

KATALYST-LIGHT PLUS

Advanced Catalytic Filtration Media

General

Katalyst-Light Plus is a brand new catalytic filter media that's produced from 82% of Magnesium Oxide and 15% **Manganese Dioxide**. The granulated form makes it ideal for applications demanding uniformity and less pressure drop. **Katalyst-Light Plus** is very effective at higher differential pressures than any media in the industry. Less pressure drops can provide longer runtime and that means less backwashes and less wastewater that sums up in great savings.

Revolution

Watch® has developed an **INSTANT OXYDES®** to kill microorganisms, bacteria and viruses which cause serious illness and deaths. Stabilized **OXYDES®** ($2H_2O$) should be fed at least 5 - 20 seconds upstream of Katalyst-Light Plus Filter. H_2O_2 generated from mixing **INSTANT OXYDES®** in water will destroy all bacteria and viruses and degrade in seconds on Katalyst-Light Plus catalyst and the filtered water will have **ZERO Disinfection byproducts (DBP)**.

Water with
contaminants
(Fe, Mn, H_2S ,
As, Rn, Ra, U)

Water with
 $Fe^{2+} + Mn^{2+}$

Adding O_2

Precipitated

$Fe(OH)_3$

Water with
 Mn^{2+}
+

$Fe(OH)_3$

Filter retains
 MnO_2
+
 $Fe(OH)_3$

KATALYST-
LIGHT Plus

Drain at backwash

Introduction: Two in one process

It is known having manganese in drinking water means also having iron in water. Removal of iron is much easier compared to difficulties involved in removal of manganese. All conventional manganese coated materials can remove iron but not manganese itself. Removal of manganese is almost impossible without raising the pH.

No media in the market can increase pH other than **Katalyst-Light Plus**. However it is clear that **Katalyst-Light Plus** is the only process and more effective which makes possible to remove both iron and manganese together in one step.

Sources of iron and manganese (basics)

Groundwater with a low redox potential contains soluble **iron** and **manganese** ions.

Oxygen: As this water does not contain much oxygen, some microorganisms reliant on **oxygen** for survival can only exist in this environment by reducing ferric (Fe^{3+}) compounds into the ferrous form (Fe^{2+}). In the same way tetravalent manganese (Mn^{4+}) is reduced to divalent (Mn^{2+}) form.

$\text{Fe}^{2+} + \text{Mn}^{2+}$ in water can form complexes with organic matter (Humus substances). So now you have understood why iron is normally present in its ferric form and bound in the molecular structure of humus compounds. They can be very similar in characteristics with iron, iron bacteria and humus substances in drinking water.

THMs occur when chlorine reacts with organic matter in the water and for this reason it's very important to make water analysis before using Chlorine.

IMPORTANT: THMs are absorbed through skin during shower or bathing. The easiest way to reduce or eliminate THMs in water that's used either for drinking or bathing is to dose stabilizes **OXYDES®** ($2\text{H}_2\text{O}$) before iron, manganese, hydrogen sulfide or any metal removal system. Treated water enriched

Hydrogen Sulfide (H_2S)

Hydrogen sulfide is a big problem in the drinking water due to its offensive odor (rotten eggs), toxicity and potential corrosion factor. Even at very low concentration as low as 4 ppb ($\mu\text{g/l}$) the odor can be detected. Hydrogen sulfide is a strong toxic agent which can cause unconsciousness and even death. Sulfates in the water is transformed into hydrogen sulfide by bacteria.

H_2S Removal: As in the case of manganese and iron they become particulate material in its oxidized form, from soluble non-reduced form. Oxidized iron reacts spontaneously with both MnO_2 and O_2 to form FeOOH (constituent of **FERROLOX®** media). By reaction of Fe^{2+} with H_2S a precipitate of particulate iron sulfide (FeS) is formed which turns the sediment black. Hence if the backwash water is black, hydrogen sulfide removal system is working perfectly.

Purest filtration process ever

A combined process for simultaneous removal of iron and manganese is summarized as follows.

- Addition of oxygen
- No Chlorine
- No KMnO_4
- No Disinfection byproducts

The addition of Oxygen into the water rapidly kills bacteria and viruses, reducing COD and BOD.

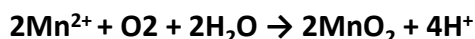
This process also eliminates the hydrogen sulfide completely.

The presence of humus substances, tannin and lignin may also affect the efficiency of filter medias. Chlorine can be used to treat iron and iron bacteria but chlorine added to water containing humus substances will contribute to the formation of trihalomethanes (THM).

...The reaction is as follow:



And when Mn^{2+} is formed, it encounters further oxidation with the oxygen and oxidized to MnO_2 , once again as follow:



pH Correction

$$\text{pH} = -\log_{10}[\text{H}_3\text{O}^+]$$

Driving all the carbon dioxide (CO_2) in water without using chemicals? How about using **Katalyst-Light Plus**. The pH scale is a logarithmic scale. In other words a pH of 6.0 is 10 times more acidic than a pH of 7.0 and a pH of 5.0 is 100 times more acidic than a pH of 7.0. As a water expert you should know and be aware that it is not a difference of ONE when you go from 6.0 to 7.0. **Katalyst-Light Plus** adsorbs CO_2 and no chemicals are needed. Any Manganese coated products available in the market can't increase the pH and HOW should they do it with sand when sand cannot hold the coating of MnO_2 ?

If any oxygen or oxidizer is dosed it destroys the coating but **Katalyst-Light Plus** is made in a unique process, where $\text{MgO} + \text{MnO}_2$ are mixed together and formed into uniform granules. This is a brand new technology and is available since January 2013. The only media in the market with **15% MnO_2** and not coated.

Adsorption of Arsenic, Phosphate and other contaminants:

The adsorption capacity for $\text{Mn}^{2+} + \text{Fe}^{2+}$ is changed only because of the pH of water being $> 7.8 - 8$. As we have changed the chemistry of water the $\text{Mn}^{2+} + \text{Fe}^{2+}$ are now settled on the filter bed in their oxidized form as MnO_2 and FeOOH , which has high adsorption capacity for Arsenic, Phosphates, Chromium, Copper, Radium and other radio-nuclides. Capacity of Adsorption on freshly prepared ferric hydroxide is same as of Granular Ferric Hydroxide. The iron is changed from $\text{Fe}^{2+} + \text{OH}$ (high pH) to FeOOH and works perfect and successfully in the pH range of 7 to 9. Ferric Hydroxide can remove huge amount of arsenic from ground water. It depends on iron concentration of inlet water.

Several arsenic and iron and manganese removal plants with **Katalyst-Light Plus** are successfully operated in Russia, Germany, UK, USA and Canada and other countries in EU. **Katalyst-Light Plus** filters are fixed bed and operate in downward water flow. This technology is not only advanced and economical but also the most effective as far as the efficiency is concerned in removing all these contaminants:

IRON, MANGANESE, HYDROGEN SULPHIDE, ARSENIC, PHOSPHATES, AMMONIUM, RADIUM, URANIUM and other RADIO NUCLIDES,

from ground water. It can be used for Residential, Industrial, Commercial and Municipal applications.



NOTE: Arsenic removal requires iron to be present in water. Research shows fresh oxidized iron content in inlet water shows higher adsorption capacity compared to iron

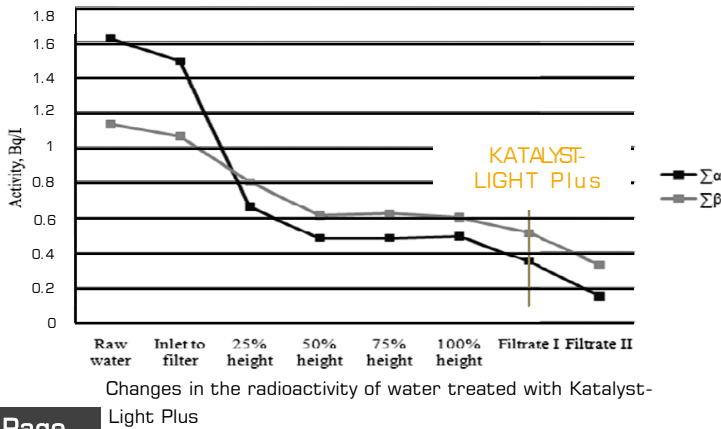
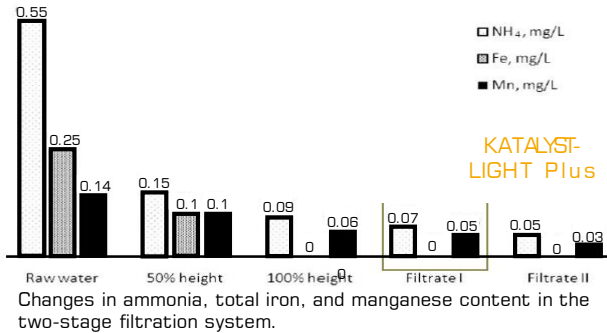
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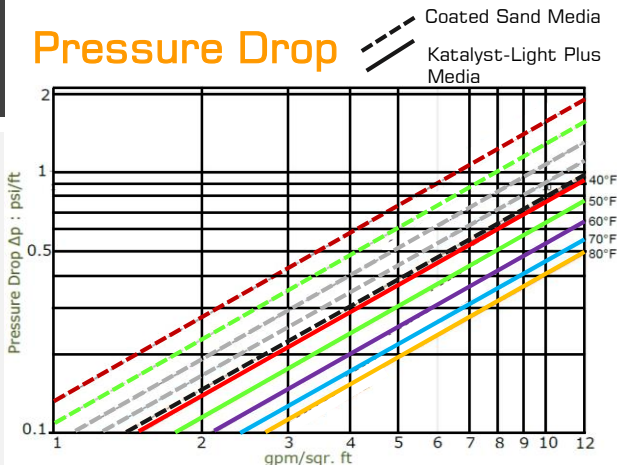
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Case Study



Pressure Drop



Technical Data

Composition of Katalyst-Light Plus

Compounds	Typical value	Specifications
MgO	82%	>80%
MnO ₂	15%	>14.5%
CaO	3%	<4%

Physical Properties:

Appearance	Black uniform beads	
Odor	None	
Mesh size	US	14 x 30
	SI	0.6 -1.4 mm
Uniformity Coefficient	≤ 1.5	
Bulk weight	US	97.4 lb/ft ³
	SI	1.55 -1.56 ton/m ³
Moister Content	<0.5% as shipped	
Removal Capacity	for Fe ²⁺ alone	3000 mg/l 85000 mg/ft ³ (aprx)
	for Mn ²⁺ alone	1500 mg/l 42500 mg/ft ³ (aprx)
	for H ₂ S alone	500 mg/l 14000 mg/ft ³ (aprx)

Recommended System Operating Conditions:

Inlet water pH	6.2 - 8.5	
Freeboard	40%	
Min. Bed Depth	US	31.5 inches
	SI	80 cm
Optimal Bed. Depth	US	47 - 59 inches
	SI	120 - 150 cm
Service flow	US	5 - 9.8 gpm/ ft ²
	SI	10 - 20 m/h
Backwash flow (min.)	US	10 - 12 gpm/ ft ²
	SI	25 - 30 m/h
Backwash flow (minimum)	10 minutes	

Regeneration/Dosing

Continuous regeneration			
H ₂ O ₂	for 1.0 mg/l of	Fe ²⁺	0.9 mg/l
	for 1.0 mg/l of	Mn ²⁺	1.8 mg/l
	for 1.0 mg/l of	H ₂ S	4.5 mg/l
KMnO ₄ /Cl	for 1.0 mg/l of	Fe ²⁺	1.0 mg/l
	for 1.0 mg/l of	Mn ²⁺	2.0 mg/l
	for 1.0 mg/l of	H ₂ S	5.0 mg/l
Intermittent regeneration			
H ₂ O ₂	for each liter of KL Plus media	1.8 - 3.6 g	
	for each ft ³ of KL Plus media	1.8 - 3.6 oz	
KMnO ₄	for each liter of KL Plus media	2 - 4 g	
	for each ft ³ of KL Plus media	2 - 4 oz	