MANGANOX®

The most effective filter media for reducing iron, manganese and hydrogen sulphide.

CHEMSYS

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MANGANOX is a high rate, granular filter media used for removing hydrogen sulphide, iron and manganese compounds from water supplies. MANGANOX operates both as a classical filter working with an oxidant and as a catalytic media due to its ability to accelerate the reaction between the oxidizing agent and any prevalent dissolved oxygen with sulphide, iron and manganese present. Dissolved iron, manganese and hydrogen sulphide will stay in solution unless the equilibrium is changed. Iron and manganese that is not oxidized become catalytically precipitated and then adsorbed directly on the media. MANGANOX is a very dense media that stops oxidized (precipitated) forms of iron, manganese and hydrogen sulphide from passing through the bed. Most of the manganese is removed rapidly in the first few inches of the media where it is further oxidized to manganese dioxide. The adsorbed manganese, iron and precipitated sulphur are expelled during backwash. Any insoluble ferric hydroxide particulate growths are expelled during backwash. The media must be properly backwashed to break loose and remove the filtered contaminants and precipitated iron, manganese and hydrogen sulphide.

Proper system sizing of the control valve and tank are necessary to sustain media performance.

A continuous reaction occurs with the addition of an oxidant, regenerating the media surface and replenishing the MANGANOX. For difficult applications, MANGANOX filters can be enhanced with aeration, chlorination, or ozone. Because of MANGANOX's naturally high manganese dioxide content, it provides a higher adsorption capacity than other media. A MANGANOX filter is recommended before softeners to protect the ion exchange resin from fouling.

ADVANTAGES

- Efficient reduction of manganese, iron and hydrogen sulphide
- Long service life
- Only regular backwashing is required
- Ability to process high flow rates with low pressure drop
- Continuous regeneration
- Ability to be utilized with common oxidants including: CL2 (gas) - Sodium hypochlorite – Potassium Permanganate
- 10 – 30 second reaction time with oxidant additive
- Converts ferrous iron to ferric iron
- Converts H2S to sulphur
- Converts Manganese to MnO2
- No chemical regeneration is required but may reduce service life
- Allows for adequate reaction time to permit for the formation of ferric hydroxide
- Allows for physical straining of the ferric hydroxide flock and sulphur until media requires
- backwashing
- Allows for adsorption of MnO2
- NSF/ANSI Standard 61 - 2002 Certified

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APPLICATIONS

- ◊ **Removal of Iron up to 10 ppm**
- ◊ **Removal of Manganese up to 5 ppm**
- ◊ **Removal of Hydrogen Sulphide (rotten egg smell) up to 3 ppm**
- ◊ **Not recommended for Iron Bacteria and Manganese bacteria removal**
- ◊ **Not recommended for tannin and organics removal**

PHYSICAL PROPERTIES

Color	Black
Purity	>85 %
C.A.S No.	1313-13-9
Physical Form	Granular
Moisture content	<0.5%
Bulk density	125 lbs/ft
Mesh size (mm)	0.85 – 2.36 / 0.425 – 0.85
Uniformity Coefficient	1.77
Specific Gravity	3.8

OPERATING CONDITIONS

PH	6 – 9
Bed depth	36 – 48 inches (900 – 1200 mm)
Service flow rate	5 – 10 gpm / sq ft. (12 – 20 m/h)
Back wash flow rate	22 - 30 gpm / Sq ft (50 - 72 m/h)
Back wash expansion	15 – 30%
Freeboard	70% of bed depth
Oxidant type	Chlorine
Oxidant Form	12.5% Sodium Hypochlorite
Oxidant contact time	10 – 30 seconds
Typical oxidant dosage	0.5 – 2 ppm
Regeneration	Continuous w / oxidant addition
Removal efficiency	95 – 99% for Iron - 99 % for Manganese
Back wash efficiency	Every 24 hours (optimal)

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SHIPPING INFORMATION

Packaging	25 kg bags OR 1 Metric Ton SuperSack
Bags per pallet	(25 kg bags) 40
NPFA Rating	Health: 2 - Flammability: 0 - Reactivity: 1

COMPARATIVE INFORMATION

PRODUCT NAME	ACTIVE INGREDIENT	RELATIVE LIFE EXPECTANCY*
ManganOX	75% - 85% manganese dioxide	7500
Manganese greensand	0.5% manganese dioxide	50
Birm	< 0.01% manganese dioxide	1

*Relative life expectancy using Brim as the measure of comparison

APPLICATION PARAMETERS

WATER TESTING

The first step in the proper installation of a MANGANOX filtration system is to have a reliable knowledge of the subject water's chemistry. Always test the water as accurately as possible before designing a system. *The nature of the water's chemistry will affect how the system is to be designed and operated. MANGANOX by itself is capable of removing the following contaminant levels chemical free:

Iron . . . . . 15.0 ppm

Hydrogen Sulphide . . . . . .7.0 ppm

Manganese . . . . . .3.0 ppm

While MANGANOX is capable of removing higher contaminant levels, such applications should be considered as special cases. Pilot testing and the use of additional treatment such as oxidizing agents, chemical regeneration, or tannin removal media should be considered.

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BACKWASHING

The next important step in ensuring a proper MANGANOX installation is to make sure the media receives a thorough backwashing. A strong backwash is important to break loose the contaminant particles and keep the bed clean so that it can continue to filter the water at peak level. MANGANOX is a rather heavy media, weighing 114+ lbs/cu. ft. A valve capable of lifting the bed at least 20% to 50% at a rate of12 to 15 gpm /sq. ft. @ 60°F during backwash must be used. If the media is not lifted during backwash, the bed will eventually foul and the system will fail. A daily backwash is highly recommended, but not always necessary, depending on the water's chemistry. Because of MANGANOX superior oxidation/ filtration capabilities, it loads up much more quickly than other media. Daily backwashing is recommended to maximize MANGANOX removal capacity. Since MANGANOX has such great particle strength, it is able to withstand the rigors of frequent backwashing and at the same time deliver 20 to 100 times the oxidation/filtration capability of other Manganese – based media.

ADDITIONAL TREATMENTS

The third step is to consider the use of oxidizers, chemical regeneration, and other additional treatments in special cases. When the subject water's contaminant levels exceed the recommended removal limits, MANGANOX will continue to outperform the competition. However, the use of an additional oxidizing agent (e.g. oxygen, chlorine, ozone, hydrogen peroxide, potassium permanganate, etc.) is recommended. Oxidizers will not adversely affect MANGANOX. In fact, they will enhance its performance. They super - oxidize the media, which enables MANGANOX to perform quicker and keep cleaner. As a matter of good measure, it is always a safe practice to install an oxidation method upstream (in front) of the MANGANOX ™ bed to ensure that the oxidation-reduction reaction is 100% complete. Similarly, the use of chemical regeneration, while often not necessary for MANGANOX to operate properly, will not harm the media, and if performed regularly, will extend the life of the media. Tannin removal media, mixed bed resins or carbon polishing filters may also be necessary depending upon the specific water's chemistry. Consult an experienced design engineer with specific application problems and establish a pilot test site. An iron, hydrogen sulphide, and manganese removal installation, regardless of contamination levels, will surely benefit from having MANGANOX properly designed into the system. MANGANOX is clearly the choice for any residential, commercial, and industrial iron, hydrogen sulphide, and manganese removal application. Its superior particle strength, high removal capacities, and ease of installation allow MANGANOX to leave the competition behind in terms of performance and value.

*Testing recommended for soluble iron, heme iron, hydrogen sulphide, manganese, pH, TDS, and Oxygen Reduction Potential (ORP).

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TESTING FOR ORP

Oxidation Reduction Potential (ORP) can be the most important factor to take into consideration in certain waters. Highly reducing waters may cause premature exhaustion or even destruction of the MANGANOX bed. Precautions can be taken prior to installation that can prevent ORP problems. Use one of the screening tests and follow the instructions below if the

THE SIMPLE TEST

Mix 1.75 ounces (50 grams) water with 0.75 ounces (22 grams) of potassium permanganate crystals. Then take 2 drops of the mixture and stir into a fresh 1/4 gallon (1 liter) sample of the subject water. Let the subject water stand for 15 minutes. If the pink colour remains, MANGANOX can be installed without additional oxidants. If the pink colour disappears, additional oxidants will be needed for MANGANOX to function properly.

THE ORP METER TEST

Note: Must use a calibrated ORP meter. Any reading that is above a negative 170 millivolts indicates MANGANOX can be used effectively without additional oxidants. Any reading falling below a negative 170 millivolts indicates that additional oxidants will be required. The amount of oxidant required for proper installation can be determined by measuring the amount of oxidant added to a specific volume of subject water until the solution remains pink or the meter reads at negative 170 millivolts or above. An extrapolation can then be made to determine the correct feed rate for the oxidant with respect to the subject water flow rate. Once installed, sample the solution after the injector and mixer and repeat the above test to confirm that the feed rate is correct. Air, hypochlorite, hydrogen peroxide, ozone, or potassium permanganate are all suitable oxidants. Generally, the weaker oxidants like air and/or hypochlorite will suffice for the majority of applications. The extreme cases will require stronger oxidants. MANGANOX is the best choice where no oxidants or weak oxidants are required. If the subject water can only be treated with the strong oxidant potassium permanganate, manganese greensand may be more appropriate.

APPLICATION CONSIDERATIONS

To help you become familiar with MANGANOX filtration media, listed below are some general specifications and applications considerations:

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pH

MANGANOX media is stable within a range of 5.0 to 9.0 pH. However, keep in mind that the generally acceptable range for drinking water is 6.5 to 8.5 pH. At extreme ranges of pH (both low and high), contaminant removal and bed stability are adversely affected. This should be considered in applications operating at the high and low ends of MANGANOX 5.0 to 9.0 pH range.

OXIDIZERS

The use of oxidizers (e.g. oxygen, chlorine, ozone, hydrogen peroxide, potassium permanganate, etc.) greatly enhances the action of MANGANOX An added benefit of using oxidizers with MANGANOX is the media's ability to remove 70% to 100% of the oxidizers, thereby eliminating the need for additional water treatment equipment.

ORGANIC IRON (HEME, PINK-WATER, ETC.)

This problem can be overcome by the use of potassium permanganate on a continuous basis. Intermittent regeneration with potassium permanganate has been highly successful.

TDS

The maximum acceptable TDS level for drinking water is 500 ppm. MANGANOX media may be successfully applied at levels exceeding 1100 ppm TDS. However, at high TDS levels, highly ionized salts, such as sodium chloride, will require the use of added oxidizers.

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SIZING CHART (7" THRU 18" TANKS)

7 INCH TANK

Backwash cold water (>60°F)	4 gpm
Backwash warm water	6 gpm
7 x 35 Tank	0.4 cu.ft. Media 2.5 gpm service rate
7 x 44 Tank	0.66 cu.ft. Media 4.0 gpm service rate

8 INCH TANK

Backwash cold water (>60°F)	5.25 gpm
Backwash warm water	7.7 gpm
8 x 35 Tank	0.5 cu.ft. Media 3.0 gpm service rate
8 x 40 Tank	0.66 cu.ft. Media 4.0 gpm service rate
8 x 44 Tank	0.75 cu.ft. Media 4.5 gpm service rate

10 INCH TANK

Backwash cold water (>60°F)	8.25 gpm
Backwash warm water	12.1 gpm
10 x 35 Tank	0.9 cu.ft. Media 5.5 gpm service rate
10 x 40 Tank	1.0 cu.ft. Media 6.0 gpm service rate
10 x 44 Tank	1.2 cu.ft. Media 7.0 gpm service rate
10 x 54 Tank	1.4 cu.ft. Media 8.5 gpm service rate

12 INCH TANK

Backwash cold water (>60°F)	9 gpm
Backwash warm water	17.4 gpm
12 x 48 Tank	1.5 cu.ft. Media 9.0 gpm service rate
12 x 52 Tank	1.9 cu.ft. Media 11.5 gpm service rate

13 INCH TANK

Backwash cold water (>60°F)	13.8 gpm
Backwash warm water	20.2 gpm
13 x 54 Tank	2.4 cu.ft. Media 14.5 gpm service rate

14 INCH TANK

Backwash cold water (>60°F)	16.0 gpm
Backwash warm water	23.5 gpm
14 x 47 Tank	2.33 cu.ft. Media 14.0 gpm service rate
14 x 65 Tank	2.66 cu.ft. Media 22.0 gpm service rate

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16 INCH TANK

Backwash cold water (>60°F)	21 gpm
Backwash warm water	30.8 gpm
16 x 28 Tank	1.75 cu.ft. Media 10.5 gpm service rate
16 x 40 Tank	2.6 cu.ft. Media 15.5 gpm service rate
16 x 53 Tank	3.2 cu.ft. Media 19.0 gpm service rate
16 x 65 Tank	4.33 cu.ft. Media 26.0 gpm service

18 INCH TANK

Backwash cold water (>60°F)	26.6 gpm
Backwash warm water	38.9 gpm*
18 x 65 Tank	5.5 cu.ft. Media 33.0 gpm service rate

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TECHNOLOGY ADVANTAGES

- ◊ User-friendly simple pump and treat process.
- ◊ High surface loading rates resulting in small plant foot print and capital cost savings.
- ◊ Modular skid mounted treatment plants for ease of installation and rapid start up for large-scale Municipal applications.
- ◊ Ideal for small flow POE applications for institutional, commercial, residential systems using stock FRP vessels with hub-lateral underdrain.
- ◊ Exceptionally efficient removal of iron and manganese concentrations of up to 10 ppm over a pH range of 6.0-8.0 with removal to less than 0.2 ppm for iron and less than 50 ppb for manganese.
- ◊ Widely utilized to remove arsenic from 100 ppb to less than 5 ppb utilizing the co-precipitation of iron and ferric arsenate.
- ◊ Removes hydrogen sulphide at raw water concentrations of above 2 ppm to non-detect levels.
- ◊ Very low clean bed pressure drop and low terminal pressure drop at breakpoint.
- ◊ Low cost sodium hypochlorite or gaseous chlorine is the only short contact time pre-oxidant required and is injected 30 seconds prior to raw water introduction into the filter. Pre-oxidant dosage is typically a few ppm and sufficient to maintain a treated water residual of 0.5 ppm chlorine. Other pre-oxidants such as potassium permanganate can also be readily used.
- ◊ Single bed of MANGANOX over garnet under bedding – no intermediate medias required.
- ◊ Very high resistant to abrasion, excellent hardness and media life of over 10 years.
- ◊ Short duration high rate backwash protocol can be either in-situ with treated water from on line filters or external supply or raw water.
- ◊ No air scour required.
- ◊ Available in 8 x 20 or 20x40 mesh size for fast adsorption kinetics.

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