

MULTIMAN 3M

CATALYTIC FILTRATION BED FOR REMOVAL OF IRON AND MANGANESE FROM WATER

GENERAL

The presence of iron and manganese, both in potable as well as industrial water in industrial applications, like power or paper making industry, starch or photographic material production is highly undesirable.

While, in surface waters, the concentration of iron and manganese rarely exceeds a few milligrams, it is considerably higher in ground waters where, due to lower availability of oxygen, soluble forms of iron and manganese at their second degree of oxidation predominate: carbonates FeCO_3 and MnCO_3 , bicarbonates $\text{Fe}(\text{HCO}_3)$ and $\text{Mn}(\text{HCO}_3)_2$, hydroxides $\text{Fe}(\text{OH})_2$ and $\text{Mn}(\text{OH})_2$, sulfates FeSO_4 and MnSO_4 , although as organic form can also be present.

The presence of iron and manganese in tap water deteriorates its flavour and it may contribute to health problems, leading to kidney, liver and bone diseases; it further makes pipelines to clog and causes rusty and brown stains on plumbing fixtures.

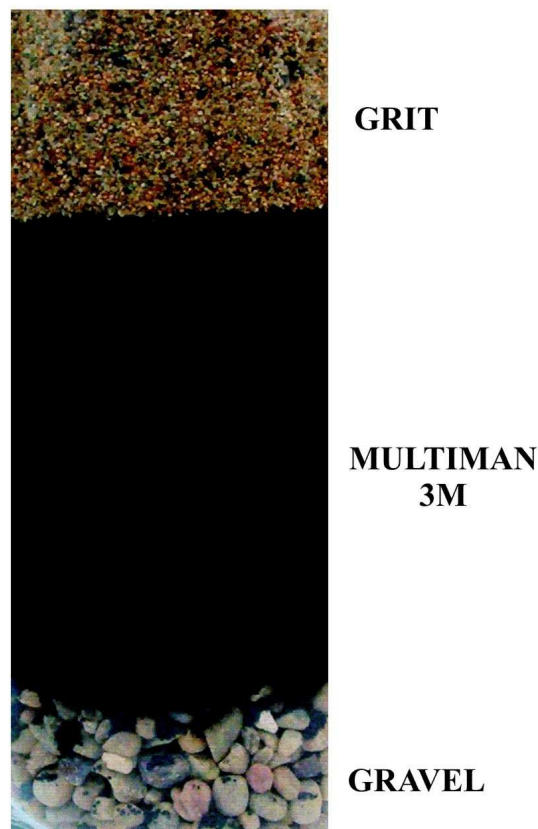


Fig.1. Filter for removal of iron and manganese from water

In general, in the removal process of manganese and iron from water the following processes are involved:

- aerating raw water in order to oxidate the contaminants to bring them to solid form,
- neutralizing pH value; oxidation of manganese in acid water is very difficult and possible by chemical methods only,
- removing of precipitated solids by filtration,
- catalytic oxidation of Mn^{2+} to Mn^{4+} during filtration using catalytic filtration media, like MULTIMAN 3M.

In Poland, the relevant regulation of the Ministry of Health determines the maximum acceptable concentrations of iron and manganese in potable water as $0,2 \text{ mg/dm}^3$ and $0,05 \text{ mg/dm}^3$, respectively.

These criteria can be achieved by water filtration with the use of our manganese removal catalytic bed MULTIMAN 3M. Typical application is shown in Fig. 1.



CATALYTIC REMOVAL OF MANGANESE FROM WATER

The high content of iron, often in its organic form, and prevailing low pH values slow down the process of manganese removal. It is, therefore, beneficial to use oxidation catalysts, like our pyrolusite catalytic medium MULTIMAN 3M, which is a very effective filtration medium consisting mainly of MnO_2 .

Using it in the process of filtration allows for effective removal of manganese, in particular from "difficult-to-treat-waters", at higher filtration speed.

The MULTIMAN 3M bed needs neither initial formation before placing in service nor regeneration with KMnO_4 .

PROPERTIES

Trade name	MULTIMAN 3M
Other customary names	Pyrolusite, catalytic bed, Mn remover
Appearance	 <p>Dark brown to black grains</p>
Physical features of grain	<ul style="list-style-type: none"> – irregular shape – rough surface – sharp edges
Grain size	Standard: $0.8 \div 2.5$ and $1.0 \div 3.0$ mm other granulation on request
Bulk density	2000 kg/m^3 , approx.
Specific weight	$4000 - 4200 \text{ kg/m}^3$
MnO_2 content	min. 82 %
Fe_2O_3 content	max. 5.0 %
SiO_2 content	max. 2.0 %
Al_2O_3 content	max. 5.0 %
CaO content	max. 1.0 %
MgO content	max. 1.0 %
Moisture content	max. 3 %
Packing	 <p>bags 25, 40 and 50 kg packed on pallets</p>



The **MULTIMAN 3M catalytic bed** is a highly effective natural granular filtration material. It is suitable for filtration processes of potable water of high iron and manganese content in both rapid pressure filters and slow gravity filters, open or closed.

Being itself an insoluble catalyst, the **MULTIMAN 3M** accelerates the oxidation of the compounds of manganese raising its oxidation degree, allowing separation of its solid MnO_2 form from the water and sorption by filtration.

The big specific surface of the catalytic bed assures effective removal of turbidity colloids; at the same time, it makes the filter runs longer, thus cutting on costs.

RECOMMENDED OPERATING CONDITIONS

Bed height	min. 30 cm or 30 %*
Filtration speed	7 - 15 m/h *
Backwashing speed:	– aeration $v = 60$ m/h – water flushing $v = 40 - 60$ m/h
Filtration bed expansion	up to 25%
water pH value	not less than 7,0 ($> 7,4$ recommended) **
Fe content (max.)	up to 15 mg/dm^3
Mn content (max.)	up to 1.5 mg/dm^3
Oxygen saturation	8 mg/dm^3

* depending on raw water parameters

** operation with lower pH values may require periodic chemical regeneration with $KMnO_4$.

OPERATING GUIDELINES

The filtration speed and filling height of the bed (filtration bed volume) are determined depending on the raw water quality.

While the bed does not get worn during service, it needs regeneration to remove the deposits from the filter media by aeration and water flushing.

With the bed flushing properly carried out, the MULTIMAN 3M medium does not get mixed with gravel because of the difference in grain size and density.

In a single stage filtration configuration, the MULTIMAN 3M can be used as one of the filtration layers and as such, depending on raw water manganese content and form, it should be 30% up to 80% of the total filter filling height. The remaining part of the filter is typically filled with filtration gravel or anthracite.

In a double stage filtration setup, the MULTIMAN 3M can be used as an independent manganese removal filtration layer in the second stage of filtration.



FILTER FILLING - EXAMPLE

FILLING	VOLUME
Free space	+20%
Filtration gravel	50%
Catalytic bed MULTIMAN 3M	40%
Supporting layer- gravel	5%
Supporting layer - gravel	5%

Fig. 2. Example of filling a single stage filter for removal of iron and manganese

The MULTIMAN 3M filtration medium has hygienic approvals of the National Institute of Hygiene ref. Nos. HK/W/0018/01/2004 and HK/W/0425/06/2006.

Analyses of water treated on objects having filter systems filled with the MULTIMAN 3M catalytic bed have proven its effectiveness in removing iron and manganese compounds from their initial concentrations reaching, respectively, a few and several milligrams per litre down to less than 0.2 mg/dm^3 and 0.05 mg/dm^3 .

MULTIMAN 3M ADVANTAGES

- no need of filtration cake formation before placing in service,
- no need of chemical regeneration,
- no need of adding chemicals to raw water,
- increased filtration speed,
- easy retrofit application in existing filtration systems or stations without adaptation work
- effective where other methods fail,
- extended filtration cycle runs thanks to big specific surface resulting in reduced costs,
- possibility to use in both rapid pressure filters and slow gravity filters, open or closed.
- excellent durability up to 8 years if properly operated and maintained,
- high tolerance to changes in contaminant concentrations in the influent.

WE WILL GLADLY ADVISE YOU ON BOTH FILTRATION MEDIA AND FILTER OPERATING CONDITIONS.