Introduction

The current technologies for removing ions from acidic chloride and sulphate waste streams is precipitation with high dosage of sodium (Na) or potassium hydroxide. Although successful, there are so many inherent drawbacks to this precipitation techniques.

Magnesium Oxide Beads (MGO) in water ($K_{sp}=1.3 \times 10^{11}$) has limited solubility in water and as a result of the common ion effect, cannot generate a filtrate with a pH greater than 9.

Calcium ($K_{sp}=5.5 \times 10^{6}$) will not coprecipitate as the Mg(OH) + OH. This is an important factor since all acidic chlorides and sulphate feeds to calcium carbonate or sodium carbonate contains significant amount of calcium, sodium and other salts raising the TDS to highest possible range.

Proprietary technology based on MGO + H₂O = Mg(OH) + OH (neutralization) with Mg(OH)₂ produces a more and higher filterable precipitate because neutralization occurs as the Mg(OH)₂ is dissolved by the acid no matter in form of water or gas. This slower solid beads/liquid reaction allows time for Crystal Growth to occur and produces large and easily filterable precipitates. This is a revolution.

On the other hand all older technologies used for neutralization of acidic water with dangerous and hazardous liquids with strong hydroxide yields numerous hydroxide or calcium and sodium ions in water or wastewater instantaneously forming a much larger volume of very tiny crystallinity that result in gelatinous sludge and extreme high pH and TDS.

Magnesium Oxide Beads

AcidTrapp® (MGO) can neutralize at least three times more milliequivalents of H⁺ per unit weight as compared to
A. Calcium carbonate (CaCO₃)
B. Sodium bicarbonate (NaHCO₃)
C. Magnesium carbonate (MgCO₃)
D. Sodium hydroxide (NaOH)
E. Potassium hydroxide (KOH)

and the AcidTrapp® is food grade with 99.9% purity.

MGO beads or AcidTrapp® also offers a safety advantage. It is a weak base, safe and easy to handle.

From a waste minimization perspective, AcidTrapp® offers many advantages.

First:

The AcidTrapp® adds Magnesium in drinking water. (Click Special Magic Filter)

Second:

The AcidTrapp® is added as a solid beads. This step eliminates the dilute water used as hydroxide solutions. Because the particle size of the precipitate is larger, more pollutants are caught in the Crystolite filter resulting in smaller amount of sludge and 100% better neutralization. No backwash is needed in up-flow process with no waste generation.
Neutralization

Watch Water’s proprietary AcidTrapp® is used for **pH correction** treatment that consists in adjusting the **pH** of a water which is acidic.

- Neutralizing various types of effluent before they are discharged into the natural environment: Acidic industrial effluent, acid mine drainage water without using chemicals (e.g. sodium, calcium, or potassium hydroxides).
- Protect distribution pipelines against corrosion (by encouraging the formation of protective pipeline passivation and avoid any scaling).
- The last point alone will be addressed in greater detail because it constitutes one of the major steps in **drinking water treatment**.

### Consumer Health protection

- Eliminating toxic corrosion inhibitors
- Protecting scale, especially caused by Calcite or calcium carbonate
- Eliminating the danger of toxic metals dissolution e.g. lead and copper
- Eliminating the risk of **redwater** at the tap (corroded cast iron or steel pipelines)
- Maintaining network (no leaks) protecting against corrosion that creates leakages and fractures. ([Click Cortrapp](#))
- Toxic gases (hydrogen sulphide) or all other gases at lower pH are more volatile. In other words they come out of the water more aggressively.
- At higher pH all **toxic gases** are neutralized
- At lower pH level chlorine causes higher amount of Disinfection by products (DBPs)
- AcidTrapp® makes **fresh drinking water** which is necessary for all life. Additionally, magnesium is the most valuable source of mineral for health.
Hydrochloric Acid (HCL)  
Sulfuric acid (H2SO4)  
Phosphoric Acid (H3PO4)  
Nitrogen Oxides (NOx)  
Nitric Acid (HNO3)  
Hydrogen sulfide (H2S)  
Carbon dioxide (CO2)  
Sulfur dioxide (SO2)

The Spherical Adsorbent (MGO) function as an inorganic ion exchange medium where Mg++ ion exchanges with a metal ion (M+x) as shown in the following equation.

\[
\text{Mgo (adsorbent)} + \text{H}_2\text{O} \rightarrow \text{Mg(OH)2 (adsorbent)}
\]

\[
\text{Mg(OH)2 (adsorbent)} + \text{M}^{+2} (\text{aq}) \rightarrow \text{M(OH)2 (adsorbent)} + \text{Mg}^{+2} (\text{aq})
\]

In this equation, the metal ion is shown as divalent, but any multivalent Ion can also be adsorbed provided the ions exists as a free cation in water or wastewater.

More on this technology please contact us or go to MetalTrapp

Acids to neutralize with MGO
- Hydrochloric Acid (HCL)  
- Sulfuric acid (H2SO4)  
- Phosphoric Acid (H3PO4)  
- Nitrogen Oxides (NOx)  
- Nitric Acid (HNO3)  
- Hydrogen sulfide (H2S)  
- Carbon dioxide (CO2)  
- Sulfur dioxide (SO2)

Chemicals Used for pH Adjustment
The most commonly used neutralization chemical for acid is
- 50% sodium hydroxide (NaOH)

In any case, this is not a good choice. To neutralize an Acid or Base a source of hydroxide ions (OH-) or hydrogen ions (H+) are required respectively. An acid must be neutralized with a base, which by definition is characterized by an excess of OH- ions. Likewise, a base must be neutralized with an acid, which by definition is characterized by an excess of H+ ions.

\[
\text{OH}^- + \text{H}^+ = \text{H}_2\text{O (pH 7)}
\]

The most suitable product for acid neutralization must consider:
- Health and Safety  
- Cost and Convenience

Only one product is safe i.e.
Spherical Magnesium Oxide Beads  
Also known as Trappsorb and following

AcidTrapp® (Magnesium Oxide)
This unique media is most effective in neutralizing acids and has been invented by Watch Water® Germany and distributed by Watch Water® Branches. As with calcite, AcidTrapp® is also much easier to use. This means that in a poorly designed system AcidTrapp® (MGO) will not raise pH above a pH of 9.0 and is very safe to use. Additionally, with its purity, it is non-toxic and certified to NSF/ANSI/CAN 60 - 2018 drinking water standards.

"Lower pH increases the risk of mobilized toxic metals absorption"

Causes of Low pH in water
- Several organic matters in the carbon dioxide (CO2) is released when they decompose, and it forms the carbonic acid (H2CO3) as it combines with water CO2 + H2O = H2CO3. As H2CO3 is an acid and it lowers the pH of water.
- Chemicals in the water released by industries or individuals. Industrial effluents that are released in the environment, are required to have a neutralization system.
Causes of Low pH in water

- Acid precipitation, acid rain occurs when carbon dioxide (CO₂), Nitrogen oxide (NOₓ) and Sulphur dioxide (SO₂) in the air are combined with water vapor. They are the products of car fumes and emissions from coal-fired plants.
- High chlorine levels also decreases the pH of drinking water, making it more acidic. The more acidic the water, the higher the corrosion level. MGO beads destroy chlorine and corrosion both.
- When chlorine (Cl₂) is added to the water (H₂O), it hydrolyses rapidly to produce hypochlorous acid (HOCl) and the hypochlorous acid will then dissociate into hypochlorite ions (OCl⁻) and hydrogen ions (H⁺). Because hydrogen ions are produced, the water will become more acidic. (The pH of the water will decrease) and the water is not safe for drinking.

Advantages of MGO Beads

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Watch Water MGO Beads</th>
<th>Calcite(CaCO₃)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides Magnesium as a micro-nutrient</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Does not Cause Scaling Problems</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Long lasting (buffered)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Alkalinity &amp; pH control</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Long lasting corrosion control</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Heavy Metal Precipitation</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Radionuclides Precipitation</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Easy and safe to handle</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Non-Hazardous &amp; Non-Corrosive</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Environmentally non-toxic</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Very safe for the environment</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Physical Properties

- **Appearance**: Off-white
- **Bulk density**: 1.300 kg/m³
- **Mesh Size**: 2 – 5 mm
- **Packaging Standard**: 28.3 liter/bag
  - Big Bags available on Request
- **Service velocity**: 10 m/h
- **Backwash velocity**: 28-30 m/h (for down-flow)
- **Certification**: NSF/ANSI 60

Conditions for Operations

- Use distributors designed for filtration to avoid pressure drop. We recommend 0.5 mm slot.
- A gravel support bed is recommended.
- Water pH range 4 to 6.5.
  - Minimum 60 cm (24 inches)
  - Maximum 80 cm (30 inches)
- Freeboard 40% (Down-flow)
  - Backwash frequently to prevent pressure drop.
- Freeboard 20% (Up-flow)
  - No Backwash
**Systems Information**

**AcidTrapp Downflow Automatic System**
- Freeboard 40%
- Bed Depth: 65-100 cm
- Service velocity: 25 m/h
- Backwash velocity: 28 m/h
- Gravel approximate 5% tank volume

**AcidTrapp Upflow System**
- Freeboard: 20%
- Bed Depth range: 83-124 cm
- Service velocity: 25 m/h
- No backwash
- Pressure: 3-6 bar
- Gravel approximate 5% tank volume

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**Table: Pressure Vessel**

<table>
<thead>
<tr>
<th>Pressure Vessel</th>
<th>AcidTrapp Media</th>
<th>Service Flowrate</th>
<th>Backwash</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>m³/h [gpm]</td>
<td>m³/h [gpm]</td>
</tr>
<tr>
<td>1/4x44</td>
<td>48</td>
<td>55</td>
<td>65.19</td>
</tr>
<tr>
<td>1/4x54</td>
<td>103</td>
<td>55</td>
<td>76.57</td>
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<tr>
<td>1/4x64</td>
<td>178</td>
<td>55</td>
<td>81.57</td>
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<td>1/4x75</td>
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<tr>
<td>1/2x40</td>
<td>309</td>
<td>55</td>
<td>83.84</td>
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<td>1/2x60</td>
<td>426</td>
<td>55</td>
<td>90.24</td>
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<tr>
<td>1/4x72</td>
<td>712</td>
<td>55</td>
<td>95.57</td>
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<tr>
<td>1/2x72</td>
<td>1072</td>
<td>55</td>
<td>100.05</td>
</tr>
</tbody>
</table>

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**Attention**: Not for human consumption. Keep away from children’s reach.

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