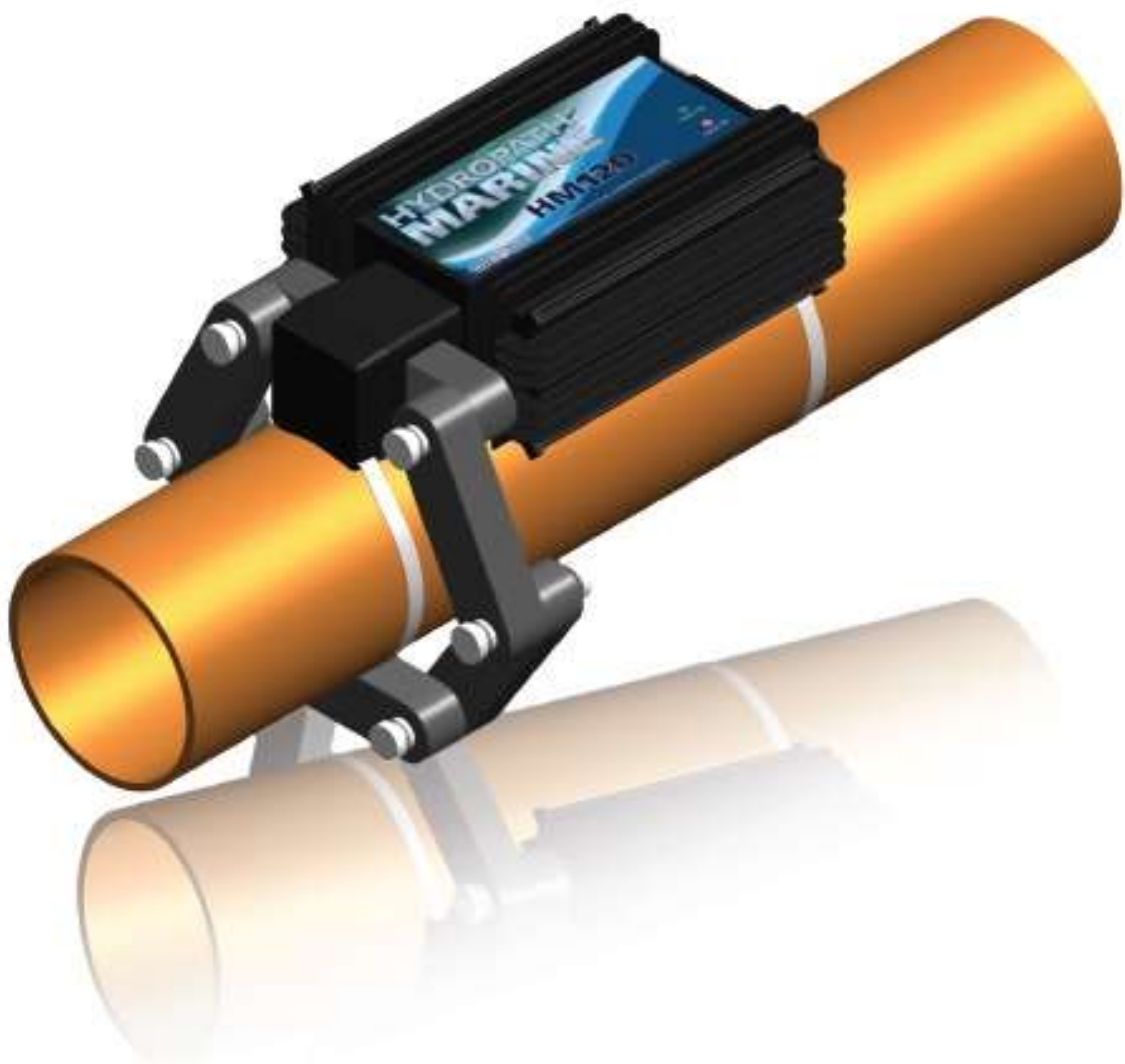




**HYDROPATH  
MARINE**

Unique Patented Electronic Water Treatment

# TECHNOLOGY GUIDE



## Introduction

HydroPath Marine Ltd. was established to introduce the shipping industry with an advanced and long established water treatment technology by HydroPath Holdings Ltd, which presently provides worldwide, land based industries, for the last three decades, with water treatment solutions. HydroPath Marine Ltd, offers to the shipping industry very low maintenance costs and environmentally friendly solutions for water treatment on board, in comparison with the existing solutions, which are essentially based on chemical treatment and at times involve intensive labor and man hours for cleaning.



As an alternative, applying HydroPath Marine Ltd systems, designed for purpose, will protect your vessel from lime scale accumulation and bio-fouling, saving the ship owner substantial costs for chemicals and labor, whilst protecting the crew members from exposure to noxious chemicals, let alone the fact that it will hinder the penetration of pungent materials into the marine environment.

### **HydroPath Marine solutions for:**

- Limescale treatment
- Bacteria elimination
- Filtration enhancement
- Corrosion reduction

### **The Benefits of HydroPath Marine Technology:**

- Prevention of Limescale
- Increased cooling efficiency
- Lower maintenance costs
- Elimination of bacteria and algae
- Prevention of biofouling
- No biocides required
- Enhancement of filtration by flocculation

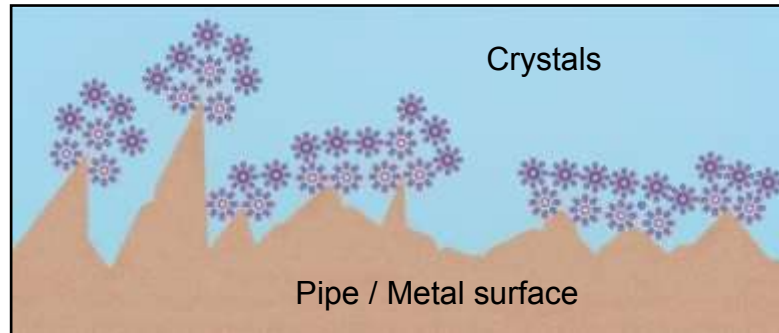


## Limescale

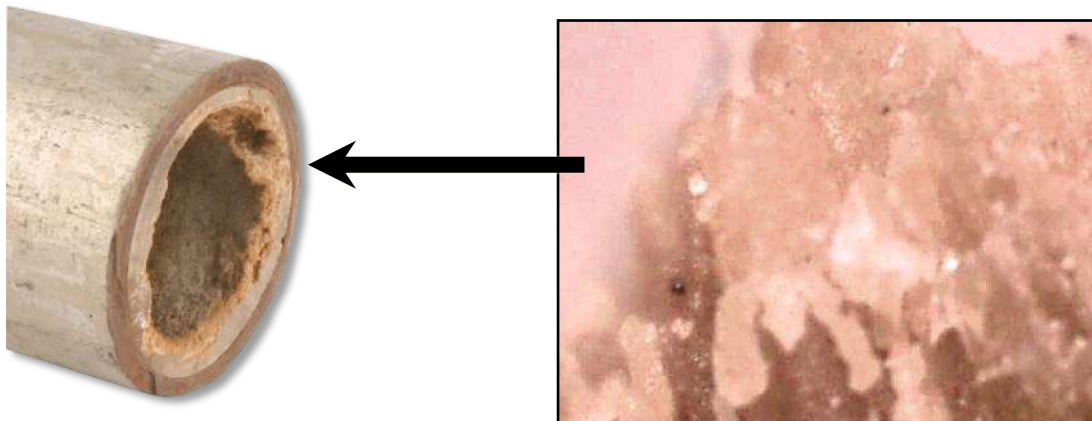


- Reduces heater efficiency
- Reduces water flow
- Causes blockages, leaks and damage
- Requires the use of expensive chemicals





Calcium and Magnesium salts dissolved in water, form a hard mass of crystals on the rough surfaces of equipment and pipes.



Crystals at 200 times magnification

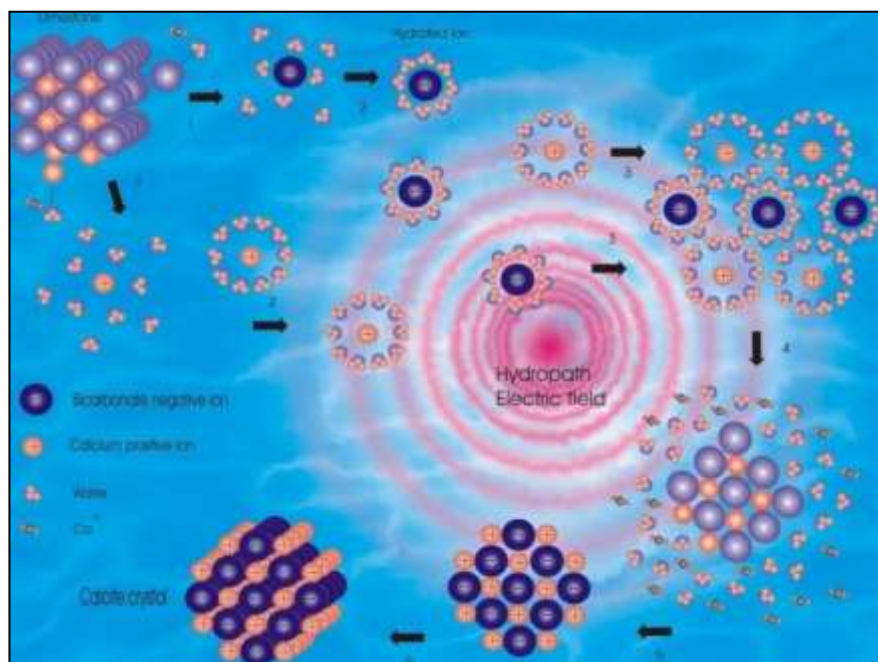


## When does Scale Form?

- Calcium and bicarbonate dissolved in water
- Water becomes super-saturated when Temperature increases or pressure decreases
- Ions precipitate as calcium carbonate: limescale

## Prevention of Scale

HydroPath Marine induces an electric field so scale does not form on the pipe. Instead, scale forms in the water and is washed away



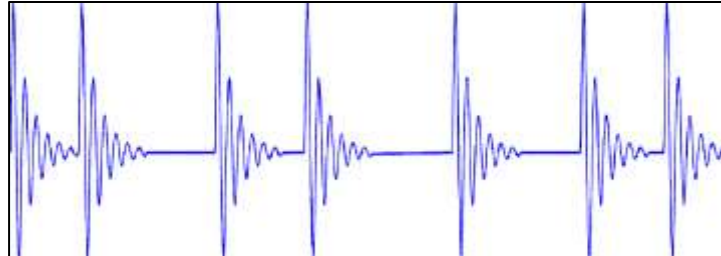
## HydroPath Marine Technology: Electric

### Electric field induced along length of pipe

- Stronger effect than magnetic field
- AC – back and forth motion
- Present all through plumbing system
- Independent of flow

### The HydroPath Marine signal

- The HydroPath Marine signal is a decaying sine oscillation, Around 150 kHz
- Pulse separation time varies to work in a range of situations
- Extremely low power (Less than 65W)

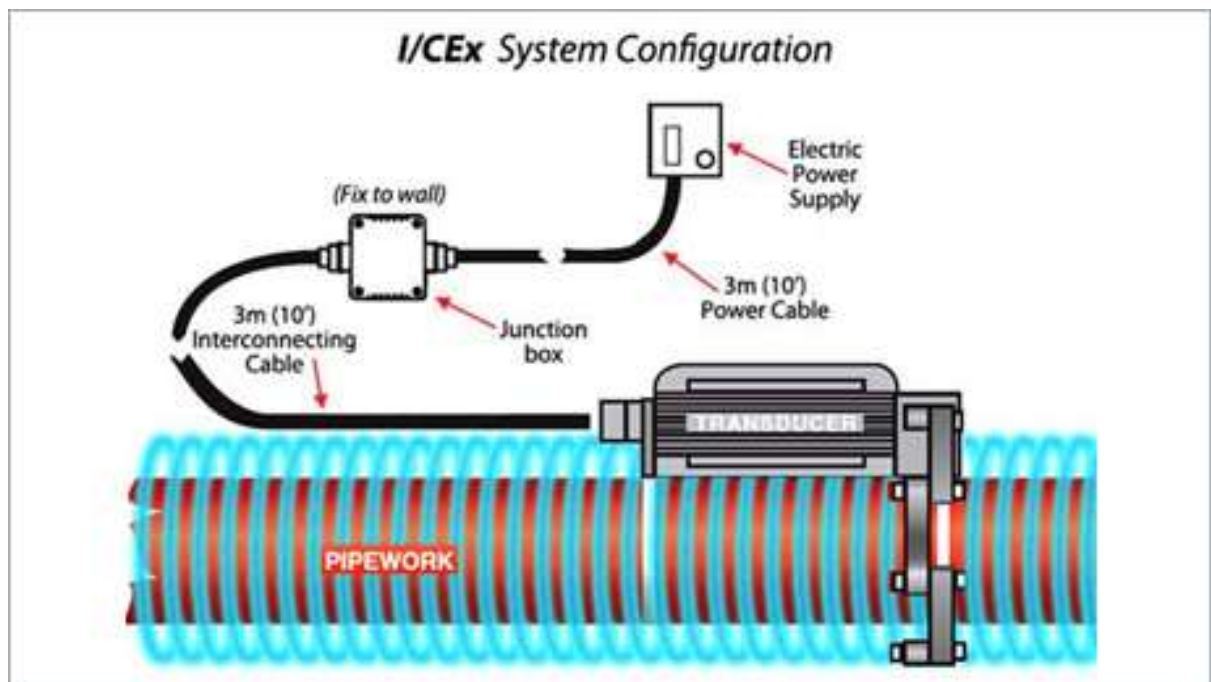


## The HydroPath Marine signal

### How do we get a signal into the pipe?

- AC current in primary circuit
- Magnetic field through ferrite
- AC current in secondary circuit
- Make secondary single loop
- Make loop bigger...

The HydroPath Marine electric field is induced into the water. The signal travels all through the plumbing system and does not depend on water flow.

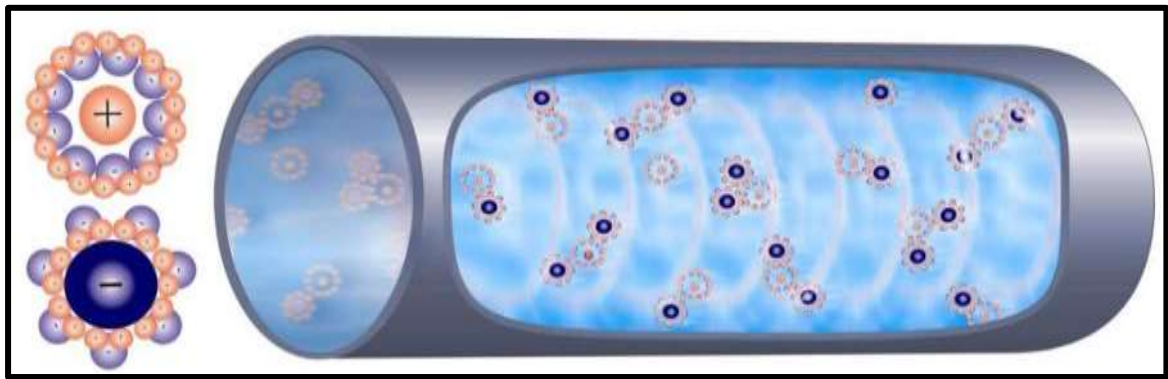




## Calcite Cluster Formation

The HydroPath Marine signal encourages the ions to form clusters. These clusters then become seed crystals.

Crystals much prefer to form on existing crystals, so further crystallisation occurs on these seeds.

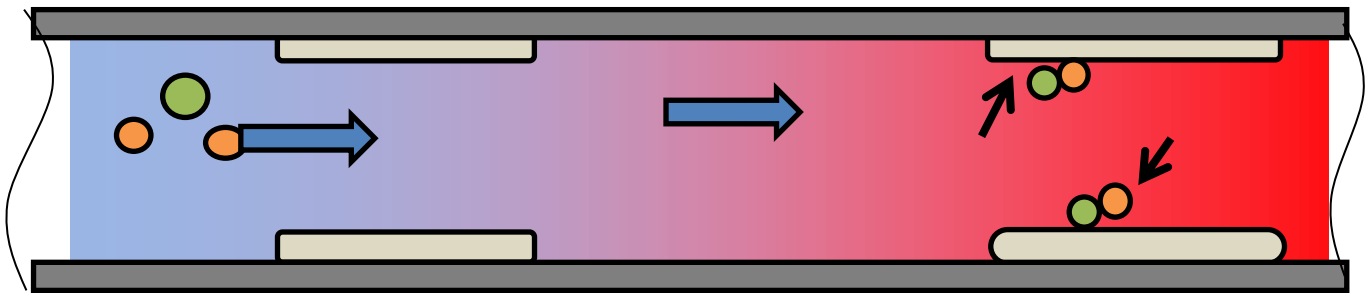


Crystals need a start point to form (a nucleation site), and prefer to form on existing crystals.

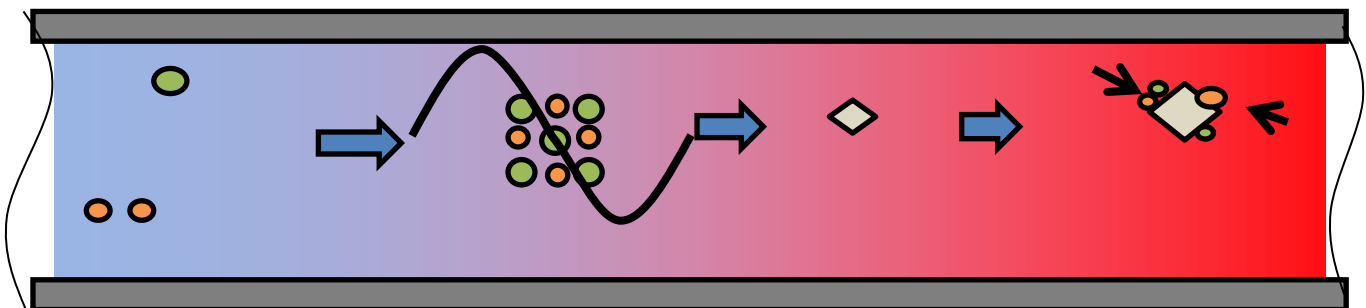
With no existing crystals, formation takes place all along the surface. Existing crystals will grow rather than form new crystals.

## Prevention of Scale

Without HydroPATH

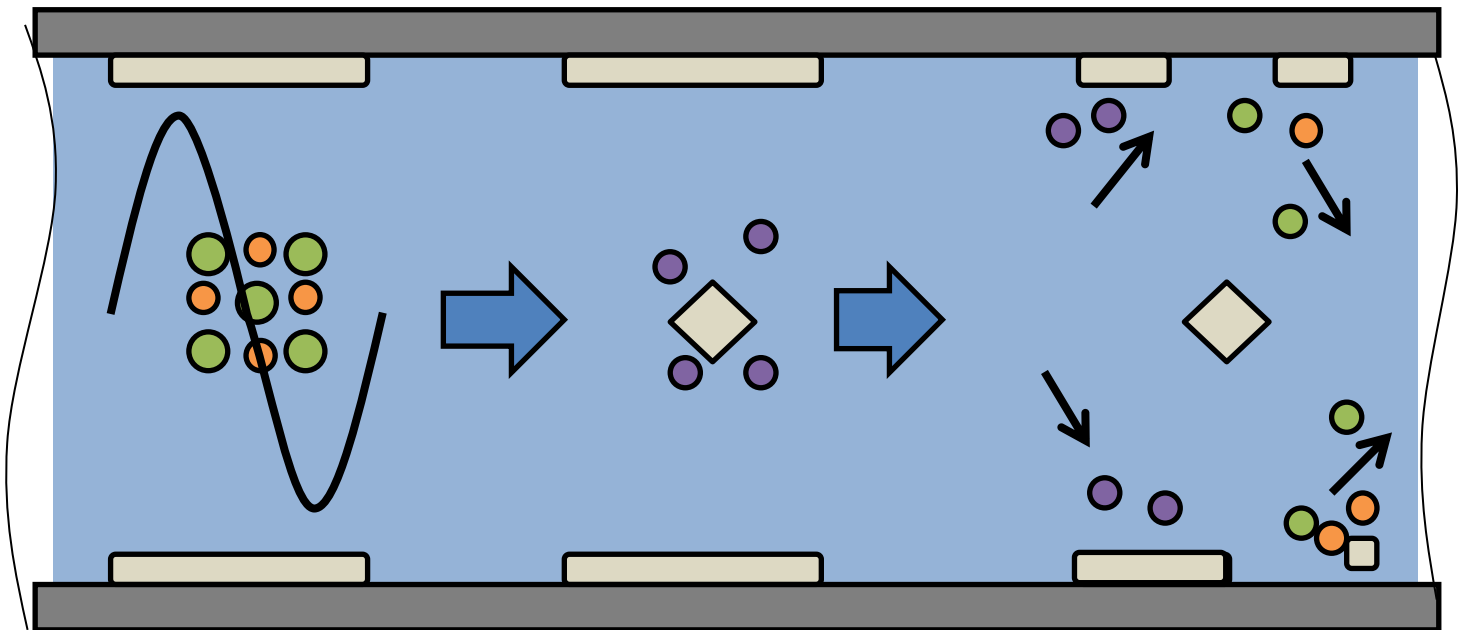
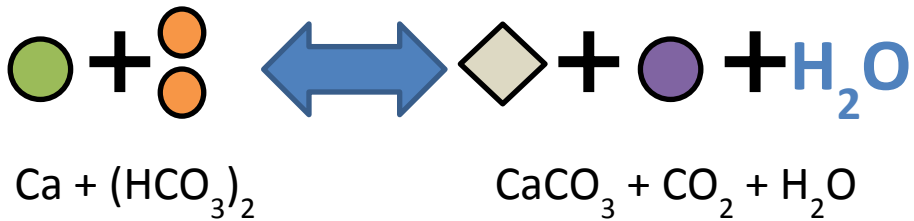


With HydroPATH



## Dissolving Existing Scale

- Crystals form
- Creates Carbon Dioxide
- Dissolves existing scale



## Dissolving Existing Scale

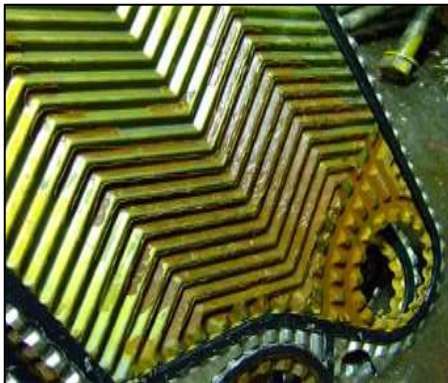
### Before and after – Plate exchanger



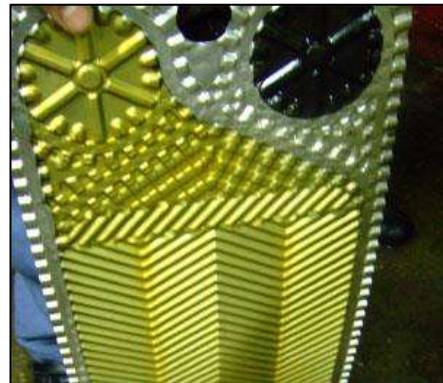
1. Before



3. After one month



2. Before – after cleaning



4. After 8 months

### HydroPath Marine prevents scale

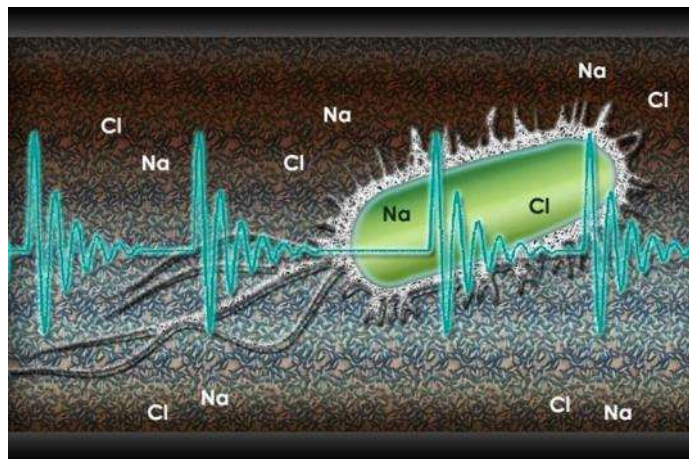
- Without chemicals
- Without changing composition of the water
- HydroPath Marine dissolves existing scale
- Carbon dioxide created as crystals are formed
- Requires Hard water feed

## Osmosis and Bacteria

Bacteria and/or algae that passes through the water conditioner's ring of ferrites becomes charged by the HydroPath Marine signal. This charge forms a hydration layer of pure water around the cell. Osmosis forces water into the bacteria and/or algae, creating osmotic pressure, which ruptures the cell membrane and causes the cell to die.

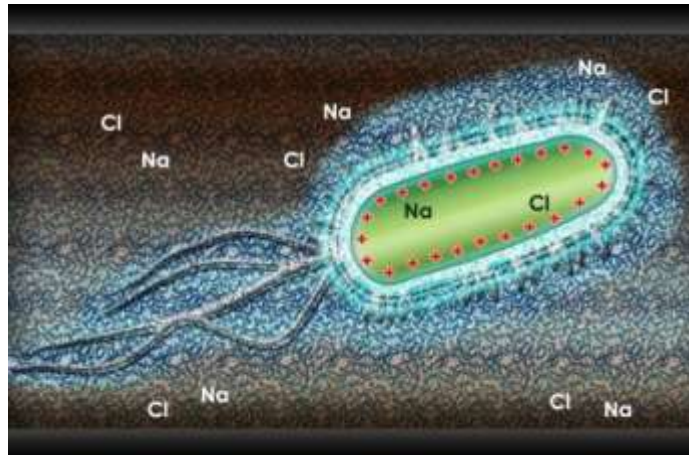
In addition to eradication via osmosis, the HydroPath Marine signal interferes with the bacteria and/or algae cell membrane which causes it to perish.

As the HydroPath Marine signal passes along a metal pipe, it disrupts the bacteria and/or algae clinging to the rough inner surface, gradually releasing the biofoul over time.

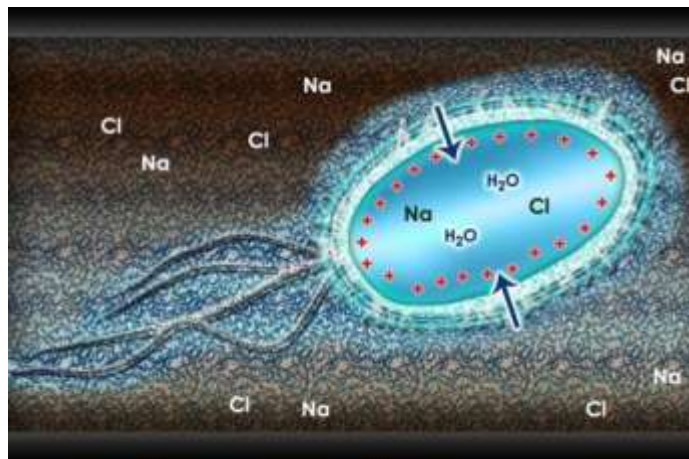


A bacterium passing through the HydroPath Marine system becomes charged.

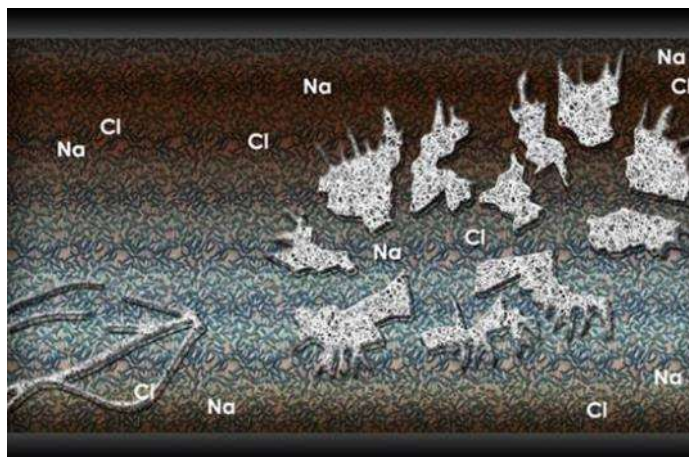




Water molecules are attracted to the charged bacterium thus creating a wetting layer of pure water.



Osmosis draws the pure water into the bacterium.

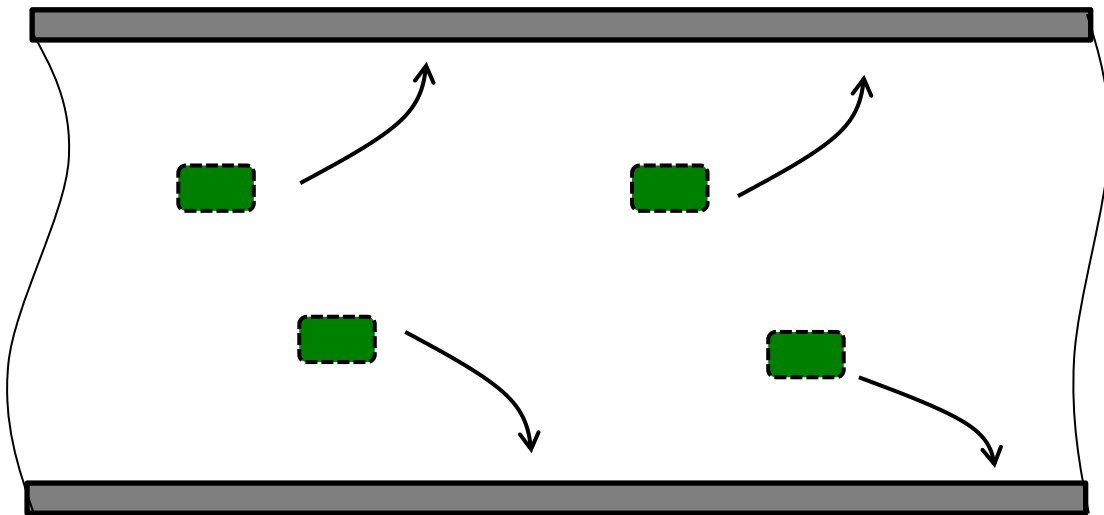


The osmotic pressure built inside the bacterium causes it to burst and die.

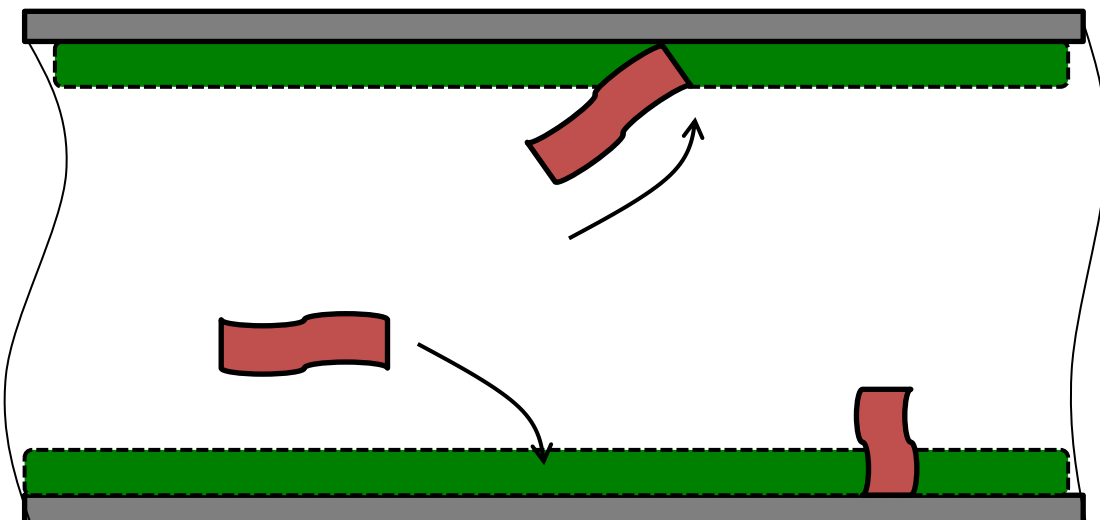
## Biofilms and Biofouling

### Why are bacteria important in an industrial context?

Fouling by bacteria leads to fouling by larger organisms. Bacteria cling to surface of pipe and Forms a Layer known as biofilm.

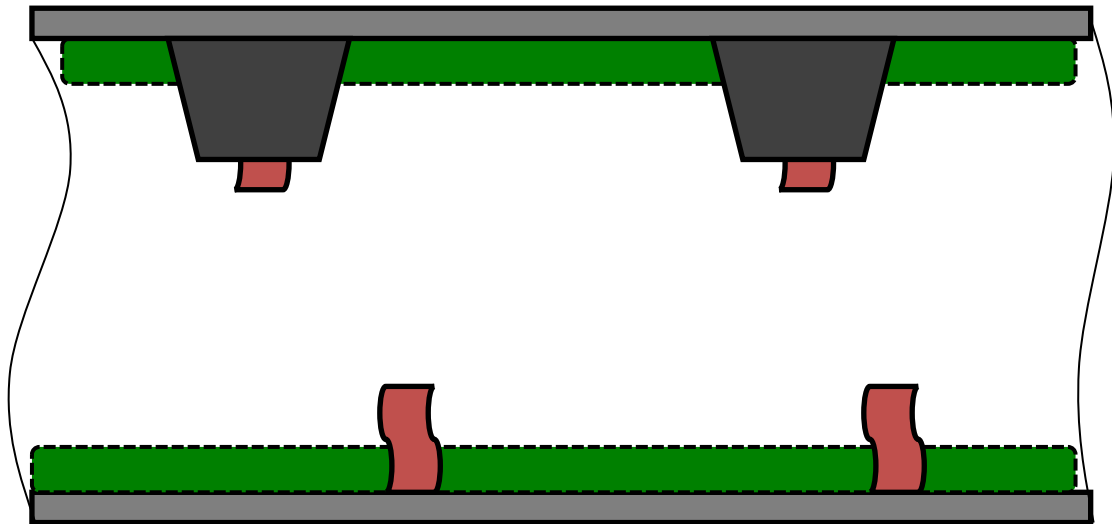


Larger “macrofoulers” attach in biofilm, Including Larvae.

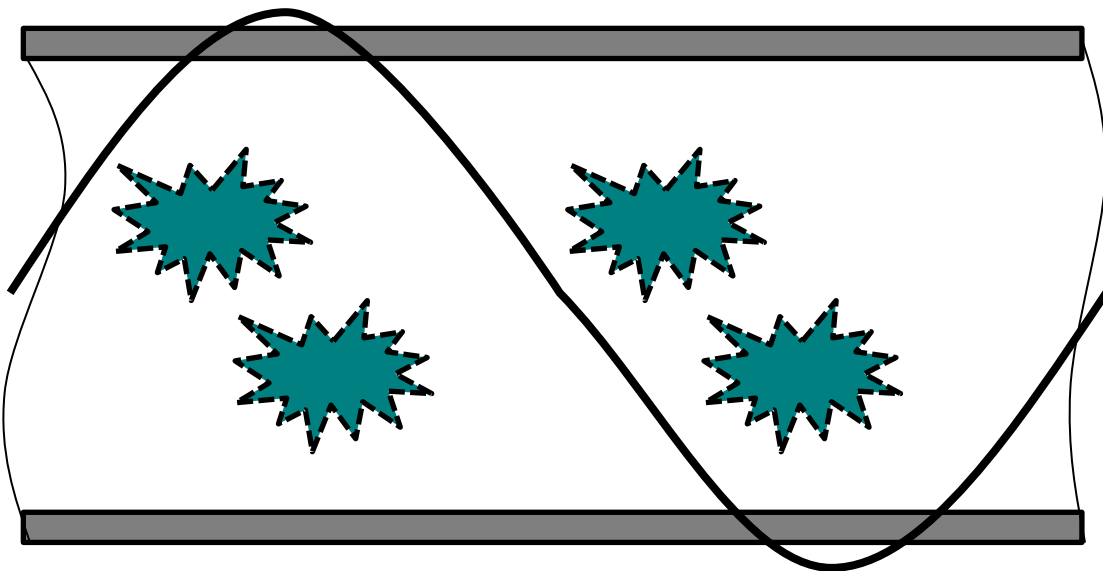


## Biofilms and Biofouling

The biofilm protects larvae, which grow and hatch into limpets, barnacles, etc.

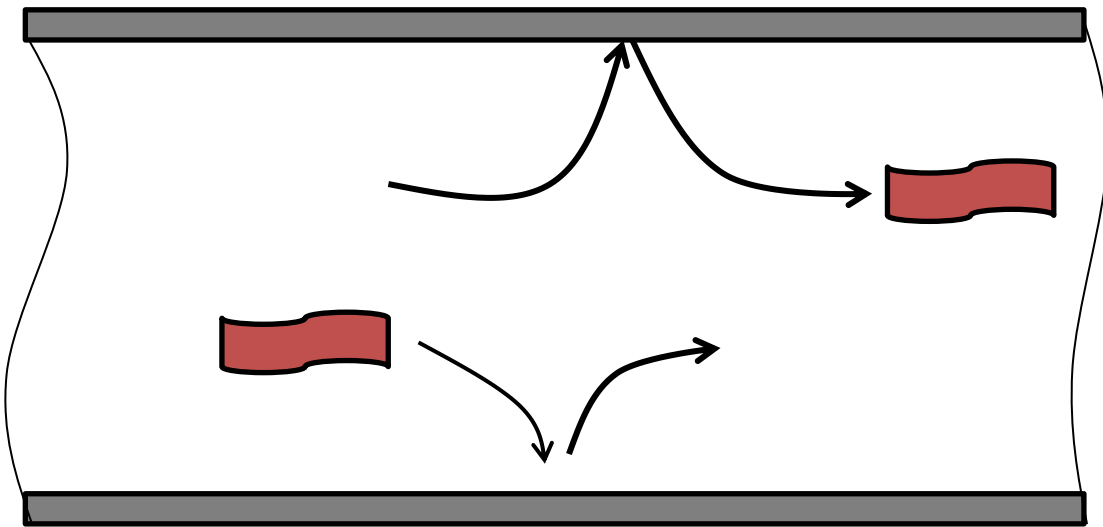


HydroPath Marine signal charges bacteria, creating wetting layer. Osmosis causes bacteria to swell and die.



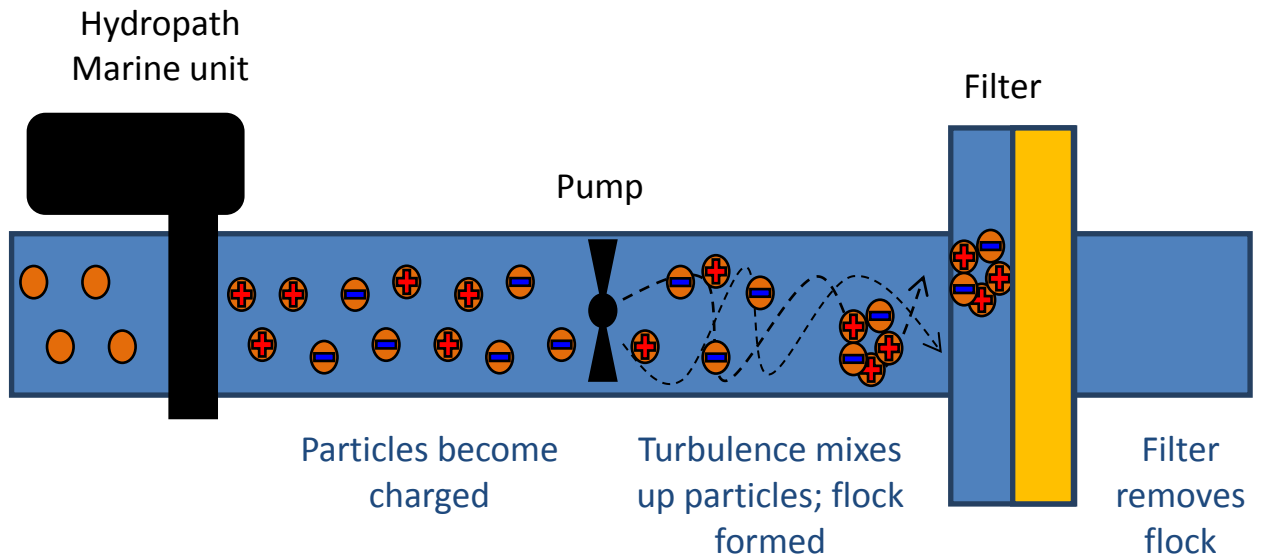
## Biofilms and Biofouling

- No bacteria means no biofilm
- Larvae and macrofoulers cannot attach
- Washed away by flow
- Pipe remains unfouled

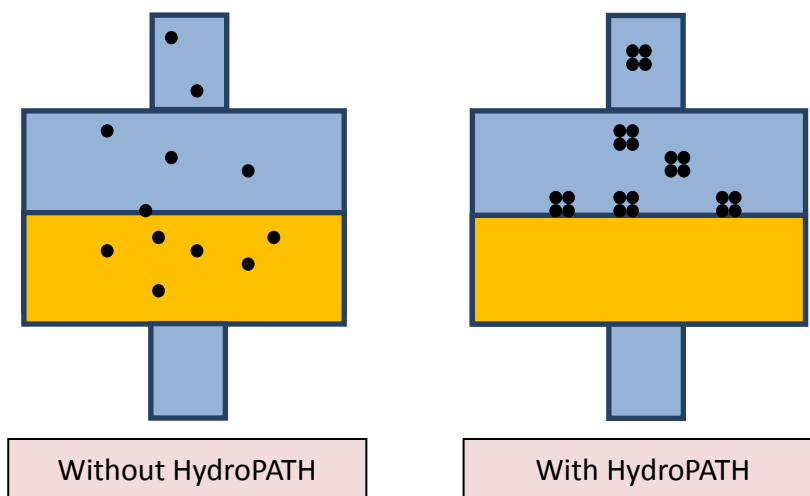


- HydroPath Marine prevents the formation of biofilm
- Biofilm required by macrofoulers
- HydroPath Marine prevents fouling by larger organisms

## Enhancement of Filtration

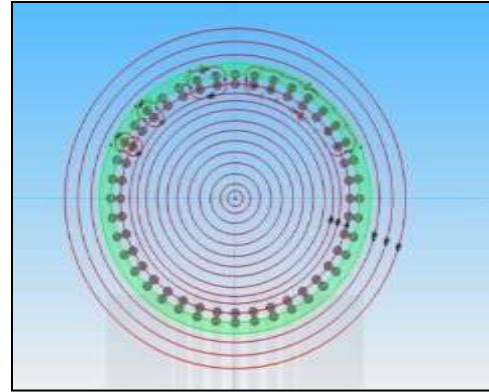
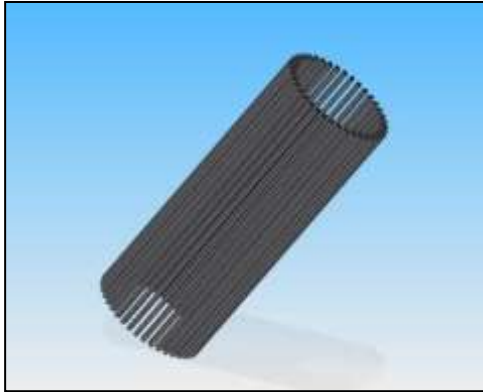


- Flocculation – particles clump to form larger “flock”
- Particles sit on surface of filter: easier to remove
- Can reduce the frequency and duration of filter backwashing
- Save on make-up water and effluent charges – no chemicals

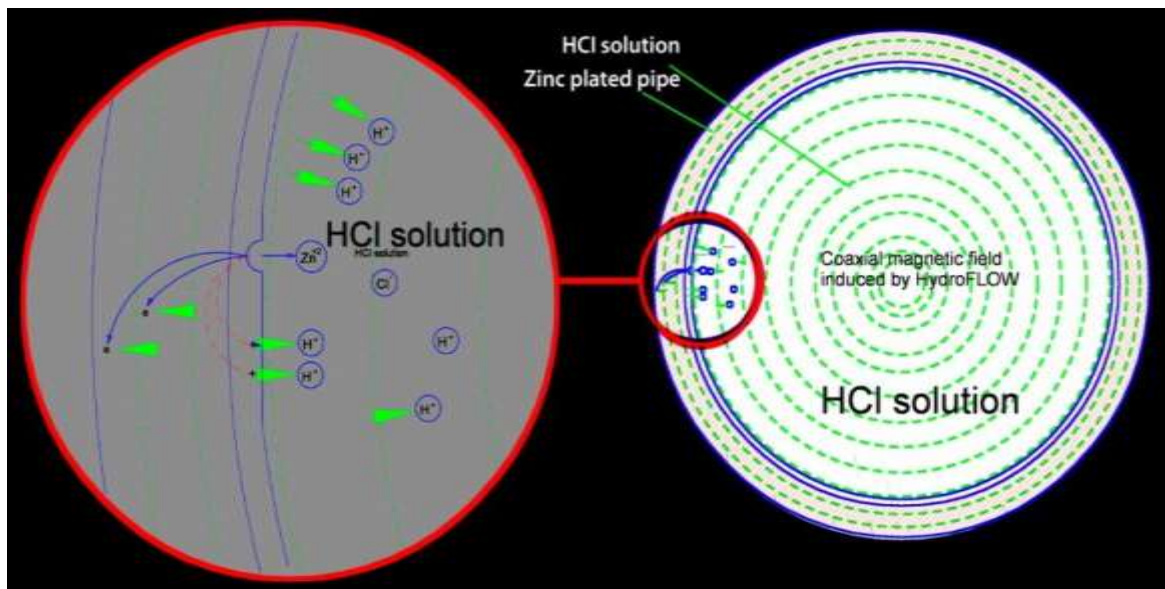




## Reduction of Corrosion



- Skin effect: AC current flows along outside of the pipe
- Reduced current on inner pipe walls
- Reduced corrosion
- Magnetite layer is formed on existing corrosion and prevents further corrosion



## HydroPath Marine Technology

**Limescale**

**Biofouling**

**Filtration**

**Corrosion**

Improves efficiency

Reduces maintenance

Improves vessel's readiness

Environmentally friendly

Without Chemicals

Easy "add on" installation

No dismantling of pipes

Negligible energy consumption





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