisers such as chlorine, chlorine dioxide and peroxide compounds. The contact duration required for a thorough oxidation of the organic fraction (varying in practice from a few minutes to several tens of minutes) is all the shorter as the oxidising agent used is more powerful and can only be determined in a valuable manner via on-site testing.

Iron removal by filter neutralisation

Calcareous material filtering is used to remove CO_2 in excess and iron from acid waters containing mineral iron in the form of ferric ions (Fe_3+). If required, such a filtering process must be preceded by a transformation of the dissolved iron into ferric iron by oxidation (by injecting air or ozone-loaded air, or by mixing oxidisers such as chlorine, ozone or hydrogen peroxide).

Finally, this technique can be valuably planned only if, after neutralisation on calcareous material, the water displays a pH sufficiently high to allow the ferric iron to appear in insoluble form.

Only on-site tests can make it possible to determine the contact times to be scheduled, both for a good CO_2 neutralisation and for development of the ferric hydroxide "flock".

Catalytic oxidation

Filtering through a porous material loaded with manganese dioxide makes it possible to use the oxidising power of the latter to treat low oxygen waters containing mineral iron in the form of ferrous ions (Fe_2+).

In addition to periodical washes by water back-flow, the material is regenerated by applying a potassium permanganate solution.

Biological iron removal on filter

Recently developed, this technique consists in using a filtering bed filter to cultivate bacteria that are likely to biologically oxidise low oxygen water iron, and periodically removing the excessive biomass by mere water back-flow washing.

The biological iron removal on filter is of course reserved to non chlorinated waters, since the presence of a disinfecting agent would impair the biomass growth.