



Watch® GmbH
A Water Company

FERROLOX®

granular ferric hydroxide

PHOSPHATE REMOVAL

STOPS EUTROPHICATION!

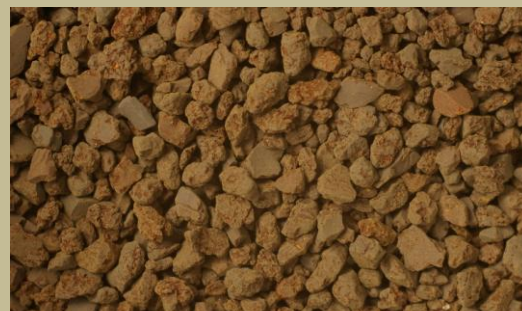
FERROLOX®, a **patented** granular Ferric Hydroxide is the most efficient and cost effective media in phosphate removal from water. pH level and the concentration has strong effect on the adsorption capacity of **IRON HYDROXIDE**. The unique adsorption properties of **FERROLOX®** adsorbent can achieve a residual phosphate concentration of less than 0.05 mg/l as PO₄ (< 20 µg/l as P⁵⁺) which is acceptable by all regulations. It is very important to reuse **FERROLOX®** in order to reduce costs. This is may be one of the biggest advantages to use **FERROLOX®** media instead of Ion-Exchange or Membranes to remove phosphates.

Adsorption of Phosphates From

- **Drinking Water**
- **Membrane Concentrates**
- **Cooling Water blow down**
- **Waste Water Treatment**
- **Municipal Waste Water**
- **Industrial Waste Water**

Also the best adsorbent for

**Aquatic life and Aquariums
for sea and fresh water tanks.**



INTRODUCTION

Phosphates are present in drinking water, ground water and industrial water. Sewage and urban waste water contains up to 10 - 30 mg/l of phosphate which lead to eutrophication. Treated water from **FERROLOX®** contains a lower concentration down to 1 - 5 mg/l. The presence of phosphate ions is a very serious problems for bio-fouling of reverse osmosis (RO) membranes. These ions can readily lead to membrane blockage through the precipitation of calcium phosphate salt. Most of the Anti-Scalants based on phosphates and phosphonates are not very effective in preventing precipitation. Poor anti-scalants cause poor results in RO purification of water or wastewater. Advanced phosphorous removal by **FERROLOX®** can be used as a pre-treatment step 1. for membrane bio-reactors, 2. for the purification of Drinking water and Ground water and 3. for the cleaning of industrial wastewater with **FERROLOX®**.

WATCH FILTRATION TECHNOLOGY

Leading Manufacturer of Filtration Media for Water Treatment

www.watchwater.de

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PHOSPHATE ADSORBENT

SYSTEM DESIGN

WATCH® WATER has succeeded to make most cost-effective design to remove phosphates contaminants from water as well as wastewater. Using **FERROLOX®**, the adsorbed phosphate can be recovered back by regeneration.

Application of **FERROLOX®** makes it unique and cost-effective because of its very high adsorption capacity which remains almost unchanged after several regenerations and recovery cycles. Therefore **FERROLOX®** is the most suitable adsorbent to treat water and wastewater containing phosphates. **FERROLOX®** does not only adsorb phosphate but also allow recovery of phosphates by regeneration.

In order to treat water or wastewater containing phosphates three stages must be considered:

1. The removal stage where phosphate is adsorbed on granules of **FERROLOX®**.
2. Recovery and separation of the adsorbed phosphate by regeneration - to reuse the media and to produce concentrated phosphate.
3. Changing **FERROLOX®** after many cycles of regeneration and disposal.

High Capacity is very much dependant on Adsorbents' volume used in the system, therefore increasing the **FERROLOX®** volume leads to a decrease in residual phosphate concentration and in a weight ratio of removal phosphate to **FERROLOX®** adsorbent.



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PHOSPHATE RECOVERY

pH level dependence of adsorption capacity

Effect of pH level

The number of units running worldwide have shown the **strong effect of pH level on phosphates removal and recovery** by FERROLOX®. For the pH value or level over 9, phosphate removal was not achieved by FERROLOX®. It is known that at this pH level, the surface of the metal-oxides in the solution are covered with hydroxyl groups. Anion adsorption takes place by positive adsorbent surface charges.

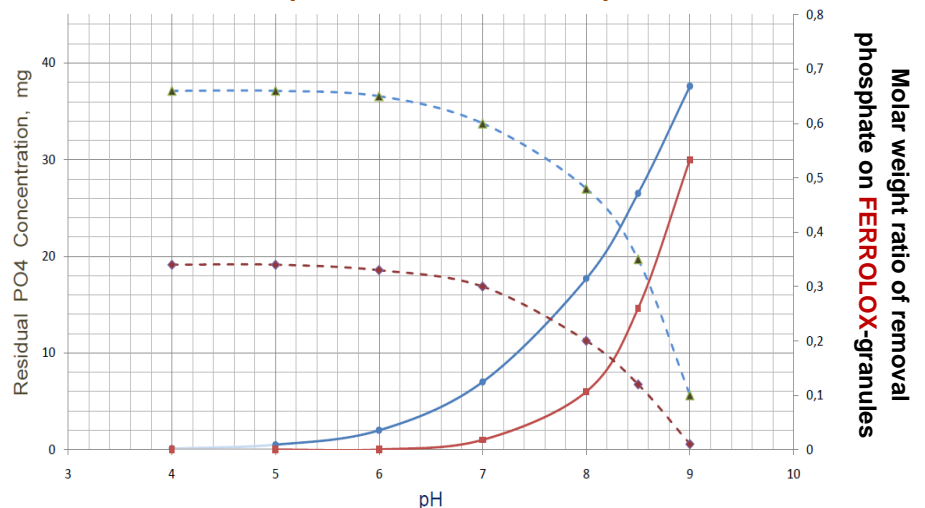
Phosphate Adsorption

The acidic nature of phosphate anions makes the surface charge more negative on the FERROLOX® media. An increase in pH value leads to a decrease in adsorption capacity. The highest adsorption capacity is between pH 6 and 7. pH value over 9 stops the adsorption process and will release all adsorbed phosphate anions. Hence the regeneration is made with 0.1% NaOH solution at pH 13.

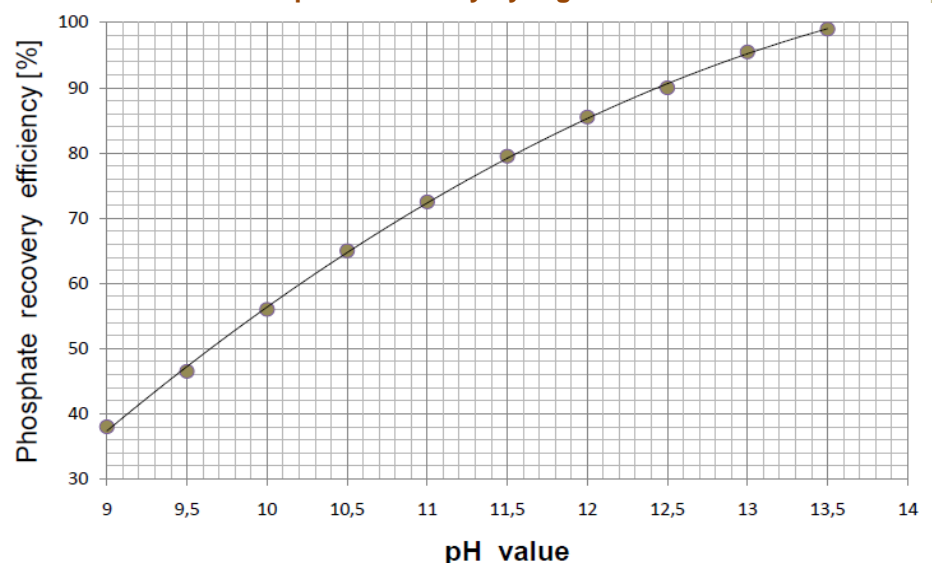
After loading the phosphate on the granulated FERROLOX® adsorbent, they can be washed out by simply soaking the media with 0.1% sodium hydroxide brine for 1 hour at a high pH value. The FERROLOX® media surface is negatively charged and this leads to repulsion between negatively charged FERROLOX® media granules and phosphate anions. The adsorbed phosphate anions are then released in the high pH solution. The pH has to be adjusted between 12.5 - 13.5.

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Phosphate removal based on pH level



Phosphate recovery by regeneration



WATCH® FERROLOX®

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These pH values can recover phosphates up to 90 - 99%. The soak solution along with the concentrated phosphate can be washed out. **FERROLOX®** can be washed later with diluted acid to the level required for reuse. pH of the wash water should be setup between **5.5 - 6.5**.

Adsorption Contact time

Contact time for phosphate adsorption on **FERROLOX®** adsorbent with phosphate concentrations from **1 mg/l** up to **80 mg/l** at the **pH level** of **5** to **6.5** can be achieved within a time **less than 3 minutes**. There is absolute no influence of phosphate concentration in water or wastewater with the given pH level of 5 - 6.5. Using **FERROLOX®** media at these conditions and no additional use of acids or alkalis, saves lots of unit running costs. A high bed volume can lead to high volumes of water treated and increasing phosphate concentration at the outlet of the system. Best results are shown at 20 Bed Volumes.

Physical Data

Operation conditions and loading capacity

Bed depth down flow (mm)	450 - 1500
Freeboard down flow	30 - 50%
Service flow rate	10 - 20 m/h
Adsorption capacity for PO ₄ ³⁻ @ pH 5	26 g/kg
Adsorption capacity for PO ₄ ³⁻ @ pH 6.5	20 g/kg
pH in service	5 - 6.5
Regeneration	Yes (4 to 5 times max.)

NOTE: Listed adsorption capacity is based on selective phosphates.

Material Properties

Chemical formula and composition:
Granulated Fe(OH)₃

Mineralogical composition:
Up to 40% of Ferric Ions from its weight.

Physical Properties:

Bulk weight	640 kg/m ³
Porosity	min. 70%
Humidity	~ 10%
Fe(OH) ₃	min. 75%
Specific surface	270 m ² /gram
Color	Dark brown
Size	0.5 - 1.5 mm x 2.0 - 4.0 mm

To know more about **FERROLOX®** applications please visit our website.

Applications	Web links
General (brochure)	Click here
Arsenic removal	Click here
Copper removal	Click here
Hydrogen Sulfide (GAS) removal	Click here
H ₂ S removal from water	Click here
Chromium removal	Click here
Selenium removal	Click here
Cooling Tower blow down	Click here

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