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ETS-DMA 75

ETS-DMA L75 is an extremely useful disinfection product for many applications like potable water, industrial activities, including water the food and beverage industry. ETS-DMA L75 is a concept in which pure chlorine dioxide is generated in water by the reaction of two stable liquids. There are no hazardous byproducts and there is no risk of explosion. It is very easy to handle and to transport.

Applications

- Disinfection of portable water
- Waste water, processing waters, ... S Surface disinfection, food industry
- Paper and pulp industry, bleaching S Cooling towers, against legionella
- Agriculture, irrigation, drinking water, farm disinfection, ...
- Food industry, milk, meat, slaughter houses,...
- Beverage industry, breweries
- Washing waters, vegetables, potatoes
- Swimming pools, Whirlpools
- Legionella, biofilm removal

Microbiological properties

ETS-DMA L75 is a broad spectrum disinfectant. Much stronger than chlorine. It kills all microorganisms like bacteria, algae, fungi, yeast, viruses, cyst.
Broad pH range (4-10). It destructs and prevents biofilm. It is effective against legionella.

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Drinking water treatment in municipal waterworks

ETS-DMA L75 (ClO2) is an alternative to Chlorine gas and sodium hypohlorite, the most used water disinfecting agents.

ETS DMA L75 produces no organic, chlorine compounds with those contaminants most frequently found in water, e.g. Chloro phenols or halogenated Hydrocarbons (for example Halo forms such as Chloroform which is considered carcinogenic).The compounds formed from the reaction of Chlorine dioxide with organic water contaminants are therefore largely negligible in terms of sensory or toxicity considerations. This makes ETS DMA L75 an ideal disinfectant for the treatment of drinking water. ETS-DMA L75 has all the benefits of chlorine with none of its downside. Furthermore, because the chlorine dioxide is a more powerful disinfectant than chlorine the result is reduced chemicals usage and lower environmental impact.

- Chlorine dioxide is superior to chlorine in the destruction of spores, bacteria, viruses and other pathogens
- The bactericidal efficiency is relatively constant at pH 4 to 10
- ClO2 requires a lower contact time
- Chlorine dioxide has a higher solubility
- Chlorine dioxide does not react with NH3 or NH4 +
- It destroys THM precursors and increases coagulation
- ClO2 destroys phenols and is odorless
- It removes iron and magnesium compounds better than chlorine, especially in complex compounds

ETS-DMA Lq will not produce hazardous chlorinated by products like THM and HAA.
ETS-DMA Lq can be used with standard teflon based dosing pumps.
ETS-DMA Lq can be dosed with dosing pumps which operate without electricity.
ETS-DMA Lq residuals can be measured with DPD1 reagents, photometer and membrane sensors.
Low investment to change a municipality or company from chlorine to ETS-DMA Lq 75!!!
In some countries we can help with the finance of equipment or have acces to financial programms for this.
For more details please contact our company.

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Waste Water

Chlorine dioxide is an oxidant that is preferred by many regulating water utilities and supply authorities for final discharge disinfection. Chlorine dioxide controls bacteria such as E-coli and other coli forms. It does not accumulate in the environment and can be used to reduce the growth of troublesome biofilms, iron bacteria, algae and other organisms known to contribute to wastewater and effluent fouling problems. Chlorine dioxide can also help reducing Biological Oxygen Demand (BOD) and foul odors in wastewater, without producing chlorinated by-products such as THM and HAA.

Chlorine dioxide is effective against many pollutants found in waste water, cyanides in wastewater, nitrites and sulfides, potential carcinogenic substances such as 3,4-benzopyrene, iron and manganese in water, tastes and odors produced by algae, the dyes produced by chlorophyll and plants and pesticides.

Chlorine dioxide is highly effective in controlling waterborne pathogens. Chlorine dioxide is a broad spectrum micro biocide as effective as chlorine against viruses, bacteria, fungi and more effective than chlorine for the inactivation of the encysted parasites giardia and cryptosporidium. Chlorine dioxide is also an effective control strategy for taste, odor, color, iron and manganese removal.

BREVERY/Brewery

ETS-DMA L75 is a safe and effective sanitizer for use in a variety of brewing and packaging applications. Chlorine dioxide can be applied to water systems, processing equipment, and environmental surfaces to reduce or eliminate brewery spoilage organisms.

Pitching yeasts collected from brewery fermentations are never absolutely free of microbiological infection. In spite of whatever care and sanitary precautions are taken, some bacteria and wild yeast will contaminate the pitching yeast. The pitching yeast can contain healthy yeast cells and trub (dead yeast cells and organic residues) and may contain 5 to 15% dry solids (35). To minimize microbiological infection, chlorine dioxide, an alternative to distilled water or acid washing, is relatively

new to the brewing industry and is gaining acceptance as a method for washing yeast. It kills via microbes by reacting chemically with sulfur-containing amino acids, the building blocks of protein which are used to form cell membranes.

MILK PROCESSING

Milk is also a very nutritious medium for microbial growth, and spoils very quickly if not handled properly after collection. In addition, many pathogenic bacteria can also grow in milk, for example, Listeria mono cytogenes, Salmonella spp, and Escherichia coli.

Chlorine dioxide is a safe and effective sanitizer for use in a variety of milk processing and packaging applications. Chlorine dioxide can be applied to water systems, processing equipment, and environmental surfaces to reduce or eliminate milk spoilage organisms. Disinfecting parts of dairy machines, cans and tan

FRUITS & VEGETABLES

As is known, the peel of fruits and raw vegetables, while having high contents of vitamins and mineral salts, contains on the surface many microbes, bacteria and other polluting substances originating from the fertilizers employed in the production, as well as from various birds, animals and insects,

atmospheric agents, etc. Tossing fruits and vegetables into baskets or boxes may not leave visible bruises and damage, but decay will begin under the skin. Seemingly sturdy vegetables such as sweet potatoes are actually quite tender and will not store well if bruised. Endemic in nature so impossible to predict where it will occur next. The largest issue facing the fruit & vegetable industry is improving the shelf life of the produce.

ETS-DMA L75 is an excellent product for washing vegetables. It has the ability to kill spores, fungi and viruses at low concentrations. Chlorine dioxide is a proven product that can be used to solve many food related problems. It does not affect taste, odor or appearance.

POULTRY

Diseases and infections have always been a major concern to the poultry industry-especially in the hatchery. Microorganisms are everywhere! Some are relatively harmless while others are highly pathogenic. Some pose a lethal threat to one species of animal while remaining harmless to another species. Some organisms are easily destroyed while others are very difficult to eliminate. Treat all microorganisms as if they are a severe threat to the chick's livelihood.

ETS-DMA L75, with its broad spectrum antimicrobial activity, can deliver kills against a wide range of microorganisms over shorter periods of contact time. Chlorine dioxide, when properly applied, minimizes toxic residues as it doesn't produce halogenated organic by-products.

Freshly slaughtered poultry or other meat products are contaminated with pathogenic microorganisms. These microorganisms are present both on the surfaces of the animals, as well as in the intestinal tracts immediately after slaughter. To insure product safety, recent federal regulations require microbiological testing rather than visual inspection. These regulations require that carcasses be tested for Salmonella.

Chlorine dioxide has been used very successfully in food, meat, slaughter house as a processing aid that is added to process water maintaining good microbial quality thereby impacting on the quality maintenance and shelf life of the produce.

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PHARMA

Decontaminating pharmaceutical manufacturing facilities is essential for producing safe and pure drugs. The most commonly used decontaminant in the industry has been sublimated formaldehyde. In June 2004, however, the International Agency for Research on Cancer classified formaldehyde as carcinogenic to humans.

The US and most world health organizations now recognize formaldehyde as a carcinogen or a possible carcinogen for humans. Although some companies still use formaldehyde, the pharmaceutical industry is looking for alternative decontaminants.

Chlorine dioxide is a broad-spectrum biocide with the advantage that bacteria, fungi and viruses do not build up a natural resistance. Chlorine dioxide as emerged as popular replacement of formaldehyde. Chlorine dioxide offers the most thorough decontamination possible in the safest manner with out producing any carcinogenic bi products. With these entire advantages chlorine

dioxide decontaminates the vessels, reactors, head space, process tanks, and filtration units. Chlorine dioxide effectively reduces the down time.

WITH the recent and quite sudden withdrawal from sale of clear soluble phenolics, as a result of the European Biocidal Products Directive, many laboratories have been involved in a rapid search for suitable alternative disinfectants.

One such alternative is chlorine dioxide, already well-established in hospitals for instrument decontamination and hard surface disinfection, and now finding an increasing role for decontaminating equipments, reactors, vessels, filtration units and processing tanks in the pharmaceutical formulation units.

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Pulp & Paper

Chlorine dioxide is one of the most widely used delignification/bleaching agents in the pulp and paper industry, providing a high-quality, low-cost delignification and bleaching process. Chlorine dioxide treatment is superior to chlorine bleaching processes in that it virtually eliminates all dioxin discharges into the environment, and has accordingly, helped pulp and paper manufactures to employ environmentally friendly processes and to meet environmental requirements. Accordingly, the use of chlorine dioxide treatment is increasing and most pulp and paper mills now have at least one chlorine dioxide delignification or bleaching stage. Chlorine dioxide treatment has also been used to treat wastewater, sludge and other process streams.

Oil and Gas industry

It is well known that during the production life of oil and/or gas wells, the well formations tend to become plugged with iron sulfides and sulfates or polymers added to injection water for increasing water viscosity and sweep efficiencies. Such plugging decreases well production. In response to this

problem, a well-established technique is to inject chlorine dioxide into the well. Chlorine dioxide rapidly oxidizes the naturally occurring iron compounds, and also is effective at breaking up and removing organic solids and added polymers.

Chlorine Dioxide treatments reduces:

- Iron Sulfide (FeS) - ClO2 destroys the FeS it contacts. The FeS will not re-precipitate, as it can with conventional acid jobs.
- Bactericide - ClO2 is a biocide that kills bacteria by destroying the bacteria's cell walls, leaving the water sterile.
- Polymers & Residue - ClO2 breaks most frac & polymer flood polymers and reduces or eliminates polymer residue.
- Hydrogen sulfide (H2S) - ClO2 oxidizes on contact, reducing H2S levels significantly. Since ClO2 destroys bacteria, bacteria-generated H2S can be dramatically reduced. ClO2 is dispersible in oil, water and organic solvents

AQUA CULTURE

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- Control of water quality is the key factor for a successful culture of aquatic animals like fish, prawn and shrimp. An open water system with sufficient good water quality may ensure successful aquaculture. However, if proper quality or sufficient quantity of water is not available, purification of water by eliminating polluting substances including toxic metabolites and growth inhibiting substances which originate mainly form fish or shrimp excretion and excessive feed is necessary. Under this lower water quality conditions there are chances for occurrence of mortalities by diseases due to viral, bacterial, protozoa, fungal pathogens. High populations of aquatic animals can be kept healthy under successful semi-closed and closed systems by maintaining proper sanitization. The increased demand in water quality and quantity in shrimp and fish culture has resulted in a growing interest in using water sanitizers and disinfectants. Chlorine dioxide is highly effective in controlling waterborne pathogens.

- Chlorine dioxide is a broad spectrum micro biocide as effective as chlorine against viruses, bacteria & fungi.

- Controll of Legionella in building installations of hospitals, nursing homes, hotels, sports facilities and schools

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- Legionella, a life-threatening microbial contaminant, was detected in the hospital's domestic hot and cold water systems. Because the contaminated water system was a source for dangerous waterborne pathogens, it posed a Serious risk for a Legionella outbreak among

- hospital patients who already Suffered from compromised immune systems. The safety of its patients is in jeopardy, surrounding a potential Legionella outbreak in the hospital.

- In the normal course of operation, hospitals generate a variety of waste which is not suitable for normal disposal. While some or most hospital waste may be harmless, it is difficult to distinguish such harmless waste from infectious waste. As a result, all of the waste from a hospital must be treated as if it may be harmful.

- Because of its bio-cidal characteristics, ClO2 is ideal for water hygiene applications in hospitals and healthcare facilities. It has consistently been shown to be the best molecule for eradicating the causative organism of Legionnaires' disease. ClO2 is strong biocide at low concentrations as low as 0.1 ppm. With minimal contact time, it is highly effective against many pathogenic organisms including Legionella, Giardia cysts,E. coli, and Cryptosporidium. ClO2 can greatly reduce and eliminate bio-film populations and discourages bacterial re growth.

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- Irrigation water treatment, e.g. in plant nurseries
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- Algae control is one of the more frustrating challenges for farmers. This problem has steadily become worse in recent years and growers are recognizing significant financial losses attributed to algae and the production problems they cause. It is frustrating because while algae are living organisms, eliminating them does not fall under the normal protocols of pest control. Algae are not insects and cannot be controlled by insecticides. Nor are they a fungus that can be controlled by fungicides. Algae and bio-film are able to form a symbiotic relationship -- what one needs, the other provides. It's a relationship that keeps feeding itself, which is a major point in understanding why algae control is so difficult. Bio-film is able to provide algae with enough nutrients to substitute for their need of light to create such nutrients. This allows algae to flourish in irrigation lines.

- ES-DMA L75 is an effective sanitizing agent for water treatment. In horticulture, it is used at a high concentration to remove established bio-film that lines irrigation systems, clogs emitters and can potentially harbor pathogens. For continuous application, a low concentration of chlorine dioxide can be used to maintain clean irrigation lines and to inhibit algae and diseases.

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- # Cooling Towers

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- The use of chlorine dioxide in cooling towers, loops and cooling systems greatly assists in the control of algae, planktonic bacteria, bio-film and scale, helping to maintain the efficiency of heat exchanger surfaces, reservoir intakes, and ancillary equipment. Traditional oxidizing agents such as chlorine and bromine suffer from pH constraints and corrosion problems.

- Chlorine dioxide is significantly more stable than other oxidizing biocides and is also compatible with most water treatment chemistry. Chlorine dioxide controls algae, plank tonic and sessile bacteria, and bio-film.

- Why is it important to control bio-film in such systems? Bio-film acts as an insulator causing deterioration in general heat transfer properties. It creates fouling and corrosion problems by accumulating scale in pipe work and equipment.

- Bio-film also creates an environment that promotes the growth of anaerobic microorganisms which in turn increases microbiologically induced corrosion (MIC) problems. Using chlorine dioxide will lead to significant cost savings including water cost, corrosion problem, reduce maintenance cost and Improved system performance

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- # Sodium-hypochlorite vs. ETS-DMA L75 solution
- Chlorine is the most common chemical disinfectant but the question is: Is disinfection with chlorine really safe and reliable?

	Sodium-hypochlorite	ETS-DMA L75 solution
1.	Sodium hypochlorite used for water disinfection (professional use) contains between 10% -15% active ingredient.	DMA L75 is a 99% pure chlorine dioxide in a 0,75% solution which contains no free chlorine and chlorite when dosed into the water.
2	Sodium hypochlorite generates hazardous byproducts like THM's , HAA's and Mutagen X in contact with organic material in the water. These by products are very strongly linked to cancer.	DMA L75 will not generate hazardous byproducts in contact with organic material in the water. Rest products of ETS DMA L75 0.75% are sodium sulfate and sodium chloride. These levels are NEGLIGIBLE.
3	Sodium hypochlorite can be dosed in the water by using standard dosing pumps. Residual levels can be measured by membrane sensors and/or photometer.	DMA L75 can be dosed in the water by using standard dosing pumps. Residual levels can be measured by membrane sensors and/or photometer.
4	Sodium hypochlorite is strongly pH dependant and is efficient by pH 7 to 7,5. pH level of the water has to be balanced and corrected for disinfection reasons.	DMA L75 works 100% effective between pH 4 and pH 10 and does not have to be corrected or balanced for disinfection reasons.
5	Sodium hypochlorite is very corrosive for all kinds of materials, pipes and dosing equipment.	DMA L75 0.75% solution is NOT corrosive when dosed into the water only when the pH of the water is <4.
6	Sodium hypochlorite is not selective and reacts with all kind of organic materials present in the water and is consumed very fast for this reason.	DMA L75 is highly selective and for this reason it will remain active for a long time in the distribution network. This implies that a long residual function of ETS DMA L75 can be achieved (up-to 72 hours) in water distribution

		systems. This is LONGER than sodium hypochlorite.
7	Sodium hypochlorite is not effective in removing a bio-film and preventing the growth of a bio-film in storage tanks and/or distribution systems. A shock dose with sodium hypochlorite can damage the material of the tank/pipes because it is highly corrosive.	DMA L75 is highly effective in removing a bio-film and preventing the growth of a bio-film in storage tanks and/or distribution systems. A present bio-film can be removed by a shock dose of 30 mg/l and a contact time of 8 hours. A low continuous dosage (0,05 to 0,2 mg/l) will prevent the re-growth of the bio film. A shock dose will not damage the material of the tank/pipes because the product is not corrosive when dosed into the water.
8	Sodium hypochlorite will not remove taste and smell problems generated by algae and phenols.	DMA L75 is very effective to remove taste and smell problems generated by algae and phenols.
9	Resistance building is possible by microorganisms against Sodium hypochlorite. Example: Cryptosporidium, Listeria and Legionella.	DMA L75 kills all waterborne microorganisms and resistance building is not possible.
10	Sodium hypochlorite is dosed in general between 1 and 5 mg/l to disinfect drinking water. A dosage of 3 mg/l of a 10% concentration consumes 30 ml of sodium hypochlorite per 1000 liter of water.	DMA L75 is dosed in general between 0,05 and 0,2 mg/l to disinfect drinking water. A dosage of 0,1 mg/l consumes 13,3 ml of product per 1000 liter of water. In most applications a 2/3 reduction of chemical dosage compared to Sodium hypochlorite is realistic.
11	Sodium hypochlorite is sold worldwide between Euro 0,15 and Euro 0,60 per liter for large volumes. Prices are indications and vary per country.	DMA L75 0.75% is sold worldwide between Euro 0,25 and Euro 0,60 per liter for large volumes. Prices are indications and vary per country. Please contact your local distributor for more information or price offers.

ETS
Environmental Technologies Solutions

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ETS DMA 75 vs Classical Chlorine Dioxide Systems

There are several "classical" methods of chlorine dioxide production.
All these methods have advantages and disadvantages but, in general, their limitations have restricted the widespread use of chlorine dioxide despite its many well-known advantages over conventional methods of water disinfection such as chlorination.
ETS DMA 75 is the modern. simple method of producing practically pure solutions of aqueous chlorine dioxide without the disadvantages of the "classical" methods. The table below highlights the many advantages of ETS DMA L75.

Classical generated chiorine dioxide vs. ETS DMA L75 solution

	Classical generated chiorine dioxide	**ETS DMA L75 solution**
1.	Classical chlorine dioxide solution decays very fast when the concentration exceeds 0.5% and becomes explosive.	ETS DMA L75 is a solution that contains a 0.75% solution of chlorine dioxide and is therefore not explosive and has a long kinetic halftime (30 days).
2	Classical chlorine dioxide solution is diluted on the fly in the production process and concentrations may vary.	The balanced application of ETS DMA L75 component A and ETS DMA ® LQ 75 component B guarantees the 0.75% concentration (just restrict to the simple user directions on the packaging and the Material Safety Data Sheets).
3	Classical chlorine dioxide solution requires complicated and expensive equipment (reactors, mix systems etc.).	As the unique composition of ETS DMA L75 Component A and ETS DMAL75 component B contain all chemistry to generate the ETS DMA ® L0.75% solution NO equipment is required to generate the solution (only a standard PE-HD black tank is required to generate ETS DMA L 0.75% solution).
4	Toxic and impure chemical compounds are used to generate the classical chlorine dioxide solution.	The chemical compounds of ETS DMA L75 Component A and ETS DMA® L75 Component B are certified and approved according to the highest purity and quality levels (including European Regulation EN 12671.

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5	The genera) purity of classical chlorine dioxide solution is up to 65%.	The purity of ETS DMA ®L 0.75% solution is 99%.
6	Classical chlorine dioxide solution requires to be generated on site and used immediately and has a kinetic halftime of only a few hours. This also implies that the residual function of classical chlorine dioxide solution is limited.	ETS DMA ® L0.75% solution can be generated on site but can also be transported to a desired location. When the storage conditions in the Material Safety Data Sheet are respected the kinetic halftime is 30 days. This implies that a long residual function of ETS DMA® L0.75% solution can be achieved (up-to 72 hours in water distribution systems. This is MUCH LONGER than classical generated chlorine dioxide or chlorine.
7	Classical chlorine dioxide solution generated from liquid components decays very fast (unstable as in chemistry the quality of liquid is decreasing as time evolves thus continuous quality cannot be controlled).	ETS DMA® L 0.75% solution is made from two liquid components (ETS DMA® L75 Component A and ETS DMA® LQ 75 Component B). The initial liquid is the most stabile form in chemistry and does not decay. ETS International guarantees a 2 year shelf life of the ETS DMA® L75 liquid components in the original unopened packaging when storage conditions are respected according to the Material Safety Data Sheets.
8	Classical chlorine dioxide solution must be applied immediately as it cannot be stored and has disappeared within a few hours.	As ETS DMA® L0.75% solution has a kinetic halftime of 30 days it can be applied according to desired situations.
9	Classical chlorine dioxide solution contains high levels of chlorite, chlorate, chloride and free chlorine and is therefore NOT pure.	ETS DMA® L0.75% solution contains 99% pure chlorine dioxide.
10	The free chlorine in classical chlorine dioxide solution implies the same by-products and side effects as known from chlorine who have proven in scientific research to cause cancer	As ETS DMA® L0.75% solution does NOT contain free chlorine when dosed into the water, the by-products and side effects of chlorine are NOT applicable to ETS DMA® L0.75% solution.

	and stress on human health and the environment tremendously.	
11	Classical chlorine dioxide leaves as rest products chlorite, chlorate, chlorides and free chlorine and forms a risk for human health (chlorite is very toxic to the human body) and stresses a load on the environment.	ETS DMA ® L75 0.75% solution leaves as rest products sodium sulphate and sodium chloride (kitchen salt). These two rest products must be in water to cal) it drinking water and the contribution of the sodium sulphate and sodium chloride levels are NEGLIGIBLE.
12	Classical chlorine dioxide is very corrosive.	ETS DMA ® L75 0.75% solution is NOT corrosive when dosed into the water only when the pH of the water is <4.

ETS DMA L85 **NEW**

Liquid and powder components.

Concentration: 0,85% of chlorine dioxide.
More economical for large projects because of a higher concentration and reduced transport cost.
Dosage of 0,1 ppm = 11,76 ml per 1000 liter of water.
Improved efficiency for countries with temperatures of less than 10°C.
Manufactured according standard EN12671.
Stability: = ETS DMA L75 and ETS DMA L75

For more info please contact our company.

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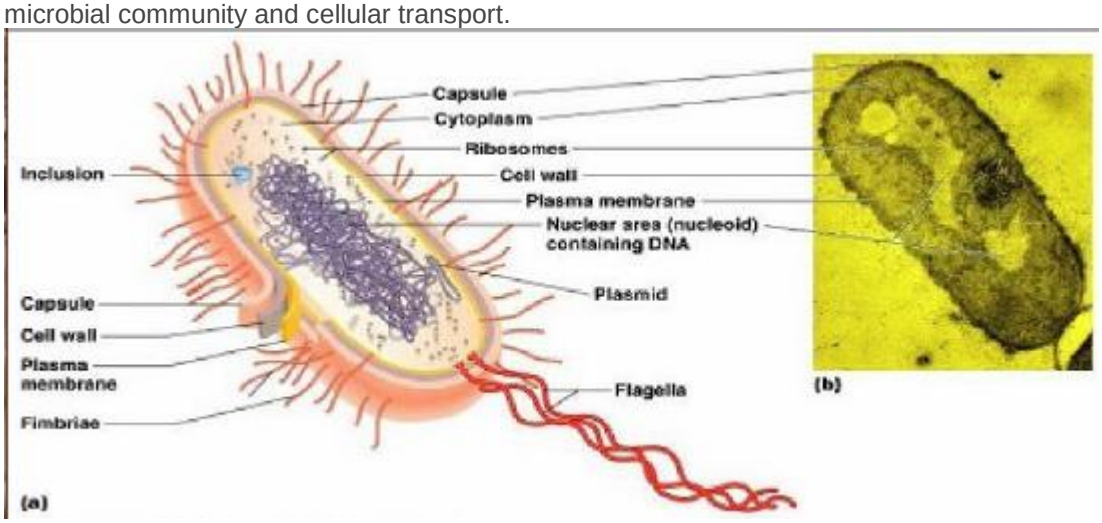
Remove and prevent growth of Biofilm with ETS DMA LQ

- Where more than 99% of the microorganisms hide and live!
- Impacts pathogen control.

What is it?

- Sessile microorganisms embedded in gelatinous matrix.
- Anchored to the surface with polymeric sugars.
- Factors affecting biofilm formation include nutrient availability, hydrodynamics, composition of microbial community and cellular transport.



Where to find them?

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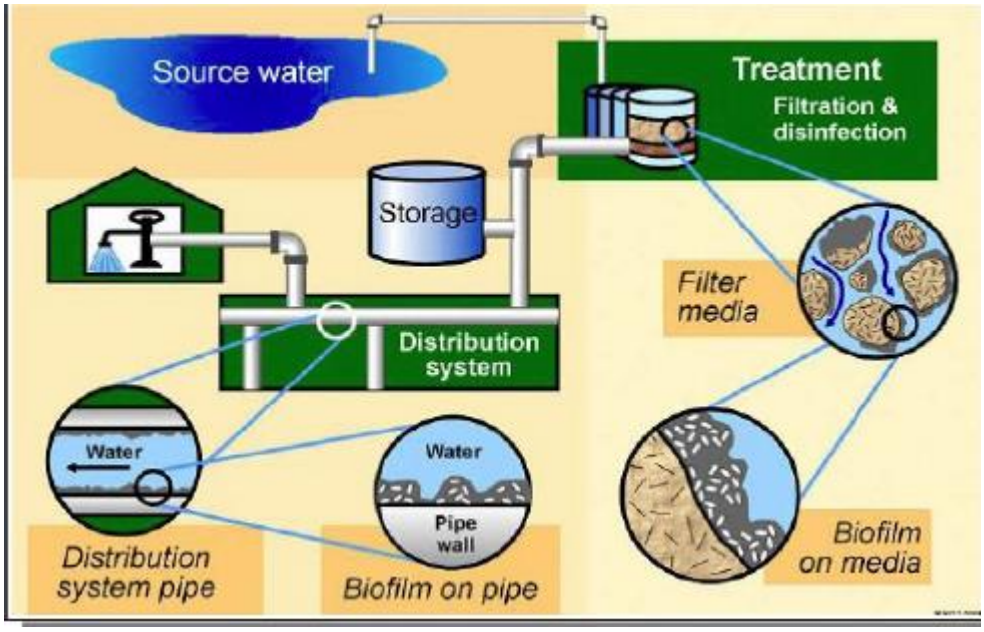


Types and kinds of microorganisms present inside it

Aerobic bacteria -

- Slimers – Pseudomonas, Mucoids.
- Spores – Bacillis Subtilis.
- Fecal – Enterobacter.
- Ubiquitous – Anabena, Asterionella.

Anaerobic bacteria -

- Sulfate reducing – Desulfovibrio.
- Iron reducing – Gallionella.

Protozoa -

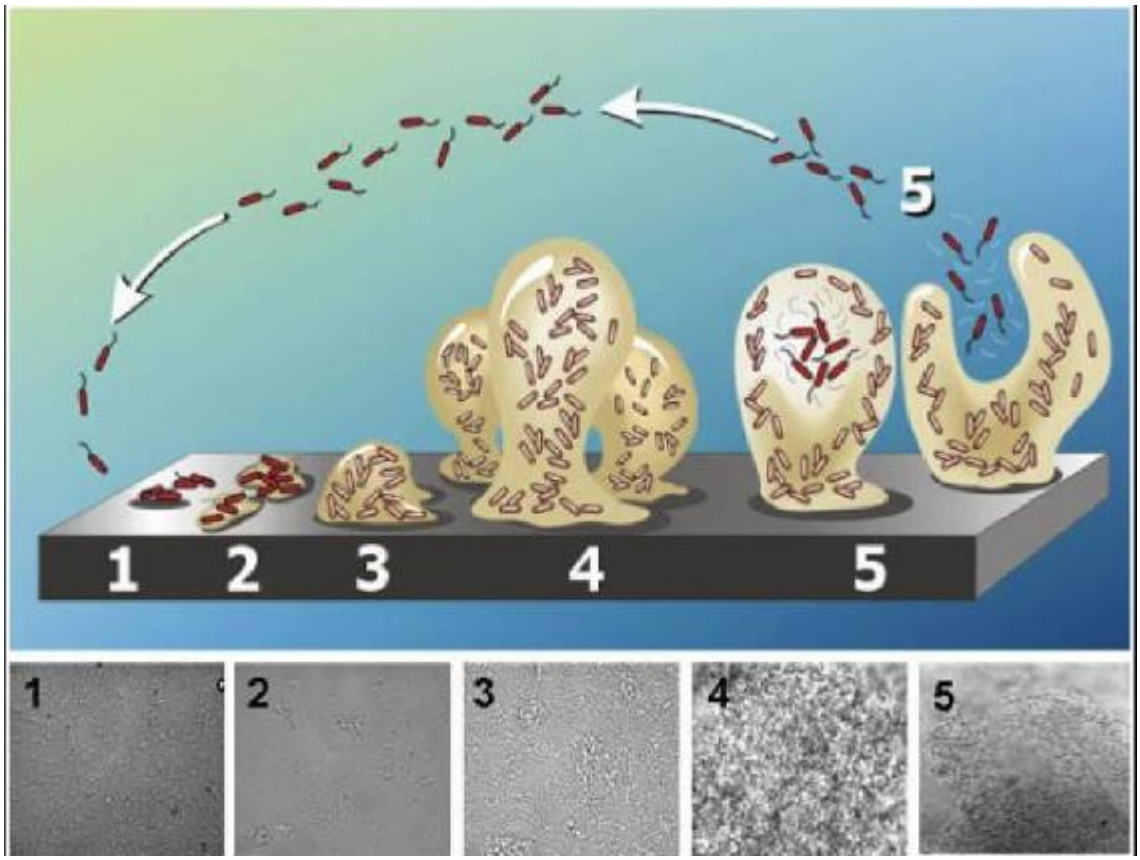
- Consume bacteria.

Biofilm diversity

- It contains microorganisms in a broad spectrum with different metabolic states.
- Aerobic and anaerobic species are capable of co existing.
- Proliferating and dominant species can co exist.
- Single layer to 3 dimensional structures.
- Unicellular to multicellular.

- Biofilm remediation indicates that a weaker disinfectant (which penetrates) will be able to perform stronger than disinfectant that fails to penetrate.

Steps of biofilm life cycle



Biofilm Control

- A biofilm under low continuous stress may persist and continue to grow slowly.
- High stress and shock biofilms off the walls, resulting in complete disinfection.

Biofilms are resistant to chlorine

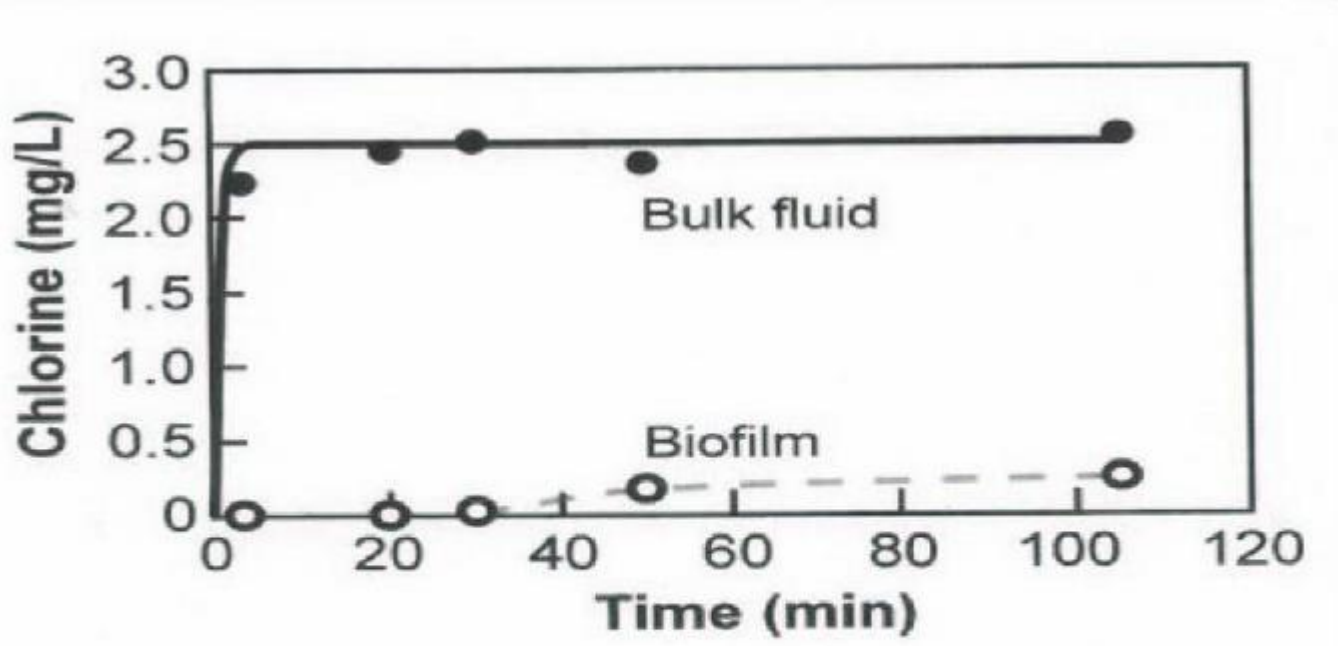


Figure 1. Retarded penetration of chlorine into a bacterial biofilm. The transport of free chlorine at neutral pH into a 300 micron-thick biofilm was measured using chlorine- sensitive microelectrodes. Chlorine was delivered in continuously flowing bulk fluid where its concentration (solid circles) was approximately 2.5 mg/L. At a point only 100 microns into the biofilm, the measured chlorine concentration (open circles) was much less than the bulk fluid concentration. The solid line is the theoretically predicted delivery of a solute the size of chlorine to a depth of 100 microns if there were no reaction between the chlorine and the biofilm. Slow penetration occurs because the chlorine does react with organic matter in the surface layers of the biofilm. See de Beer et. al., 1994.

- The real barrier to chlorine penetration occurs when chlorine is neutralized in the surface layers of the biofilm faster than it diffuses into the biofilm matrix.
- Both chlorine and hydrogen peroxide are prone to transport breakdown.
- Chlorine and bleaching powder are consumed by useless side reactions.

Penetration of the biofilm layer by chlorine dioxide (ETS-DMA L75)

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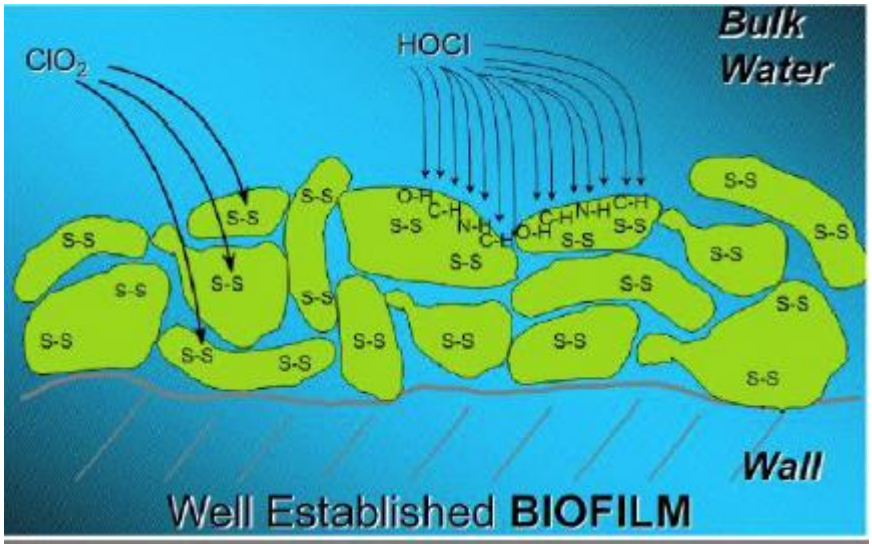
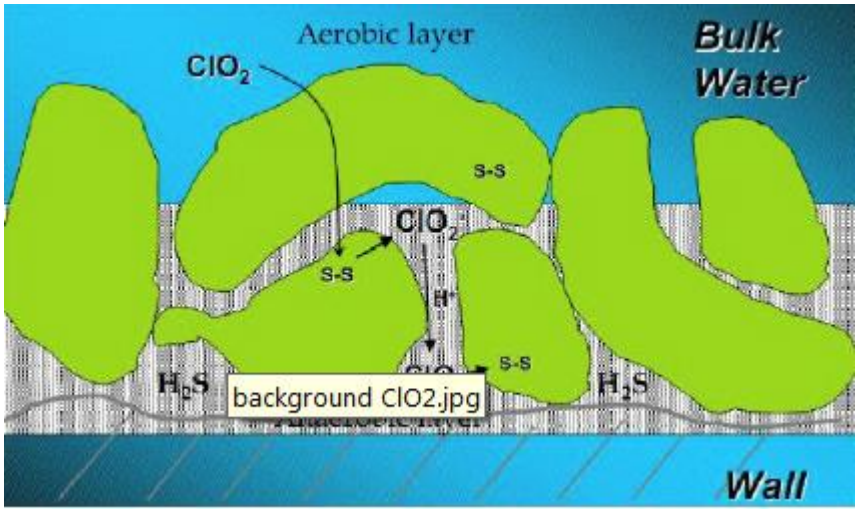


Chlorine dioxide (ETS DMA L75) efficasy and chemical selectivity

HOCl, H2O2 and O3 are indiscriminant disinfectants. They react with all most all organic and inorganic species present.
Chlorine dioxide reacts selective. Reacts rapidly with sulfide and hydroxides. It is less effected by organic contamination.

Chlorine dioxide's (ETS DMA L75) catalytic chemistry in a biofilm layer



ClO2 reacts rapidly with sulfides

- amino acids containing sulfide groups.

- (cystine, thymine, etc.) (cystine, thymine, etc.).
- di -sulfide linkage(s) in protein synthesis.
- H2S from anaerobic bacteria (SRBs).

ClO2 can penetrate biofilm "in search"of these chemical functionality

Iron and Manganese Removal with ETS DMA L75

ETS DMA L75 from Chemoxide is a 0.75% 7500 mg/L solution of practically pure chlorine dioxide in water.
ETS DMA L75 is produced as and when requited by mixing two precursor solutions.
In addition to being an excellent biocide for the control of bacteria, bacterial spores, fungi, protozoa, viruses, algae and biofilm. ETS DMA L75 is used as a pretreatment to aid in the removal of iron and manganese from drinking water and waste water.

Iron and Manganese

Iron (Fe) and manganese (Mn) are responsible for a number of problems with water supplies. Above 0.3 mg/l iron and 0.05 mg/l manganese, these contaminants cause aesthetic problems such as discolouration of water, turbidity. staining and unpleasant taste.
The presence of iron and manganese can also accelerate biological activity further exacerbating taste, odour and colour problems.
Chlorine dioxide selectively oxidises the relatively soluble Fe (II) and Mn (II) to insoluble Fe (III) and Mn (III or IV) species.
The resulting precipitate of Insoluble iron and manganese compounds are removed by filtration or sedimentation followed by tiltration. Any remaining Fe (II) and Mn (II) is removed by hydrated Iron and manganese species coated on the tilter media where the trapped ions are oxldised to the insoluble form.
In addition, chlorine dioxide can oxidise organic complexing agents which assist in keeping iron and manganese in solution. In some cases the chlorine dioxide works by destroying biotilms that encapsulate organically bound metal ions preventing them from being oxidised by conventional oxidising biocides spread or disease-causing bacteria, fungi and viruses.