

# Bioxyl<sup>1000</sup>

Stabilized chlorine dioxide 1000 ppm in water solution



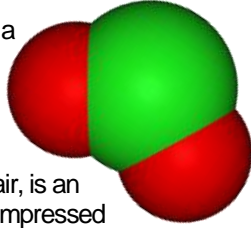
The "solution" effective,  
fast, safe and environmentally  
friendly for all problems of  
sanitization in the industrial  
and institutional



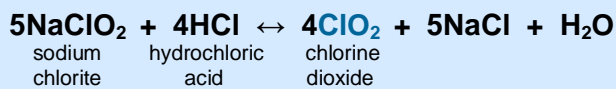
## Introduction - Chemical aspects of Bioxyl 1000

Chlorine dioxide, at room temperature, is a gas of yellowish colour, more dense than air, very soluble in water. It's an energetic oxidizer and has a high virucidal, sporicidal, bactericidal and algicidal power.

Since it, at a certain concentration in the air, is an unstable and explosive gas, it can't be compressed and liquefied and stored in gas tanks, but must be generated in situ by specific plants (generators) or through the use of reagent solutions that require activation by mixture with other reagents, and then solubilized in water.



The chemical reaction that leads to its formation is the following:

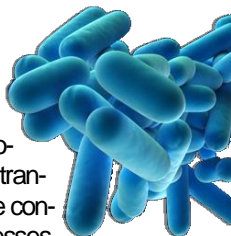


However, the high cost of generation plants and the need for adequate security measures for the handling and storage of the product, have so far allowed the use of chlorine dioxide only in industries characterized by the use of high volumes that justified the investment for the purchase of generators and the safe management of the product, precluding the use in many other small and medium manufacturing facilities.

Hence the idea of AQUOS to develop **Bioxyl 1000**: a solution of stabilized chlorine dioxide that does not have as its objective the replacement of generation facilities on-site, suitable for large users, but the purpose to allow new and effective applications of chlorine dioxide in various industrial and institutional sectors.

## Mode of action of Bioxyl 1000

The active ingredient of **Bioxyl 1000** acts against bacterial cells by penetrating directly through the cell wall because it has activity lipophilic (affinity for membrane phospholipids), and then react with the amino-acids in the cell cytoplasm by interrupting the transfer of nutrients through the wall itself, with the consequent arrest of the cellular metabolic processes.



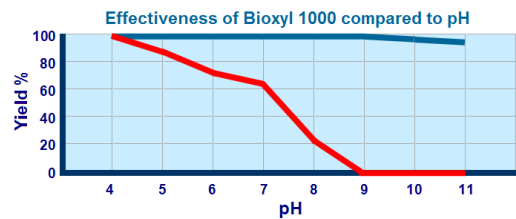
This mode of action prevents the development of bacterial resistance phenomena against the active substance, and this allows, unlike other substances, of not having the need to increase the dosage or periodically replace the product with other biocide substances to ensure over time the efficiency of sanitizer.

Unlike bacterial cells, the virucidal action of **Bioxyl 1000** is determined by its ability to release active oxygen in situ by determining the oxidation of the molecules that constitute the viral structures, and the consequent inactivation.

## Advantages of using Bioxyl 1000

### a) Effectiveness of Bioxyl 1000 depending on pH

**Bioxyl 1000** (stabilized chlorine dioxide 1000 ppm in water solution) is effective in a wide pH range (4 to 11) and temperature, unlike other biocide products of common use such as chlorine and sodium hypochlorite which, when used in solutions with pH values greater than 7 (alkaline solutions), to exert their biocide activity, needing long contact times or, alternatively, very high concentrations that can lead to considerable problems of corrosion to equipment and installations. Unlike chlorine, **Bioxyl 1000** (chlorine dioxide) does not hydrolyze as is the case for the sodium hypochlorite, which generates weak hypochlorous acid which is neutralized in an alkaline medium and therefore its sanitizing activity is not influenced by the pH and its effectiveness is guaranteed in a pH range from 4 to 11.



### b) Use of Bioxyl 1000 and food safety

In the food industry, where it's sometimes often elevated the presence of nitrogen compounds, ammonia and amines, **Bioxyl 1000** is an excellent alternative to chlorine and chlorine derivatives because, not being reactive to these substances, it does not generate hazardous reaction by-products (chloramines).

### c) Bioxyl 1000 and drinking water

While chlorine, widely used in the purification of drinking water, reacts with organic compounds (humic acids) generating organo-chlorinated substances, including the highly carcinogenic compounds such as trihalomethanes (THMs), **Bioxyl 1000** doesn't react with those substances, thus representing a valid alternative in the treatment of drinking water.

### d) Bioxyl 1000 and biofilm

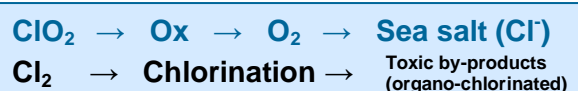
It's scientifically recognized that the chlorine dioxide has, compared to chlorine, a greater ability to attack, destroy and prevent the formation of BIOFILM.

### e) Residual substances after use of Bioxyl 1000

Unlike chlorine, **Bioxyl 1000** doesn't develop active chlorine because chlorine dioxide oxidizes organic substances donating active oxygen and is reduced to chloride ion (Cl<sup>-</sup>) normally found in common table salt.

During the entire process of oxidation by chlorine dioxide doesn't generate any reaction product dangerous for human health and the use of the product does not determine, therefore, no problem of environmental impact.

Chlorine, instead, during the sanitizing process, reacts with the organic substances by oxidizing them by chlorination developing reaction by-products hazardous to human health (organo-chlorinated).




## Differences between chlorine and Bioxyl 1000 - Summary table

Chlorine	Bioxyl 1000 (chlorine dioxide)
Its activity is pH dependent and becomes ineffective above pH 7	It's effective in a wide pH range. Does not hydrolyze in water.
It generates toxic sanitization by-products (organo-chlorinated)	It doesn't create trihalomethanes (THMs), neutralizes phenols and oxides because it frees O <sub>2</sub> (active oxygen)
It has a limited potential oxidative	Oxidizes and precipitates iron and manganese
It reacts with ammonia to form highly carcinogenic chloramines	It doesn't react with ammonia
Do not inactivates chlorinated phenols	It removes the taste and smell of chlorinated phenols from drinking water
Ineffective against particular complex microorganisms (e.g. protozoa and cysts)	Broad spectrum of biocide action even at low concentrations. Ability to inactivate viruses
After sanitizing wastewater require additional treatment to eliminate the harmful by-products before release into the environment	The low dosages required, and the absence of harmful by-products, reduce the need of additional treatment of wastewater
Corrosive action on many metals	Virtually non-corrosive at use concentrations
Its use is banned in some American and European states	It replaced the chlorine in many industrial processes

## Bioxyl 1000 - Effectiveness of biocidal activity

Microorganism	Concentration (ppm)	Contact times	Effectiveness %
Aspergillus Fumigatus	200	60 seconds	99,999
Bacillus Cereus (Spores)	200	5 minutes	99,999
Escherichia Coli	100	30 seconds	99,999
Legionella Pneumophila	25	60 seconds	99,999
Listeria Monocytogenes	100	30 seconds	99,999
Pseudomonas Aeruginosa	100	10 minutes	99,999
Candida Albicans	100	60 seconds	99,999
Staphylococcus Aureus	93	60 seconds	99,999
Klebsiella Pneumoniae	390	30 minutes	99,999
Newcastle Disease Virus	250	20 minutes	100
Pseudorabies Virus	250	20 minutes	100
Canine Parvovirus	250	20 minutes	100

## Physical and chemical properties and safety information about Bioxyl 1000

Physical state	Liquid	<p><b>Hazard Statement (H)</b>                      H315 Causes skin irritation.                      H319 Causes serious eye irritation.                      H335 May cause respiratory irritation.</p> <p><b>Precautionary Statement (P)</b>                      P261 Avoid breathing vapours/spray.                      P280 Wear protective gloves/protective clothing/eye protection/face protection.                      P302+P352 IF ON SKIN: Wash with plenty of soap and water.                      P332+P313 If skin irritation occurs: Get medical advice/attention.                      P362 Take off contaminated clothing and wash before reuse.                      P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.                      P337+P313 If eye irritation persists: Get medical advice/attention.                      P304+P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.                      P312 Call a POISON CENTER or doctor/physician if you feel unwell.                      P403+P233 Store in a well-ventilated place. Keep container tightly closed.                      P501 Dispose of contents/container in accordance with national regulation.</p>
Appearance	Clear	
Colour	Yellow	
Odour	Slight, product specific	
Relative density @ 20 °C	1,000 g/ml	
pH @ 25 °C (as is)	~ 4,00	
Solubility in water	Fully miscible	
Active substance (as ClO <sub>2</sub> )	1000 ppm	
 <b>Warning</b>		



## Compatibility with the materials of Bioxyl 1000

**Bioxyl 1000**, at concentrations above 100 ppm (mg/l):



is stable for a maximum period of 4 months at room temperature (12 ÷ 18 ° C) in containers and tanks constructed with the following materials: **titanium, phenolic resins, 6-Mo steel, PTFE, nylon, fiberglass, Hypalon, PVC, HDPE.**



is compatible with pumps and pipes made with the following materials: **13 Cr steel, 22 Cr steel, 316 L stainless steel, Hastelloy alloys, nylon, PVC, HDPE.**



is compatible with systems of seals and gaskets made with the following elastomers: **Viton, fluorosilicone, FEP, Kalrez.**



is applicable on surfaces and worktops made of the following material: **316 L stainless steel, phenolic resins, nylon, PVC, HDPE, PTFE.**

At concentrations below 100 ppm (mg/l), **Bioxyl 1000** is compatible with most of the materials generally used for the construction of plants, however it is recommended to avoid the use of the product on aluminium, copper alloys and soft metals in general.

## Applications of Bioxyl 1000

### FOOD & BEVERAGE

#### Meat processing and production of cured meats

- Sanitizing of tops and work surfaces
- Sanitizing environments, plants and equipment
- Sanitizing of cold rooms
- Sanitizing of the transport vehicles
- Control of contamination of Salmonella, Listeria
- Control of molds
- Reduction of odors

#### Manufacturing of wine, beer and beverages

- Sanitizing of primary water and process waters
- Sanitizing of cooling water
- Sanitizing of waste water
- Control of odors and mold growth
- Sanitizing of C.I.P. plants (Cleaning In Place) and C.O.P. plants (Cleaning Out Place)
- Sanitizing of cold rooms
- Sanitizing of containers and fermenters
- Sanitizing of tubs, tanks and wine vases

#### Fruit and vegetable processing

- Sanitizing of tops and work surfaces
- Sanitizing plants and environments
- Sanitizing of washing waters and waters transport
- Sanitizing of cold rooms and transport vehicles
- Sanitizing of vegetables\*

\* In the production of salads and IV range products a solution of **Bioxyl 1000** at a concentration of 3 ÷ 5 ppm can be used in the washing steps and bubbling of salads and other vegetable products to prolong their shelf life without altering the natural color and organoleptic qualities.

#### Processing fresh and smoked fish

- Sanitizing of primary water and process waters
- Control of odors, molds and contamination of Listeria
- Sanitizing plants, environments and transport vehicles
- Sanitizing of cold rooms
- Control of bacterial contamination in the manufacture of ice and brine

#### Dairy industry

- Sanitizing of tops and work surfaces
- Sanitizing pasteurizers, filling machines and equipment
- Sanitizing plants and environments
- Control of contamination of Salmonella, Listeria
- Sanitizing of transport vehicles and manufacturing areas
- Sanitizing of C.I.P. plants (Cleaning In Place) and C.O.P. plants (Cleaning Out Place)

#### Manufacturing and packaging of eggs

- Sanitizing eggshells
- Sanitizing of primary water, process waters and waste water
- Sanitizing of cold rooms
- Control of odors and mold growth
- Control of Salmonella infections
- Sanitizing of manufacturing areas

#### Manufacturing frozen foods

- Sanitizing of primary water, process waters, cooling water and waste water
- Sanitizing of cold rooms and cooling tunnel freezers
- Control of odors
- Sanitizing of containers and transport vehicles
- Control of contamination of Listeria
- Sanitizing of C.I.P. plants (Cleaning In Place) and C.O.P. plants (Cleaning Out Place)

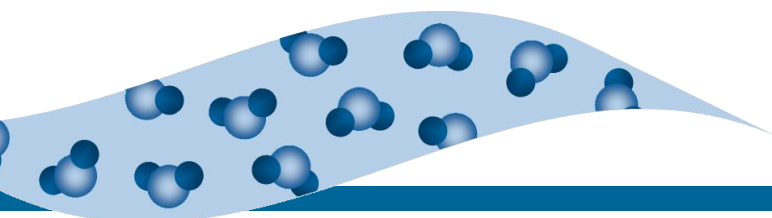


Table permissions U.S.A. about using the product in the food industry (U.S. NFPA and/or FDA)

APPLICATION	NFPA AND/OR FDA APPROVAL	AUTHORIZED DOSAGE
Vegetables and whole fruit and with peel	NFPA and FDA correspondence on 3-11-92	Up to 5 ppm and rinsing with potable water
Whole carrots	NFPA and FDA correspondence on 3-11-92	Up to 5 ppm and rinsing with potable water
Beans and peas with pods	NFPA and FDA correspondence on 12-92	Up to 5 ppm and rinsing with potable water
Defoliated corn on the cob	NFPA and FDA correspondence on 3-11-92	Up to 5 ppm and rinsing with potable water
Peeled and cut potatoes	FDA correspondence on 11-20-95	Up to 1 ppm and rinsing with potable water
Tomatoes	NFPA and FDA correspondence on 3-11-92	Up to 5 ppm and rinsing with potable water
Processing of fruits and vegetables peeled and/or cut	21 CFR 173.300	Up to 3 ppm for washing and then rinsing with clean water, cooking or packaging
Transport or process water in contact with whole poultry carcasses	21 CFR 173.300	Up to 3 ppm of residual chlorine dioxide in the process water that comes in contact with the whole carcasses of chickens
Sanitizing solution	21 CFR 178.1010(b)(46) and 21 CFR 178.1010(c)(40)	From 100 to 200 ppm
Process water and ice in contact with the fish	21 CFR 173.325(d)	From 40 to 50 ppm

## INSTITUTIONAL

### Ho.Re.Ca.

- Sanitizing of tops and work surfaces
- Sanitizing of environments, tools and plants
- Sanitizing of transport vehicles, containers and areas for waste
- Sanitizing and deodorizing bedclothes, pillow covers, towels, kitchen staff uniforms, carpets, etc.

### Hospital, nursing homes, boarding schools

- Removal of BIOFILMS from pipework and tanks
- Biological waste treatment
- Sanitizing medical equipment
- Control and prevention of Legionella in water systems and air conditioning systems
- Sanitizing equipment and environments
- Control and elimination of odors
- Sanitizing of transport vehicles
- Sanitizing and deodorizing of clothing of health personnel, bedclothes, pillow covers, clothing, etc.

## ZOOTECHNY

### Herds of cattle, pigs, sheep, poultry, etc.

- Removal of BIOFILMS
- Sanitizing of equipment, environments, vehicles and garbage containers
- Sanitizing of drinking water of the animals
- Control and elimination of odors

## WATER TREATMENT

### Civil and industrial waste systems

- Oxidation of organic pollutants (surfactants, phenols, sulfides, cyanides, etc.)
- Improvement of sludge sedimentation
- Reduction of turbidity and color

### Water treatment for cooling towers

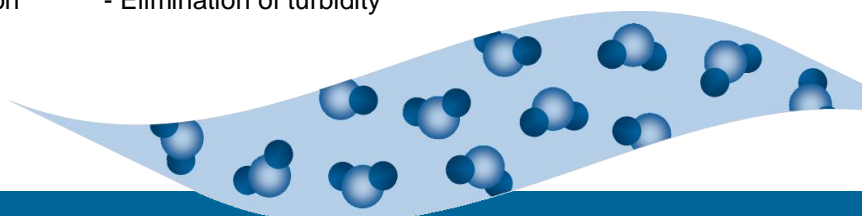
- Control and prevention of Legionella infections
- Removal of BIOFILMS
- Control of algal proliferation
- Sanitization of internal surfaces and plate packs
- Control of odors

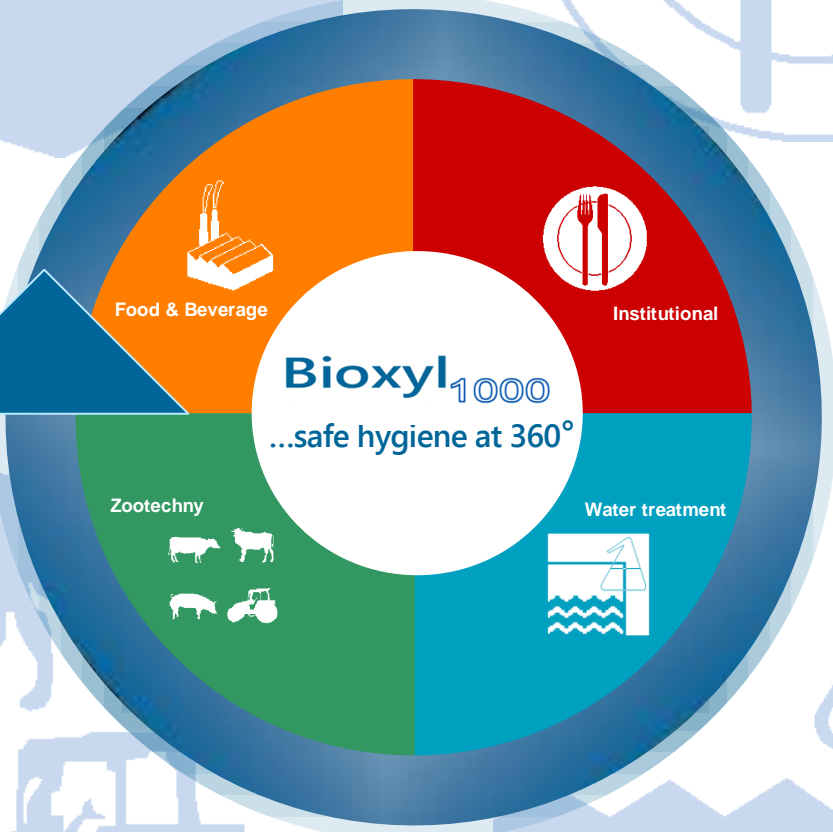
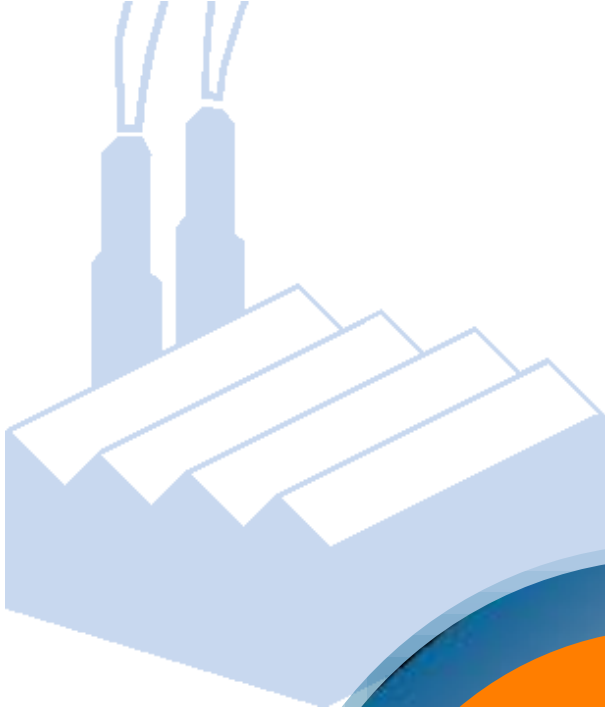
### Treatment of air conditioning equipment

- Control and prevention of Legionella infections
- Removal of BIOFILMS
- Sanitization of pipelines, grids and plate packs
- Sanitization of drain lines and of the condensate collection tanks

### Water treatment of swimming pools - Fountains

- Control of algal proliferation
- Removal of BIOFILMS
- Microbiological control
- Elimination of turbidity





**AQUOS**   
**Chemical Corporation**  
*...a little magic for a perfect clean*

P.zza Regina Margherita, 24  
 80040 San Gennaro Vesuviano (NA) - Italy

- (+39) 081 3415947
- (+39) 081 3415947
- (+39) 345 1116363
- (+39) 392 9513074

[www.aquoschemical.it](http://www.aquoschemical.it)  
[info@aquoschemical.it](mailto:info@aquoschemical.it)

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