FILMTEC Membranes

Water Chemistry and Pretreatment: Colloidal and Particulate Fouling Prevention

Oxidation-Filtration

Some well waters, usually brackish waters, are in a reduced state. Typically, such waters contain divalent iron and manganese, sometimes hydrogen sulfide and ammonium, but no oxygen; therefore, they are also called anoxic. Often the oxygen has been used up (e.g., by microbiological processes) because the water is contaminated with biodegradable organic substances, or the water is from a very old aquifer.

One method of handling anoxic waters is to oxidize iron and manganese by air, sodium hypochlorite or potassium permanganate ($KMnO_4$). The hydroxides formed can then be removed by media filtration. Hydrogen sulfide will be oxidized to elemental sulfur that can be removed by media filtration as well.

Oxidation and filtration can be accomplished in one step by using a filter media with the ability to oxidize divalent iron and manganese by electron transfer. Greensand is such a granular medium, which is a green (when dry) mineral glauconite. It can be regenerated with $KMnO_4$ when its oxidizing capability is exhausted. After regeneration, the residual $KMnO_4$ has to be thoroughly rinsed out to avoid oxidation damage of the membranes. This technique is used when <2 mg/L Fe^{2+} is present in the raw water. For higher Fe^{2+} concentrations, $KMnO_4$ can be continuously dosed into the inlet stream of the filter. In this case, however, measures have to be taken to ensure that no permanganate can reach the membranes (e.g., by installation of a carbon filter) - see *Chlorination/Dechlorination (Section 2.6.3)*.

Birm filtration has also been used effectively for Fe^{2+} removal from RO feed water. With birm filtration a pH increase and consequently a shift in the LSI value might occur, so care should be taken to avoid $CaCO_3$ precipitation in the filter and in the RO system.

Instead of media filtration, microfiltration or ultrafiltration (see *Microfiltration/Ultrafiltration, Section 2.5.6*) can be used to remove small iron and manganese hydroxide particles formed from an oxidation process. This is a rather new technology for iron and manganese removal.

The pretreatment of anoxic waters is described in more detail in *Prevention of Iron and Manganese Fouling (Section 2.9)* and *Prevention of Aluminum Fouling (Section 2.10)*.

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FILMTEC™ Membranes
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