Passivation Technology

CORRTRAPP products are non-hazardous, environmental-friendly, safe and cost-effective treatment options for Alkalinity addition and pH adjustment without using phosphates for drinking water treatment pipes and equipment. Environmental regulations have become increasingly severe regarding the types and amount of pollutants that may be released into the environment. In particular, phosphates are commonly restricted. Often phosphates dosing is not completely successful in reducing metal corrosion in the drinking water pipes and equipment (like heaters). The adsorbent used to avoid corrosion is a Novel Magnesium based adsorbent from Watch Water® Mannheim, that has been used to avoid any corrosion and simultaneously neutralizing acidic components from water to stop all corrosion process.

**Mechanism**

\[ \text{Mg(OH)}_2 + M^* \xleftrightarrow{} \text{M(OH)}_2 + \text{Mg}^{2+} \]

M* is shown as Metal Surface include Lead, Copper, Nickel, Iron and Zinc.

**Factors Influencing Corrosion**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>• Low pH increase Corrosion.</td>
</tr>
<tr>
<td></td>
<td>• High pH protects Corrosion.</td>
</tr>
<tr>
<td>Chloride and Sulfate</td>
<td>High levels increases Corrosion in Iron, Lead and Copper pipes.</td>
</tr>
<tr>
<td>Water Softners</td>
<td>High sodium levels increases metal corrosion</td>
</tr>
<tr>
<td>TDS</td>
<td>High conductivity increases corrosion</td>
</tr>
<tr>
<td>Alkalinity</td>
<td>Only high alkalinity controls pH and help to form protective coating and passivation</td>
</tr>
</tbody>
</table>

**Oxidation**

- Fe $\xrightarrow{}$ Fe$^{2+}$ + 2e$^-$
- Pb $\xrightarrow{}$ Pb$^{2+}$ + 2e$^-$
- Cu $\xrightarrow{}$ Cu$^{2+}$ + 2e$^-$

**Reduction**

- 2H$_2$O + 2e$^-$ $\xrightarrow{}$ H$_2$ + 2OH$^-$

**Passivation**

- 2MgO + 2e$^-$ $\xrightarrow{}$ Mg + 2OH$^-$

**PIGE WALL**

- Fe$^{2+}$ + 2H$_2$O $\xleftrightarrow{}$ Fe(OH)$_2$ + 2H$^+$

Electrolyte (WATER)

- 2H$^+$ + 2e$^-$ $\xrightarrow{}$ H$_2$
- Fe$^0$ $\xrightarrow{}$ Fe$^{2+}$ + 2e$^-$

Cathode Anode

www.watchwater.de
**CORROSION STABILIZATION**

Never use Phosphates
Phosphates increases
1. Bacterial Growth
2. Legionellae Water
3. Forms calcium phosphate scale

Calcium Phosphate passivation rarely adheres to Lead and Copper Pipe walls and are not considered as an effective form of corrosion control.

**PIECE CORROSION**

Iron, Lead, Zinc and Copper corrosion are one of the most complicated and costly problems facing drinking water utilities. A large number of parameters affect pipe corrosion, including water quality and composition, flow conditions, biological activity and cheap corrosion inhibitors. CORRTRAPP synthesizes nearly 100 years of corrosion studies and now available to water treatment industry. Watch Water® estimates that it will cost worldwide Municipalities and utilities $850 billions over the next 20 years to update and passivate water distributions systems. The majority of distribution system pipes are composed of Lead, Copper, Iron and Zinc pipes.

**pH Control Cost**

CORRTRAPP offers unparalleled pH control. The buffering characteristic of

\[
\text{MgO} + \text{H}_2\text{O} \leftrightarrow \text{Mg(OH)}_2
\]

does not raise drinking water pH above 9.5 - the upper control limit mandated by German TVO-Drinking Water Regulation. This eliminates the cost of the Phosphates and Sodium Hydroxide required to reach this pH to keep high buffering capacity and corrosion control.

**BENEFITS**

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Corrtrapp</th>
<th>Phosphates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does not Cause Scaling Problems</td>
<td>✔</td>
<td>❌</td>
</tr>
<tr>
<td>Supplies more MgOH alkalinity</td>
<td>✔</td>
<td>❌</td>
</tr>
<tr>
<td>Long lasting</td>
<td>✔</td>
<td>❌</td>
</tr>
<tr>
<td>Alkalinity/Passivation</td>
<td>✔</td>
<td>❌</td>
</tr>
<tr>
<td>pH Control</td>
<td>✔</td>
<td>❌</td>
</tr>
<tr>
<td>Provides Healthy Magnesium</td>
<td>✔</td>
<td>❌</td>
</tr>
<tr>
<td>Safe for the environment</td>
<td>✔</td>
<td>❌</td>
</tr>
<tr>
<td>Non-Toxic for the environment</td>
<td>✔</td>
<td>❌</td>
</tr>
<tr>
<td>No Need to Use NaOH</td>
<td>✔</td>
<td>Danger</td>
</tr>
</tbody>
</table>

**Applications**

- Municipal Water Processing
- POU and POE
- All Healthy System’s
- All Boilers (Hot Water Systems)
- Cooling Water System’s
- Refinery Unit & Lubricants
- Gas Pipelines
- Oil & Gas production
- Food & Beverage Industry
- Acid Mine Industries
- Paint and Pigments
- Aggressive and Acidified Well’s

www.watchwater.de
Phosphates free up-flow corrosion inhibitor – Eliminate corrosion of metallic pipes Lead, Copper, Iron and Zinc by adding Alkalinity into the water

- Raising pH.
- Neutralizing all acids like CO$_2$ and Hydrogen Sulfide.
- Adding Magnesium to make the water taste Great, Healthy and eliminate bottle water use.
- Multiple CORTRAPP Towers can be used for maximum flows.
- Up-flow design doesn’t require water for back washing.
- Up-flow design doesn’t require electric Valves.

- As the corrosion and passivation media dissolves into the water increase (raises Alkalinity) buffer capacity, it will need to replenished from time to time.
- Using Fiberglass pressure vessels is more suitable as they do not Rust and Corrode.
- Top Mount tanks sizes 10” up to 21” and top opening 2.5” or 4”.
- Flange Tanks are 6” top and 6” bottom opening with 0.5mm star distributors. Tank sizes 16” inch diameter up to 63” diameter can be ordered from Watch Water® Mannheim.
Anodic part of CORRTRAPP (Called corrosion and Passivation inhibitor) act by Reducing anodic reaction, that blocks the Anode Reaction and supports the natural reaction of passivation metal surface also due to the forming of film adsorbed on the metal. The inhibitor reacts with the corrosion product, initially formed, resulting in a cohesive and insoluble film on the metal surface.

The anodic inhibitor reacts with the metallic ions Meo+ produced on the anode, forming insoluble hydroxides (OH-) which are deposited on the metal surface as insoluble film and impermeable to metallic ion. From the Hydrolysis of CORRTRAPP results in OH- ions Figure above shows how is the mechanism of the CORRTRAPP and the anodic inhibitory effect. When the concentration of hydroxides (Anodic inhibitor) becomes high enough, the cathodic current density at the primary Passivation potential becomes higher than the critical Anodic current density, that shift the potential for the noble sense and consequently the metal is passivated.

For the anodic inhibitor effect, it is very important that the pH concentration should be high enough in the solution. The inappropriate amount of the inhibitor affects for the formation of film protection, because it will not cover the metal completely, leaving sites of metal exposed and thus causing a localized corrosion.

Concentrations below pH-8, these values are worse than without CORRTRAPP at all. pH value less than 8 can cause pitting, due Reduction at the Anodic area relative to Cathodic or can accelerate corrosion, like generalized corrosion, due to full break down the passivity.

Some Toxic Anodic Inorganic inhibitors are Molybdates, Chromates, Phosphates and Phosphonates. These inhibitors should not be used in drinking water systems.

Cathodic Inhibitor

Magnesium is a cathodic inhibitor in CORRTRAPP technology. It reacts with Hydroxyl (OH-) of the water forming the insoluble hydroxides as Mg(OH)2 which is deposited on the Cathodic site of the metal surfaces and protect them from corrosion. Polyphosphates, Phosphonates, Tannins, Lignin’s and calcium inhibitors cannot undergo the same mechanism like CORRTRAPP.

CORRTRAPP minimize the release of Hydrogen ions and change its structure to Hydroxide ions and stops over voltage. CORRTRAPP contain oxygen when adsorbed on the metallic surface blocking the active corrosion. The most effective and efficient inhibitors are compounds that have Magnesium Ions. CORRTRAPP is the only inhibitor without any Biological toxicity or environmental harmful characteristics. Toxic inhibitors are Amines, Benzotriazole, Tolyltriazole, Aldehydes and also Ascorbic acid. These mentioned inhibitors should never be used Drinking Water Systems.

Best Corrosion Inhibitor

CORRTRAPP is a great method of Preventing Corrosion and are easy to apply through CORRTRAPP towers and has wide range of applications in different water treatment sector. All facilities around the world has a choice to prevent pipes, heating systems, Cooling towers to use CORRTRAPP with its high efficiency, avoids damages and have healthy water. The search for environmental friendly corrosion inhibitor is now CORRTRAPP which has shown excellent results, outperforming conventional inhibitors.

NOTE: Maintenance of system during stagnant period of time, backwash is recommended at least once a week.