GREEN Q

Your Partner for Purity

Hospitals **sterilization**

Elimination of bacterial and viruses,
odor removal and waste management

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GREEN Q
Your Partner for Purity

K-system for a healthy life without discrimination

Introduction of pure nano chlorine dioxide for perfect quarantine and sterilization of hospitals

PURE NANO CHLORINE DIOXIDE VIRUS ZERO 6000

ClO_2

Disinfectant Environmental Friendliness
Stability Deodorization Sterilization Persistence

What is chlorine dioxide?

Chlorine dioxide is a compound of oxygen and chlorine, which is already recog nized by all international organizations such as WHO, EPA, FDA, JECFA, USD, HACCP and KFDA and is a fully functional disinfectant for medical and food a dditives. However, chlorine dioxide is not a chlorine-based disinfectant, but an oxygen-b ased disinfectant that functions with powerful disinfecting power of oxygen. In o ther words, it has been used worldwide as a disinfectant for drinking water for t he past 100 years and is not the 'Chlorine' that generates toxic substances. Chlorine dioxide is a perfect eco-friendly disinfectant that does not destroy any amino acids in the body and does not cause any harmful substances. Especially, it has a remarkable function to kill all bacterial molds in a minute and remove odor as well as high-risk viruses such as SARS, COVID19.

Characteristics of chlorine dioxide

- WHO, grade A1 envir onmentally safe
- 2 ~ 10Ph wide area strong sterilization power, Virus multiplication removal
- Almost all odor removal Remove the causative substances
- World's highest concentration (6000PPM) and longest storage capacity

Sterility of virus zero

Sterility	It has more than 250% oxidative power and more than 500% disinfection ability (CT value) than chlorinated products.
Stability	No disinfection by-products from ozone, sodium hypochlorite (chlorine) (THMs, HAAs, HANs, etc.)
Deodorant, bleaching power	Removing the root cause of malodorous odor, odor, fungi and fermenting bacteria
Environmental friendliness	It is easily and quickly decomposed by light, so it is harmless to the human body and does not cause environmental damage

Division	E. coli	Yellow staphylococcus	Bacillus subtilis	Yeast mold
Alcohol	500,000	500,000	500,000	500,000
Sodium hypochlorite	10	10	1,000	1,000
VIRUS ZERO	1	1	10	10

Classification	VIRUS ZERO	Chlorine	Ozone	UV
Storage	18 Month	Several hours	Several minutes	-
Raw material for production	HCl and NaClO2 or electrolysis	Chlorine gas, hypochlorite or electerolysis	Air or oxidization, electric energy	Electric energy
Sterilization (Oxidization) Power	2.5~5 times more than chlorine	Good	Strong instant sterilization	Affected greatly by chromaticity and turbidity
Protozoa Removal	High	Low (Smell causing)	Almost none	Almost none
Deodorization Power	Very Good	Almost none	None	Very Low
icn. Marganese, Phenol Removal	Very Good	None	None	None
pH Range	2~10	6.5~7.5	6.5~7.5	-
Corrosiveness	Weak	Yes	Very Strong	None
Disinfection By products (DBPs)	None	THM, HAA, HAN, etc.	Cyanogen bromide etc.	None

Sterility of virus zero

Data: Journal Of Food Protection. Vol43. June. 1980

Object	Time required (seconds)	Required PPM	Mortality rate(%)
E. coli	41	0.25	99.0
Bacillus	150	0.25	99.9
0-157 fungi	150	0.25	99.9
Staphylococcus	150	1.00	99.9
Salmonella	300	2.00	99.9
Pneumoniae	300	0.11	99.9
Shigella	300	0.12	99.9
Typhoid	300	0.03	99.9
Bacillus subtilis	300	1.00	99.9

VIRUS ZERO deodorization performance

DATA: Environmental Clean Technology Research Center, Suwon University

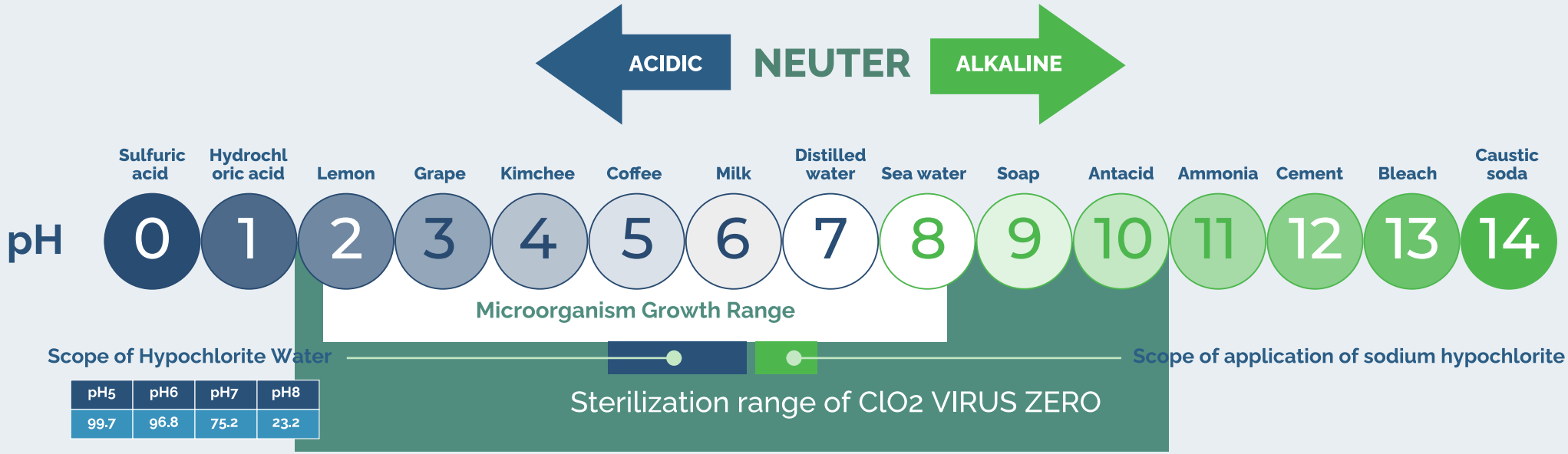
Item	Hydrogen sulfide	Methy mercaptan	Sulfurou methyl	Methyl sulfide	Ammonia
BEFORE	729.0ppb	57.1ppb	12.5ppb	13.5ppb	420ppm
AFTER	26.9ppb	null	7.3ppb	null	35ppm
ROMOVER RA TE(%)	96.3	100	41.6	100	83

Possible deodorization main material DATA: USA VULCAN Technical Data Sheet

ITEM	ITEM
Sulfides	Ammonia
Reduced Sulfur Compounds	Aldehydes
Nitrogen Compounds	Amines
Cyanides	Mercapatans
Phenols	THM precursors
Manganese	VOCs

Sterilization range of ClO2 VIRUS ZERO

pH of p means power and H stands for hydrogen ion. In other words, pH means hydrogen ion index. Pure water has a pH of 7, which is called neutral, and if it is less than 7, it is acidic and if it is higher than 7, it is alkaline.



pH5	pH6	pH7	pH8
99.7	96.8	75.2	23.2

Disinfection Persistence

Unlike chlorine, no bacterial reproduction

Non-toxic

Only traces of no n-toxic residues ar e produced after d ecomposition

No carcinogens

No carcinogens, THM, chloroamine, chlorophenol, etc

Heavy metal removal

Oxidizes or structurally destroys odor sources such as hydrogen sulfide and phenol

Bacterial film removal

Excellent efficacy i n removing bacterial cell mem branes

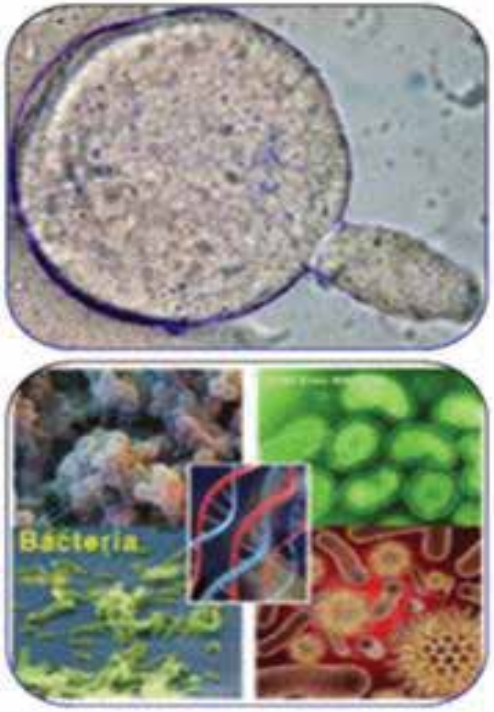
Reactivity & high sterilization power

Has 2.5 times stronger sterilizing power and 5 times more disinfecting power than chlorinebased

Selectivity

Selectively reacts with substances requiring disinfection

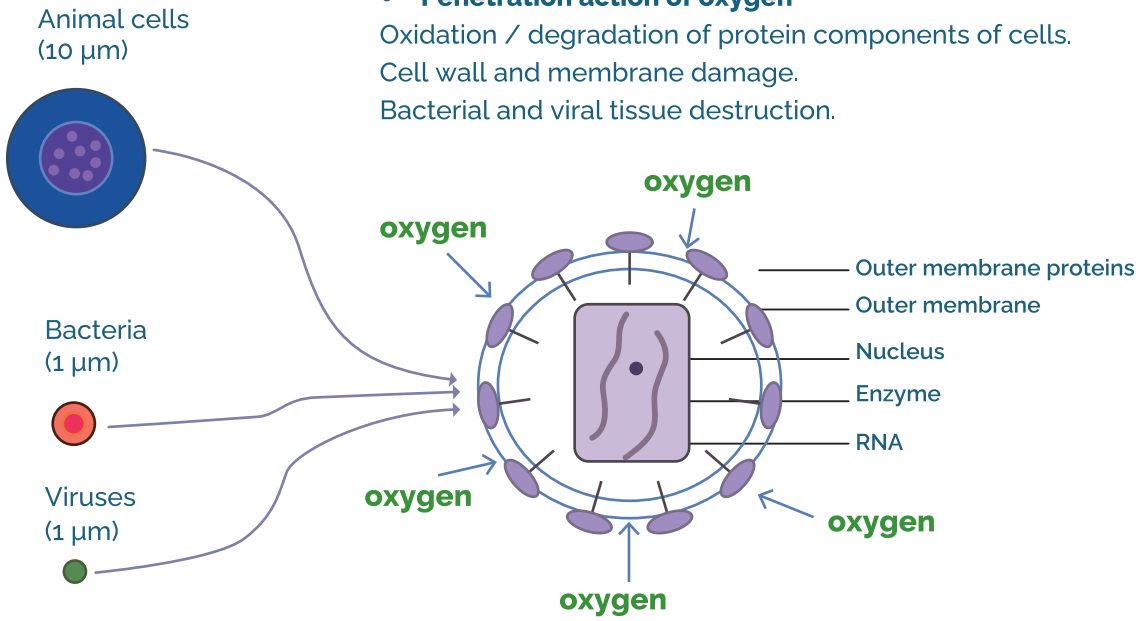
Operating principle of the VIRUS ZERO

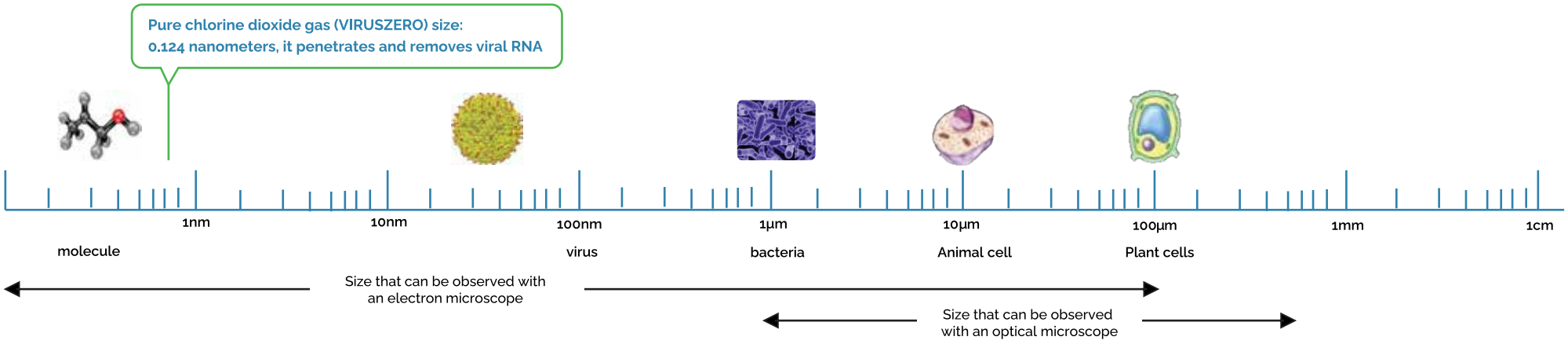


Operating principle of ClO2
Destroy the protein structure of the cell

- **Penetration action of oxygen**

Oxidation / degradation of protein components of cells.
Cell wall and membrane damage.
Bacterial and viral tissue destruction.





Comparison with other disinfectants

Division	Chlorine Dioxide / VIRUS ZERO (ClO_2)	Sodium hypochlorite (HOCL) Or NaOCL	Soft acidic hypochlorous acid (HOCL)
Selectivity	Does not react with organics resulting in no byproducts	Chlorine reacts with almost all compounds, resulting in oxidation, substitution and addition. Therefore, the efficacy is remarkably lowered in the places with high pollution.	It can be used only at concentration close to the stock solution, and its utilization is low at high pollution. (Ie, it cannot be diluted with water and the stock solution must be used as it is)
Disinfection Persistence	Strong penetration into the membrane of microorganisms There can be greatly suppressed bacteria and breeding.	Frequent regeneration of bacteria due to poor disinfection	Bacteria with strong outer membranes have poor persistence and bactericidal power.
Disinfection By Products	Almost no disinfection by-products are produced by oxidation and reduction	Produces 600 kinds of carcinogenic by-products such as trihalomethane (THMs), haloacetic acid (HAAs) and haloacetonitrile (HANs).	Low concentrations and neutral pH do not produce byproducts.
Protozoa and Heavy Metal Removal Ability	Microbial control ability is about 5 times stronger than chlorine, and remains in food Decomposes pesticides and removes iron, manganese, phenols and toxic substances.	Poor inactivation of protists and removal of heavy metals. Poor odor when chlorine disinfectant is used in phenol.	Capable of controlling microorganisms but not removing heavy metals
Responsive	Sterilization at a wide pH range of 2 to 10	Increasing pH sharply decreases bactericidal power, Hypochlorite is separated according to pH and converted into hypochlorite ions	Sterilization is possible only in the range of Ph5 ~ 7, and can be generated only up to 200ppm, and it is not sterilized or deodorized below 60ppm.

Characteristic	Chlorine dioxide	Chlorine
Sterilization power (Escherichia coli 99% or more sterilization standard)	pH8.5-0.25ppm-41second	pH8.5-0.25ppm-60second
Odor concentration	17ppm	0.35ppm
THMs Concentration occurs	Not applicable	10hours - 0.25mol/ℓ
Concentration for sterilization of drinking water	0.1 ~ 0.2ppm	0.2 ~ 0.4ppm
Oxidative power	2.5 times of chlorine	1

**Comparison of chlorine dioxide and chlorine characteristics

Target organism	Time (seconds)	Density(ppm)	Mortality rate(%)
E. coli	41	0.25	99
Pneumoniae	300	0.01	99.9
Staphylococcus	300	0.12	99.9
Poisonous fungus	300	0.01	99.9
Typhoid	300	0.03	99.9
Gypsum	300	1.00	99.9

Journal Of Food Protection.Vol.43.June.1980

Division	PURE CHLORINE DIOXIDE VIRUSZERO(ClO2)	CHLORINE BASIC CHLORINE	HYDROGEN PEROXIDE
Kind		•CHLORINE •SODIUM HYPOCHLORITE (HOCl)	
Advantages	• It does not react with organic matter and does not generate by-products. • Strongly penetrates the microbial membrane and has the effect of removing the bacterial membrane, greatly suppressing the reproduction of bacteria. • Disinfection by-products are rarely generated through oxidation and reduction reactions. • The ability to remove microorganisms is about 5 times stronger than that of chlorine, decomposing pesticides remaining in food and removing iron, manganese, phenol, and toxic substances. • Maintains sterilizing power in a wide pH range of 2 to 10. • Chlorine dioxide gas is smaller than the virus and penetrates the RNA of the virus and kills it.	• It has been used for the longest time because of its low cost and low maintenance cost. • Storage of materials is stable	• Oxygen meter • It is colorless, transparent, and has no odor, but sometimes it sterilizes by oxidizing bacteria with a liquid that smells like ozone. • The International Cancer Research Institute (IARC), affiliated with the United Nations, recognizes that hydrogen peroxide is a substance that is difficult to classify as causing cancer in humans if it is used in the recommended reference amount (Class 3 group) • It is mainly discharged into the air, and the hydrogen peroxide released is rapidly decomposed by reacting with other compounds, and is apidly decomposed in water or soil, so it hardly remains in the environment.
Disadvantages	• As it was impossible to concentrate and store, it was impossible for the general public to use it except large-scale waterworks, wastewater treatment plants, and source mining sites. • KFC's pure nano chlorine dioxide is stored at 6000PPM and can be maintained for up to 18 months. When producing directly on site, it can produce up to 20,000ppm.	• Since chlorine reacts with almost all compounds, oxidation, substitution, and addition reactions occur, so utilization is poor in places with high contamination. • The disinfection persistence is low, so the bacteria cannot be completely removed, causing frequent regrowth. • It produces over 600 species of carcinogens such as trihalomethane (THMs), haloacetic acid (HAAs), and haloacetonitrile (HANs). • Inactivation of protozoa and low ability to remove heavy metals. When using chlorine disinfectants in phenol, it causes odor. • As the pH increases, the sterilizing power decreases rapidly, and hypochlorous acid dissociates according to the pH, turning into hypochlorite ion.	• Breathing hydrogen peroxide (3% concentration) for household use may cause respiratory irritation or mild irritation when entering the eyes. • At concentrations above 3%, stomach ulcers or corneal perforation may occur, skin and hair may be temporarily discolored, and severe burns and blisters may occur. • At concentrations above 10%, severe irritation of the respiratory tract may occur and symptoms such as vomiting and stomach swelling may occur even if diluted hydrogen peroxide solution is ingested. • Dilution rate is too small. The best concentration of hydrogen peroxide is 35%, but when diluted to 9% ~ 3%, it should be diluted 3.8 ~ 11.2 times. • Low disinfection ability.

EPA U.S. Environmental Protection Agency (Hospitals, medical and nursing facilities)

Where to use	EPA Registration Number	Application method	Application rate and frequency
Ice factory and machinery	9804-9, 9804-1, 9804-5	Pump, injection	20 ppm
Canned sterilization device and pasteurizer	9150-2, 9150-3, 9804-9	Chemical pump	5 ppm
Stainless transportation equipment, coolers, and the low-temperature sterilizer	9150-2, 9150-3 9804-9, 9804-1	Mixing, filling	20 ppm
Hospital food : Vegetable washing water and tank line	9150-2, 9150-3, 9804-1	Pump, injection	5 ppm
Drinking water	59055-1	Metering pump	1 ppm or less
	9150-2, 9150-3 9804-1, 9804-5,9150-9		5 ppm

Dental Clinic: Dental-related fungicides	9150-3, 9804-1	Applicable equipment	500 ppm
General sterilization of public institutions such as hospitals, nursing, and nursery schools	10589-3 9150-11, 9804-1	Spray	1000 ~ 1406 ppm
Disinfection of hospitals, laboratories, hard and porous surfaces (tile floors and walls, ceilings and stainless steel freezers)	9150-2, 9150-3 9804-1	Spraying, mopping	300 ~ 500 ppm
Disinfection of benches, incubators, stainless steel devices, etc	9150-2, 9150-3 9804-1	Spray	300 ~ 500 ppm

Incubator	**9150-2, 9150-3, 9804-1**	**Bath, water basin**	**300 ppm (Odor and dirt removal: 50 ppm)**
Sterilization of pressure cookers, etc.	**9150-2, 9150-3**	**Spray, injection**	**1000 ppm**
Eliminate odors in animal breeding rooms, hospital rooms, archives and other workplaces	**9150-2, 9150-3 9804-1**	**Spray on ceiling, wall**	**1000 ppm**
Deodorization of accommodation, hospitals and restaurants	**9804-3**	**Spray**	**Spray and wait 10 minutes**
Deodorization of toilets and bathrooms, containers for disposal, diapers, etcrestaurants	**9804-3**	**Spray**	**Spray and wait 10 minutes**
Cooling system	**59055-1, 9804-9, 9804-1**	**Batch processing, quantitative water supply**	**100 ppm 5 ppm**
Cooling system using heavy water system	**9150-2, 9150-3, 9804-9**	**-**	**50 ppm**
Ventilation system	**9804-1**	**Spraying, fumigation**	**500 ppm(10min)**

● ClO2 , Chlorine Dioxide → Eco-friendly oxygen-based disinfectant
First reaction and extraction by Davy in England in 1811.An oxygen-based substance in which chlorine (17th halogen group) and oxygen (oxygen group 16th group) are ionically bond ed.A gas with a freezing point of -59°C, a boiling point of 9.7°C, and a greenish-yellow color at room temperature.

● The **US EPA defines** a sterilizer as able **"to destroy or eliminate all forms of microbial life including fungi, viruses, and all forms of Bacteria and their spores,"** meaning chlorine dioxide will inactivate any form of antimicrobial life including spores

WHO	● Eco-friendly sterilization, disinfection, and deodorant classification criteria → Classified as the highest grade 'A-1' (1999) ● CAS No. : 10049-04-4 ● Evaluation of Hazard Exposure (Fire, Explosion) and Human Exposure (Inhalation/Skin/Eyes/Ingestion)
US FDA / EPA	● US EPA approved as disinfectant ● US EPA approved as disinfectant and disinfectant for drinking water ● US FDA registered as a food additive (21 CFR 173.300) ● EU recommends to Member States as a disinfectant for drinking water ● US FDA permits use of red meat-related products by immersion or spraying (FCN No. 45) ● US EPA, Detailed Uses and Method Regulations (EPA 738-R-06-007) ● Permitted to use in US FDA, red meat processing, canned food, seafood, ice, restaurant tools (FCN No, 668)
EU	● EU Commission: Classification of ClO2 as a drinking water disinfectant (2006) ● Northern Ireland and Ireland: Allowed as a food additive ● France Environment Agency: Permission to use chlorine dioxide as a disinfectant and disinfectant
KOREA Ministry of Environment Ministry of Food and Drug Safety Ministry of Agriculture, Forestry & Livestock	● Ministry of Environment notification 1999-173, sanctioned as food sanitizing disinfectant. ● Ministry of Environment, sewage treatment, chlorine dioxide disinfection facility can work in the best economic evaluation guidelines disinfection ● Designated to be used as sanitizing and disinfecting agent of the Korea Food and Drug Administration Notice 2005-33. ● Notified by Korea Food & Drug Administration Notification No. 2007-74, for the purpose of disinfecting foods such as fruits and vegetables ● Ministry of Agriculture, Forestry and Fisheries, Food Industry Promotion Act No. 9759, Designation and use as a processing aid for organic agricultural products ● Ministry of Agriculture, Forestry and Fisheries, Article 20 of Enforcement Regulation of Livestock Epidemic Prevention Act ● Approved by Korea Food and Drug Administration Notification No. 2009-66, sanitary management material for aquarium ● National Veterinary Research and Quarantine Service, Livestock Specification -1600, Licensed for use in meat processing surface treatment

KFC pure chlorine dioxide (VIRUS Z ERO) certification

FDA	No 10071038
KFDA	No 20160513307
EU	No, 2015/830
ISO9001	No. Q328220
KOREA PATENT	No. 10-1919332, 10-1502503
MINISTER OF ENVIRONMENT	GB20-21-0368
Ministry of Agriculture, Forestry & Livestock	GWANGYANG 012-GA-10406

Characteristics of chlorine dioxide

- Excellent effect for sterilization, disinfection and deodorization.
- An environmentally friendly and safe material that is decomposed by light and produces almost no by-products.
- Excellent sterilization power against almost all parts such as bacteria, viruses, fungi, green algae, and spores (very high in preventing and blocking infectious diseases).
- Removal of harmful substances such as iron, manganese, cyan, and phenol.
- It can be used in various ways for sterilization of drinking water, food, and equipment (approved for food additives by US FDA and Korean FDA).
- Unlike chlorine-based disinfectants and ozone, it does not produce carcinogens.
- The effect of maintaining freshness and extending the preservation period is very high by removing food poisoning bacteria and spoilage bacteria from fish, fruits and vegetables.
- Maintains sterilization effect in a wide pH range (pH2~pH10)
- As it does not react with organic matter, it has superior disinfection durability and no resistance compared to chlorine-based.
- Removal of pesticide residues (removal of pesticide residues on crops)
- Re-reproduction after disinfection is greatly suppressed.
- Root removal of odor-causing bacteria

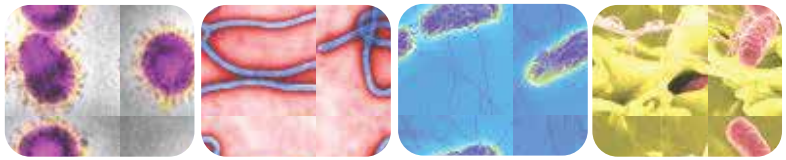
KFC pure nano chlorine dioxide VIRUSZERO Hospital Label

Division	PPM (Dilution ratio)	Reference (Method)	
Water tank cleaning	100PPM (60:1)	Clean once every six months	① Remove the water completely, ② Dilute to 100PPM and spray it sufficiently inside the water tank using a low-pressure sprayer. ③ Leave it for 30 minutes. Bacteria attached to the surface will flow down by themselves. ④ Wash with a high-pressure sprayer, remove the contaminated water completely, and fill it with water.
General Drinking water	0.5 ~1PPM (12,000~ 6000:1)		A metering pump is installed at the area where water enters the tank. Automatic adjustment according to the amount of water flowing
General room (emergency, general office, kitchen, Laundry, baby room	60PPM (100 : 1)	10 seconds ~ 15 seconds (20㎡ standard)	· Set the number of times for each hospital to be autonomous, and sterilize the respiratory and internal disease related roomsonce a day. · Diluted chlorine dioxide is not a problem for adults, but move sensitive babies to other places. · Close food lids before sterilization
Operating room	200PPM (30 : 1)	1time use immed Ately after surgery	Before surgery, sterilization in general space is the same
Vent ducts, etc	200PPM (30 : 1)		The duct needs to know the structure clearly. Identify breeding sites of germs
Surgical tool	120PPM (50 : 1)	Dipping for 1 hour, closing the lid to prevent leaking of chlorine dioxide gas	When sterilizing surgical instruments, first use it after cleaning with general drinking water.
Garbage collection hall	50PPM (120 : 1)	Sterilization for 5 minutes every 2 hours	
Cooking tools	50PPM (120 : 1)	1time a day	Stainless steel, plastic, rubber and wood are no problem. However, in the case of ordinary steel materials, clean with sterile water after sterilization (corrosion protection)
Sterilization of vegetables, fish, etc.	5PPM (1,200 : 1)		Dip for 3 seconds, then take out and wash with normal sterile drinking water.
Outdoor (parking lot, landscaping trees, etc.	60PPM (100 : 1)		Every 15 to 20 days

Chlorine dioxide in an oxygen based Disinfectant, Sterilizer and Deodorizer. It is not Chlorine

The world's first storage · transport technology!

ClO2(Chlorine dioxide) is already recognized as a fully functional disinfectant added for medical use, food from all the international organizations such as WHO, EPA, FDA, JECFA, HACCP, KFDA. Chlorine dioxide, however, because the volatility of the radical type, and can not be stored and carried. However, now it can be stored in long-distance transport by KFC technicians. Chlorine dioxide is a complete environment-friendly disinfectant that does not generate any harmful substance without destroying the amino acid of the living body. In particular, high-risk viruses such as SARS, aAnthrax, fungi, Escherichia coli, Staphylococcus bacterium, Bacillus subtilis, yeast fungi, downy mildew, pestilence, Sclerotinia rot, black blotch, gray mold, wilt, tap rot, Bacterial canker, soft rot, cucumber copperas mosaic, root rot, damping-off, SARS (SARS), HB, bird flu, the elimination of all odors



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