

KATALOX-LIGHT®

ENGINEERED FOR IRON & MANGANESE

Gamma surface • Hydroxide ions • Adsorption • Oxidation • Filtration

MANGANESE REMOVAL: UNDERSTAND THE SURFACE CHEMISTRY

TWO METALS. COMPLEMENTARY REACTION PATHWAYS.

Katalox-Light combines an active manganese-oxide surface with a porous filtration bed. Iron and manganese removal depend on pH, surface reactions, oxidant availability and contact time. The resulting solids are captured and removed by backwashing.

01

THE GAMMA SURFACE AND pH

Watch Water's high-pH brochure describes hydrogen-ion uptake at the negatively charged surface:



Net H^+ uptake can decrease hydrogen-ion activity and raise pH as the surface and water equilibrate. The symbol $\equiv$ identifies a site on the solid.

This describes a possible surface contribution; the overall pH response also depends on the media formulation and water chemistry.

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WHY HYDROXIDE IONS MATTER

At constant temperature, decreasing H^+ activity increases OH^- activity. OH^- is the hydroxide ion. At approximately 25°C:

$$\text{pH } 8: [\text{OH}^-] \approx 10^{-6} \text{ mol/L}$$

$$\text{pH } 9: [\text{OH}^-] \approx 10^{-5} \text{ mol/L}$$

$$\text{pH } 10: [\text{OH}^-] \approx 10^{-4} \text{ mol/L}$$

Each pH-unit increase gives approximately ten times more hydroxide ions in dilute water. This changes precipitation equilibria and surface reactions.

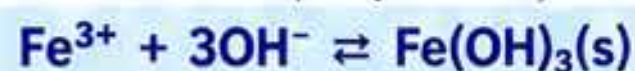
03

IRON: Fe^{2+} TO FILTERABLE SOLIDS

Oxidation converts dissolved ferrous iron to ferric iron:



Ferric iron can then form poorly soluble hydroxide:



$\text{Fe}(\text{OH})_3$ represents hydrated ferric oxide and related precipitates in simplified form. Oxygen or a suitable oxidant supports oxidation. The bed captures the yellow-brown iron solids.

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MANGANESE: THE KEY TECHNICAL FOCUS

Dissolved Mn^{2+} is generally harder to oxidize with oxygen than dissolved iron under comparable near-neutral conditions. This makes pH, catalytic surface sites and sufficient contact time particularly important.

Katalox-Light's active manganese-oxide surface provides sites for Mn^{2+} adsorption and supports catalytic oxidation to solid manganese oxides. Suitable pH helps these processes work together.

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MANGANESE HYDROXIDE AND OXIDATION

If the solubility limit is exceeded, dissolved manganese can form manganese(II) hydroxide:



Under suitable oxidizing conditions, that hydroxide can be converted to manganese dioxide:



These are simplified possible pathways. Actual solids can include manganese oxides and oxyhydroxides. Bulk $\text{Mn}(\text{OH})_2$ precipitation is not a required first step in every catalytic filter: adsorption and oxidation can occur at the surface.

06

HOW HIGHER pH SUPPORTS MANGANESE REMOVAL

Higher pH can increase the availability of negatively charged binding sites through surface deprotonation:



These sites can bind Mn^{2+} . Suitable alkaline conditions also favour manganese oxidation and, where saturation is reached, hydroxide precipitation.

Surface deprotonation is the reverse of H^+ uptake. Their balance depends on operating conditions; proton binding is not an unlimited source of alkalinity.

07

CAPTURE AND BACKWASH

The granular bed retains iron and manganese precipitates. Backwashing expands the bed and carries accumulated solids into the backwash stream. The metals are separated from the treated water, not destroyed. Reliable removal requires appropriate bed depth, flow, contact time and backwash performance.



THE KATALOX-LIGHT TREATMENT PRINCIPLE

- ✓ Condition the water chemistry.
- ✓ Support surface reactions.
- ✓ Convert dissolved iron and manganese into removable forms.
- ✓ Capture the solids. Remove them by backwashing.



DESIGN FOR THE ACTUAL WATER

- ✓ Check pH, alkalinity, dissolved oxygen or selected oxidant, iron and manganese concentrations, competing substances and contact time.
- ✓ Verify dissolved and total iron and manganese after treatment.
- ✓ Hydroxide chemistry supports performance; the complete process determines the result.

GERMAN WATER TECHNOLOGY - SURFACE CHEMISTRY. PRECIPITATION. SEPARATION.

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