PUREO2STiCK

Anytime, Anywhere

Tick! Tick! Tock!

Portable chlorine dioxide generator

Creating a comfortable space

without Viruses and Bacteria!

JAS-ANZ

ISO 9001 / ISO 14001

Safe Space Cleaner

99.9% of harmful bacteria are removed. Disinfectant for drinking water

Environmentally friendly deodorant

Strong deodorizing removes odor. Oxidation and structural destruction of odor.

Human harmless substance

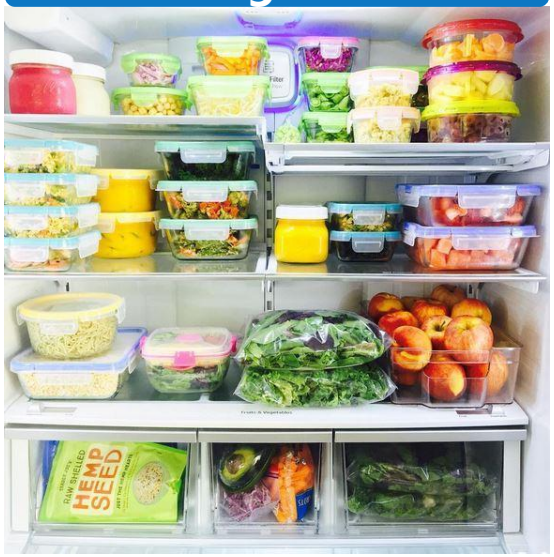
It is colorless, non-alcoholic, non-toxic and harmless to human body.

www.pureclo2.co.kr

PUREO2STiCK

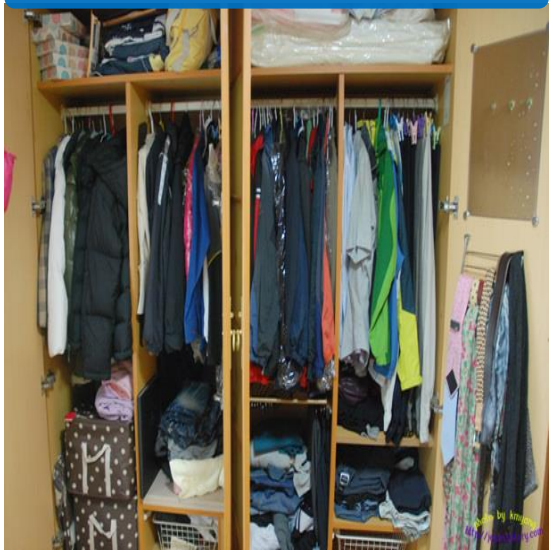
Please use it like this!

Refrigerator



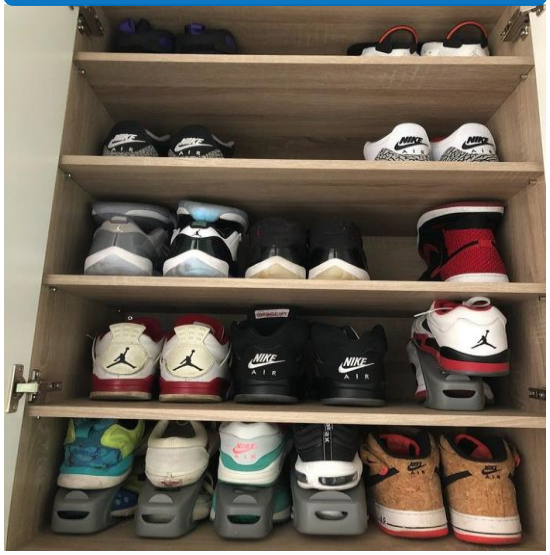
- Sterilization of bacteria, viruses and fungi
- Removes various odors
- Keep freshness of fruits, vegetables and meat

Wardrobe



- Sterilization of bacteria, viruses and fungi
- Unpleasant odor removal

Shoe Closet

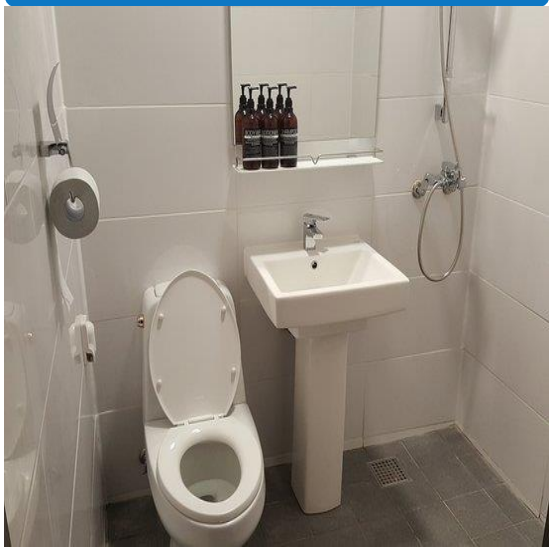


- Sterilization of bacteria, viruses and fungi
- Sterilization of athlete's foot
- Odor elimination

PUREO2STiCK

Please use it like this!

Bathroom

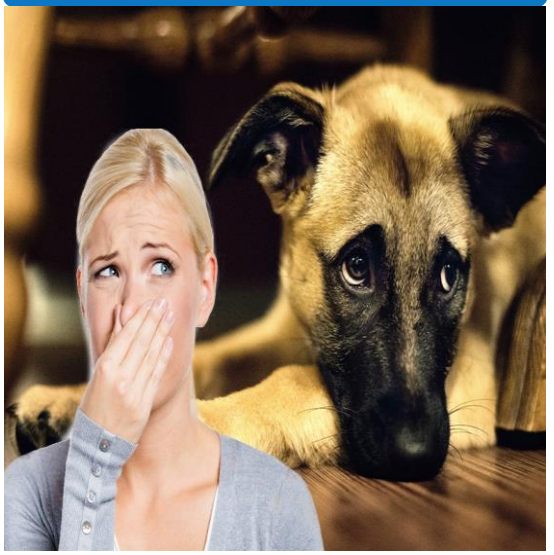


• Sterilization of bacteria, viruses and fungi
• Odor elimination

Vehicle Interior

• Sterilization of bacteria, viruses and fungi
• Unpleasant odor removal
• Decomposition of nicotine residues in air

Pets

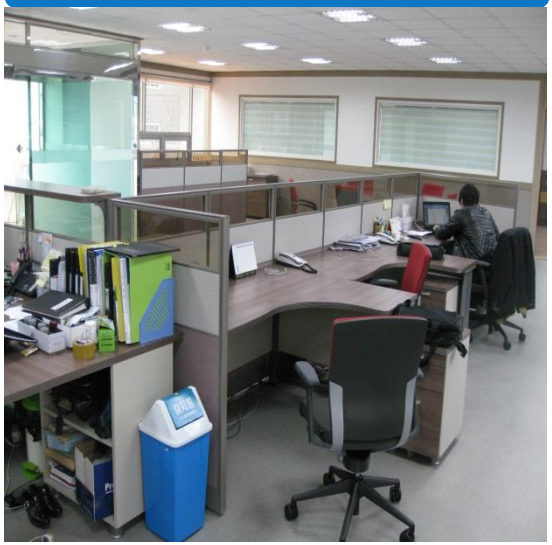


• Sterilization of bacteria, viruses and fungi
• Animal odor removal

PUREO2STiCK

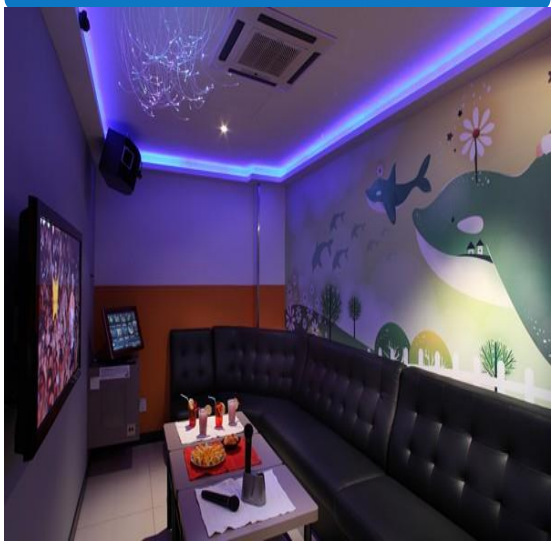
Please use it like this!

Offices



- Sterilization of bacteria, viruses and fungi
- Removes various odors

KTV or Room



- Sterilization of bacteria, viruses and fungi
- Unpleasant odor removal
- Decomposition of nicotine residues in air

Sink

- Sterilization of bacteria, viruses and fungi
- Food odor removal

PUREO2STiCK

Odors, Bacteria, Viruses, Mold Eradication!

PUREO2
STiCK

Sterilization Target

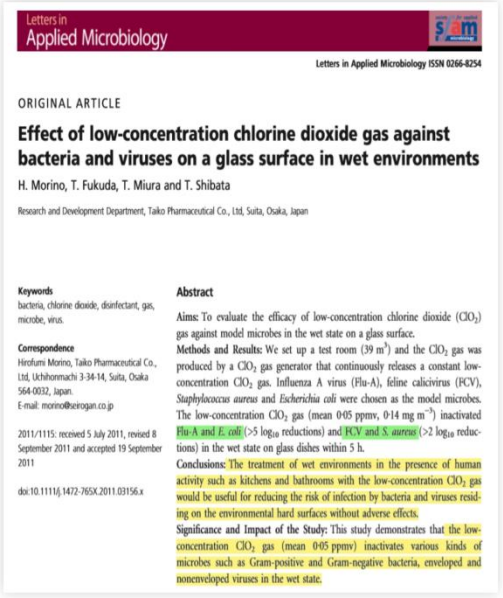
- Coronavirus (cold, acute respiratory syndrome)
- H1N1 (swine flu)
- Norovirus (the cause of epidemic gastroenteritis)
- Legionella (airborne contagion)
- Staphylococcus (food poisoning, pneumonia, otitis media, cystitis)
- Pneumococcus (pneumonia)
- Bacillus (conjunctivitis, iritis)
- Staphylococcus aureus (meningitis, cystitis, prostatitis)
- Streptococcus (pyogenic disease, sexually transmitted disease, rheumatic fever)
- E-coil 0157 (Intestinal Hemorrhagic Escherichia coli)
- Dermatological fungus (Athlete's foot)

Deodorant Target

- Metal mercaptans (Vegetable rotten smell)
- hydrogen sulfide (egg rotting odor)
- Ammonia (strong odor of disinfectant)
- Trimethylamine (odor from fish)
- Tobacco odor
- Propionaldehyde
- Toluene

Chlorine dioxide

Chlorine dioxide, which is the main ingredient, is well known to be effective against viruses even in SCI-level papers that are recognized worldwide.



Letters in Applied Microbiology

Letters in Applied Microbiology ISSN 0266-8254

ORIGINAL ARTICLE

Effect of low-concentration chlorine dioxide gas against bacteria and viruses on a glass surface in wet environments

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Keywords
bacteria, chlorine dioxide, disinfectant, gas, microbe, virus.

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2011/1115: received 5 July 2011, revised 8 September 2011 and accepted 19 September 2011

doi:10.1111/j.1472-765X.2011.03156.x

Abstract

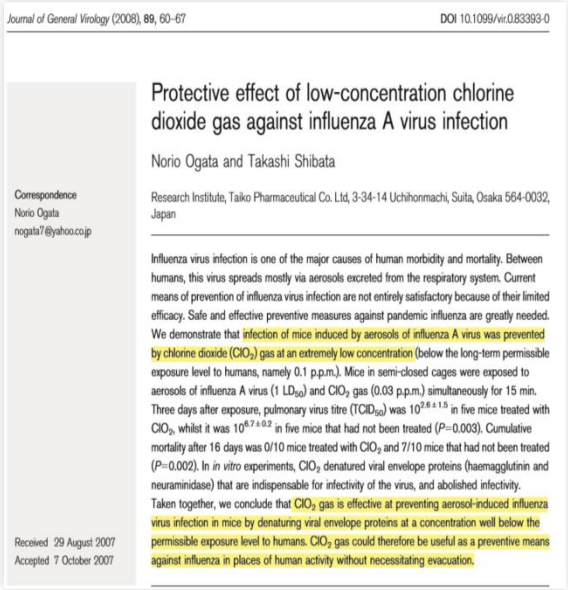
Aims: To evaluate the efficacy of low-concentration chlorine dioxide (ClO_2) gas against model microbes in the wet state on a glass surface.

Methods and Results: We set up a test room (39 m^3) and the ClO_2 gas was produced by a ClO_2 gas generator that continuously releases a constant low-concentration ClO_2 gas. Influenza A virus (Flu-A), feline calicivirus (FCV), *Staphylococcus aureus* and *Escherichia coli* were chosen as the model microbes. The low-concentration ClO_2 gas (mean 0·05 ppmv, 0·14 mg m^{-3}) inactivated Flu-A and *E. coli* (>5 $\log_{10}$ reductions) and FCV and *S. aureus* (>2 $\log_{10}$ reductions) in the wet state on glass dishes within 5 h.

Conclusions: The treatment of wet environments in the presence of human activity such as kitchens and bathrooms with the low-concentration ClO_2 gas would be useful for reducing the risk of infection by bacteria and viruses residing on the environmental hard surfaces without adverse effects.

Significance and Impact of the Study: This study demonstrates that the low-concentration ClO_2 gas (mean 0·05 ppmv) inactivates various kinds of microbes such as Gram-positive and Gram-negative bacteria, enveloped and nonenveloped viruses in the wet state.

Against Flu-A, E. coli, FCV and S. aureus



Journal of General Virology (2008), **89**, 60–67 DOI 10.1099/vir.0.83393-0

Protective effect of low-concentration chlorine dioxide gas against influenza A virus infection

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Influenza virus infection is one of the major causes of human morbidity and mortality. Between humans, this virus spreads mostly via aerosols excreted from the respiratory system. Current means of prevention of influenza virus infection are not entirely satisfactory because of their limited efficacy. Safe and effective preventive measures against pandemic influenza are greatly needed. We demonstrate that infection of mice induced by aerosols of influenza A virus was prevented by chlorine dioxide (ClO_2) gas at an extremely low concentration (below the long-term permissible exposure level to humans, namely 0.1 p.p.m.). Mice in semi-closed cages were exposed to aerosols of influenza A virus (1 LD_{50}) and ClO_2 gas (0.03 p.p.m.) simultaneously for 15 min. Three days after exposure, pulmonary virus titre ($TCID_{50}$) was $10^{2.6\pm1.5}$ in five mice treated with ClO_2, whilst it was $10^{6.7\pm0.2}$ in five mice that had not been treated (P=0.003). Cumulative mortality after 16 days was 0/10 mice treated with ClO_2 and 7/10 mice that had not been treated (P=0.002). In *in vitro* experiments, ClO_2 denatured viral envelope proteins (haemagglutinin and neuraminidase) that are indispensable for infectivity of the virus, and abolished infectivity. Taken together, we conclude that ClO_2 gas is effective at preventing aerosol-induced influenza virus infection in mice by denaturing viral envelope proteins at a concentration well below the permissible exposure level to humans. ClO_2 gas could therefore be useful as a preventive means against influenza in places of human activity without necessitating evacuation.

Received 29 August 2007
Accepted 7 October 2007

Against influenza A virus

Infection, Genetics and Evolution 67 (2019) 78–87

Contents lists available at ScienceDirect

Infection, Genetics and Evolution

journal homepage: www.elsevier.com/locate/meegid

Research paper

Chlorine dioxide inhibits the replication of porcine reproductive and respiratory syndrome virus by blocking viral attachment

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ARTICLE INFO

Keywords:
PRRSV
Chlorine dioxide
Antiviral activity

ABSTRACT

Porcine reproductive and respiratory syndrome virus (PRRSV) causes a great economic loss to the swine industry globally. Current prevention and treatment measures are not effective to control the outbreak and spread of porcine reproductive and respiratory syndrome (PRRS). In other words, new antiviral strategies are urgently needed. Chlorine dioxide (ClO_2) is regarded as a broad-spectrum disinfectant with strong inhibitory effects on microbes and parasites. The purpose of this study was to evaluate the inhibitory effects and underlying molecular mechanisms of ClO_2 against PRRSV infection in vitro. Here, we identified ClO_2 (the purity is 99%) could inhibit the infection and replication of PRRSV in both Marc-145 cells and porcine alveolar macrophages (PAMs). ClO_2 could block PRRSV binding to cells rather than internalization and release, suggesting that ClO_2 blocks the first stage of the virus life cycle. We also demonstrated that the inhibition exerted by ClO_2 was attributed to the degradation of PRRSV genome and proteins. Moreover, we confirmed that ClO_2 could decrease the expression of inflammatory cytokines induced by PRRSV. In summary, ClO_2 is an efficient agent and potently suppressed PRRSV infection in vitro.

Against virus(PRRSV)

★ SCI(Science Citation Index)급 논문 : 미국의 과학 기술분야 학술잡지 중 엄격한 선정 기준에 의하여 선별한 저명 학술지를 의미하며, 해당 학술지에 게재된 논문

⊡ Chlorine Dioxide Efficacy List

43 Studies worldwide. 190 species of germs and molds are killed

Bacteria	Ref.
Blakeslea trispora	28
Bordetella bronchiseptica	8
Brucella suis	30
Burkholderia mallei	36
Burkholderia pseudomallei	36
Campylobacter jejuni	39
Clostridium botulinum	32
Corynebacterium bovis	8
Coxiella burneti (Q-fever)	35
E. coli ATCC 11229	3

Bacteria	Ref.
E. coli ATCC 51739	1
E. coli K12	1
E. coli O157:H7 13888	1
E. coli O157:H7 204P	1
E. coli O157:H7 ATCC 43895	1
E. coli O157:H7 EDL933	13
E. coli O157:H7 G5303	1
E. coli O157:H7 C7927	1
Erwinia carotovora (soft rot)	21
Franscicella tularensis	30

Bacteria	Ref.
Fusarium sambucinum (dry rot)	21
Fusarium solani var. coeruleum (dry rot)	21
Helicobacter pylori	8
Helminthosporium solani (silver scurf)	21
Klebsiella pneumonia	3
Lactobacillus acidophilus NRRL B1910	1
Lactobacillus brevis	1
Lactobacillus buchneri	1
Lactobacillus plantarum	5
Legionella	38
Legionella pneumophila	42
Leuconostoc citreum TPB85	1
Leuconostoc mesenteroides	5
Listeria innocua ATCC 33090	1
Listeria monocytogenes F4248	1
Listeria monocytogenes F5069	19
Listeria monocytogenes LCDC-81-861	1
Listeria monocytogenes LCDC-81-886	19
Listeria monocytogenes Scott A	1
Methicillin-resistant Staphylococcus aureus (MRSA)	3
Multiple Drug Resistant Salmonella typhimurium (MDRS)	3
Mycobacterium bovis	8
Mycobacterium fortuitum	42
Pediococcus acidilactici PH3	1
Pseudomonas aeruginosa	3
Pseudomonas aeruginosa	8
Salmonella	1
Salmonella spp.	2
Salmonella Agona	1
Salmonella Anatum Group E	1
Salmonella Choleraesins ATCC 13076	1
Salmonella choleraesuis	8
Salmonella Enterica (PT30) BAA-1045	1
Salmonella Enterica S. Enteritidis	13
Salmonella Enterica S. Javiana	13
Salmonella Enterica S. Montevideo	13

Bacteria	Ref.
Vibrio strain Sr-3	37
Yersinia enterocolitica	40
Yersinia pestis	30
Yersinia ruckeri ATCC 29473	31

Viruses	Ref.
Adenovirus Type 40	6
Calicivirus	42
Canine Parvovirus	8
Coronavirus	3
Feline Calici Virus	3
Foot and Mouth disease	8
Hantavirus	8
Hepatitis A Virus	3
Hepatitis B Virus	8
Hepatitis C Virus	8
Human coronavirus	8
Human Immunodeficiency Virus	3
Human Rotavirus type 2 (HRV)	15
Influenza A	22
Minute Virus of Mouse (Parovirus)(MVM-i)	8
Minute Virus of Mouse (Parovirus)(MVM-p)	8
Mouse Hepatitis Virus (MHV-A59)	8
Mouse Hepatitis Virus (MHV-JHM)	8
Mouse Parvovirus type 1 (MPV-1)	8
Murine Parainfluenza Virus Type 1 (Sendai)	8
Newcastle Disease Virus	8
Norwalk Virus	8
Poliovirus	20
Rotavirus	3
Severe Acute Respiratory Syndrome (SARS) Coronavirus	43
Sialodscryoadenitis Virus (Coronavirus)(SDAV)	8
Simian rotavirus SA-11	15
Theiler's Mouse Encephalomyelitis Virus (TMEV)	8
Vaccinia Virus	10

▣ Chlorine Dioxide Efficacy List

Bacteria	Ref.
Salmonella Enteritidis E190-88	1
Salmonella Javiana	1
Salmonella newport	4
Salmonella Typhimurium C133117	1
Salmonella Anatum Group E	1
Shigella	38
Staphylococcus aureus	23
Staphylococcus aureus ATCC 25923	1
Staphylococcus faecalis ATCC 344	1
Tuberculosis	3
Vancomycin-resistant Enterococcus faecalis (VRE)	3
Vibrio strain Da-2	37

Algae/Fungi/Mold/Yeast	Ref.
Aspergillus egyptiacus	28
Aspergillus elongatus	28
Aspergillus fischeri	28
Aspergillus fumigatus	28
Aspergillus giganteus	28
Aspergillus longivesica	28
Aspergillus niger	12
Aspergillus ochraceus	28
Aspergillus parvathecius	28
Aspergillus sydowii	28
Aspergillus unguis	28
Aspergillus ustus	28
Aspergillus versicolor	28
Botrytis species	3
Candida spp.	5
Candida albicans	28
Candida dubliniensis	28
Candida maltosa	28
Candida parapsilosis	28
Candida sake	28
Candida sojae	28
Candida spp.	5
Candida tropicalis	28
Candida viswanathii	28
Chaetomium globosum	7
Cladosporium cladosporioides	7
Debaryomyces etchellsii	28
Eurotium spp.	5
Fusarium solani	3
Lodderomyces elongisporus	28
Mucor circinelloides	28
Mucor flavus	28
Mucor indicus	28
Mucor mucedo	28
Mucor rademosus	28
Mucor ramosissimus	28
Mucor saturnus	28
Penicillium chrysogenum	7

Algae/Fungi/Mold/Yeast	Ref.
Alternaria alternata	26
Aspergillus aeneus	28
Aspergillus aurolatus	28
Aspergillus brunneo-uniseriatus	28
Aspergillus caespitosus	28
Aspergillus cervinus	28
Aspergillus clavatonanicus	28
Aspergillus clavatus	28

Bacterial Spores	Ref.
Alicyclobacillus acidoterrestris	17
Bacillus coagulans	12
Bacillus anthracis	10
Bacillus anthracis Ames	30
Bacillus atrophaeus	14
Bacillus atrophaeus ATCC 49337	31
Bacillus megaterium	12
Bacillus polymyxa	12
Bacillus pumilus ATCC 27142	12
Bacillus pumilus ATCC 27147	11
Bacillus subtilis (globigii) ATCC 9372	11
Bacillus subtilis ATCC 19659	31
Bacillus subtilis 5230	12
Clostridium. sporogenes ATCC 19404	12
Geobacillus stearothermophilus ATCC 12980	11
Geobacillus stearothermophilus ATCC 7953	31
Geobacillus stearothermophilus VHP	11
Bacillus thuringiensis	18

Chemical Decontamination	Ref.
Mustard Gas	
Ricin Toxin	10
dihydronicotinamide adenine dinucleotide	24
microcystin-LR (MC-LR)	25
cylindrospermopsin (CYN)	25

Beta Lactams	Ref.
Amoxicillin	29
Ampicillin	29
Cefadroxil	29
Cefazolin	29
Cephalexin	29
Imipenem	29
Penicillin G	29
Penicillin V	29

Algae/Fungi/Mold/Yeast	Ref.
Penicillium digitatum	3
Penicillium herquei	28
Penicillium spp.	5
Phormidium boneri	3
Pichia pastoris	3
Poitrasia circinans	28
Rhizopus oryzae	28
Roridin A	33
Saccharomyces cerevisiae	3
Stachybotrys chartarum	7
T-mentag (athlete's foot fungus)	3
Verrucarin A	33

Protozoa	Ref.
Chironomid larvae	27
Cryptosporidium	34
Cryptosporidium parvum Oocysts	9
Cyclospora cayetanensis oocysts	41
Giardia	34

Microsporidia	Ref.
Encephalitozoon intestinalis	27

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▣ Chlorine Dioxide Introduce

MOLECULAR SIZE MATTERS

The size of the chlorine dioxide gas molecule is 0.124 nm, which is much smaller than that of microorganisms and viruses.
Anywhere these microorganisms are hidden can easily penetrate.

CHEMICAL PROPERTIES

The name chlorine dioxide contains the word chlorine,
The chemical properties of chlorine dioxide are fundamentally different from those of chlorine.
When chlorine dioxide reacts with other substances, it is weaker and more selective, making it a more efficient and effective sterilizer.

Chlorine dioxide, for example, does not react with ammonia or most organic compounds.
Chlorine dioxide is oxidizing, unlike chlorine, does not chlorinate products.
Chlorine dioxide does not produce organic compounds that contain environmentally undesirable chlorine.

Chlorine dioxide is also a yellow-green gas that can be seen with the eye, so it can be measured with a photometer.

▣ Chlorine Dioxide Introduce

CHLORINE DIOXIDE

Chlorine dioxide has the functions of sterilization, bleaching, deodorization, disinfection and freshness maintenance.

The mechanism of action is mainly oxidation, the electron structure of the chlorine dioxide molecule is unsaturated, there are 19 electrons in the outer layer, it has a strong oxidizing power and is mainly used for atomic groups rich in electrons (or electron donors). Thiol enzymes and sulfides, chlorides) achieve the purpose by forcibly looting electrons, inactivating and changing properties.

1. Sterilization mechanism

Chlorine dioxide has a strong ability to adsorb and penetrate cell walls, and release oxygen to oxidize thiol-containing enzymes in the cell, Exerting a bactericidal effect.

2. Bleaching effect

The bleaching of chlorine dioxide is the release of atomic oxygen and the formation of hypochlorite, which degrades the pigment. When used as a bleach instead of chlorine, chlorate, etc., it can prevent and avoid the oxidation of the fiber and reduce the strength of the fiber, so the effect is more comprehensive.

3. Deodorizing effect

This is because deodorization of chlorine dioxide can be dehydrated with odorous substances (e.g. H2S, -SOH, -NH2, etc.) and quickly oxidize and convert odorous substances to other substances. It can also prevent methionine from decomposing into ethylene, and it can destroy the formed ethylene, which can delay food decay without destroying food structures, react with fatty acids, and kill microorganisms.

Comparison of PURE O2 products with imported products and other products

Sort	PURE O2 STICK	Imported products and other products
Component	Pure Chlorine Dioxide (Pure ClO2)	Chlorine (Cl)
Type	**Powder + liquid Type** Use and release only pure chlorine dioxide Maintain and record emissions of 0.03 ppm, which is 'unharmful concentration to the human body, 0.1 ppm or less', as stated in WHO and international certificates.	**Liquid + liquid Type** - Using hydrochloric acid and additives, which are toxic substances, not pure chlorine dioxide - No emission concentration measurement data (chlorine gas emission)
Country of Origin	EU-registered Spanish + Made in Korea	Raw material : Made in China
US FDA / KFDA Certification	Human disinfectant (OTC) FDA registration OTC DrugNDC CODE: 75124-0003-1 https://www.accessdata.fda.gov/scripts/cder/ndc/index.cfm - As of September, can be found in the US FDA website Can be found using NDC Code. - Completed registration with Korea Food and Drug Administration	- Not registered with Korea Food and Drug Administration - Registration of medical devices that are not disinfectants or deodorants. - Administrative disposition in case of illegal distribution as a medical device
CE Certification	· Certification No.: ICR POLSKA/VC/S200809 · Chlorine dioxide sterilizer · Bacteria remover	–
National Certification	Disinfectant/antibacterial agent of the Ministry of Environment (to be acquired within September 2020) - Manufacturer's product PURE O2 STICK is the scertified by the Food and Drug Administration. - PURE O2 sticks, biochemical products and biocarbons Report number according to the Enforcement Rules of the Act on Safety Management (Ministry of Environment certification number) " GB19-21-0096" - Confirmation number of living chemical products issued by FITI: PEUH-817I-2QSQ * Chlorine dioxide products not certified by the Ministry of Environment cannot be sold in Korea - No domestic sale of any certification, including overseas certification, without certification by the Ministry of Environment, fines and suspension of sales if sales are detected	- No Ministry of Environment approval. - Self-test data (chlorine gas emission)
Other National Tests	Antibacterial/deodorizing test using chlorine dioxide gas (FITI, KCL) Measurement of the emission concentration of chlorine dioxide gas emitted from the product (Kyungpook National University, KCL) Chlorine dioxide gas effect report on specific viruses (Chonbuk National University Infectious Disease Research Institute) Self-sterilization test / Self-release concentration test MRSA bacteria, Covid 19 kill test completed.	- Self-sterilization test
Complaints	- Short hours of use in high temperature and humidity (one to two weeks) - Due to the nature of the gas-using product, the release of chlorine dioxide gas in a hot environment (tropical or hot vehicle) is more active than usual, reducing the time spent compared to the average usage time of about four weeks.	-Actual use time within 10 days -Cases of emergency room visits due to respiratory disease -Bronate (carcinogenic substance, chlorine gas) detection -Explosion risk -Lack of detailed measurement and certification data to support product reliability

PURE O2
1833-9947
www.pureclo2.co.kr

▣ Chlorine Dioxide Studies

Six-month low level chlorine dioxide gas inhalation toxicity study with two-week recovery period in rats

doi:10.1186/1745-6673-7-2
Journal of Occupational Medicine and Toxicology 2012 7:2.

Background : Chlorine dioxide (CD) gas has a potent antimicrobial activity at extremely low concentration and may serve as a new tool for infection control occupationally as well as publicly. However, it remains unknown whether the chronic exposure of CD gas concentration effective against microbes is safe. Therefore, long-term, low concentration CD gas inhalation toxicity was studied in rats as a six-month continuous whole-body exposure followed by a two-week recovery period, so as to prove that the CD gas exposed up to 0.1 ppm (volume ratio) is judged as safe on the basis of a battery of toxicological examinations.

Methods : CD gas at 0.05 ppm or 0.1 ppm for 24 hours/day and 7 days/week was exposed to rats for 6 months under an unrestrained condition with free access to chow and water in a chamber so as to simulate the ordinary lifestyle in human. The control animals were exposed to air only. During the study period, the body weight as well as the food and water consumptions were recorded. After the 6-month exposure and the 2-week recovery period, animals were sacrificed and a battery of toxicological examinations, including biochemistry, hematology, necropsy, organ weights and histopathology, were performed.

Results : Well regulated levels of CD gas were exposed throughout the chamber over the entire study period. No CD gas-related toxicity sign was observed during the whole study period. No significant difference was observed in body weight gain, food and water consumptions, and relative organ weight. In biochemistry and hematology examinations, changes did not appear to be related to CD gas toxicity. In necropsy and histopathology, no CD gas-related toxicity was observed even in expected target respiratory organs.

Conclusions : CD gas up to 0.1 ppm, exceeding the level effective against microbes, exposed to whole body in rats continuously for six months was not toxic, under a condition simulating the conventional lifestyle in human.

Table 1 Relative Organ Weight (%) of Rats Exposed to CD Gas for 6 Months

Group	Control		Low		High	
Organ	Male	Female	Male	Female	Male	Female
Brain	0.36 ± 0.00	0.60 ± 0.06	0.34 ± 0.02	0.59 ± 0.04	0.38 ± 0.06	0.64 ± 0.07
Liver	2.56 ± 0.20	2.46 ± 0.19	2.49 ± 0.28	2.47 ± 0.15	2.47 ± 0.15	2.43 ± 0.28
Spleen	0.19 ± 0.01	0.17 ± 0.02	0.19 ± 0.01	0.16 ± 0.01	0.19 ± 0.01	0.16 ± 0.01
Adrenal gland (right)	0.01 ± 0.00	0.01 ± 0.00	0.01 ± 0.00	0.01 ± 0.00	0.01 ± 0.00	0.01 ± 0.00
Adrenal gland (left)	0.01 ± 0.00	0.01 ± 0.00	0.01 ± 0.00	0.01 ± 0.00	0.01 ± 0.00	0.01 ± 0.00
Testis (right)	0.29 ± 0.04		0.28 ± 0.05		0.32 ± 0.04	
Testis (left)	0.30 ± 0.04		0.30 ± 0.02		0.32 ± 0.05	
Ovary (right)		0.02 ± 0.01		0.01 ± 0.01		0.02 ± 0.01
Ovary (left)		0.02 ± 0.00		0.01 ± 0.01		0.02 ± 0.01

Each value represents mean ± standard deviation of 10 rats.

Table 2 Biochemistry Values of Rats Exposed to CD gas for 6 Months

Group	Control		Low		High	
Analyte	Male	Female	Male	Female	Male	Female
AST (U/l)	173.3 ± 34.7	1406 ± 64.3	166.6 ± 28.0	115.5 ± 21.8	99.7 ± 22.1	178.6 ± 178.5
ALT (U/l)	37.5 ± 10.5	33.7 ± 19.6	33.4 ± 7.5	30.1 ± 11.1	38.8 ± 15.7	82.8 ± 116.4
γ-GTP (U/l)	1.0 ± 0.0	1.1 ± 0.3	1.0 ± 0.0	1.0 ± 0.0	1.0 ± 0.0	1.0 ± 0.0
TP (g/dl)	6.2 ± 0.2	7.3 ± 0.6	6.0 ± 0.4	7.3 ± 0.4	6.2 ± 0.2	7.2 ± 0.6
ALB (g/dl)	2.3 ± 0.1	3.0 ± 0.3	2.2 ± 0.1	3.1 ± 0.2	2.3 ± 0.1	3.1 ± 0.3
A/G	0.58 ± 0.03	0.72 ± 0.07	0.58 ± 0.04	0.74 ± 0.04	0.60 ± 0.04	0.76 ± 0.06
BG (mg/dl)	137.6 ± 11.3	137.1 ± 24.6	130.3 ± 27.6	131.2 ± 14.7	132.7 ± 13.0	129.2 ± 16.3
TC (mg/dl)	75.2 ± 14.2	87.5 ± 28.2	67.3 ± 18.2	101.6 ± 23.0	76.2 ± 16.0	88.5 ± 29.3
TG (mg/dl)	71.0 ± 19.4	84.4 ± 50.1	61.1 ± 21.9	116.6 ± 86.7	64.8 ± 32.9	69.1 ± 36.0
BUN (mg/dl)	14.1 ± 2.1	13.1 ± 1.8	14.0 ± 1.9	13.6 ± 2.3	15.4 ± 2.1	15.2 ± 0.9*
CRE (mg/dl)	0.33 ± 0.03	0.38 ± 0.05	0.35 ± 0.05	0.35 ± 0.02	0.36 ± 0.05	0.36 ± 0.02
CRP (mg/dl)	0.03 ± 0.00	0.03 ± 0.00	0.03 ± 0.00	0.03 ± 0.00	0.03 ± 0.00	0.03 ± 0.00
P (mg/l)	6.3 ± 0.4	5.8 ± 0.4	6.2 ± 0.3	5.3 ± 0.7	6.2 ± 0.4	5.7 ± 0.6
Ca (mg/l)	10.1 ± 0.1	1.2 ± 0.6	9.9 ± 0.2*	11.0 ± 0.2	10.3 ± 0.3	11.2 ± 0.6
Na (mEq/l)	145.6 ± 1.0	141.6 ± 1.5	143.5 ± 1.5	141.5 ± 1.9	143.7 ± 0.9	142.0 ± 1.2
K (mEq/l)	4.6 ± 0.2	4.8 ± 0.6	4.7 ± 0.2	4.4 ± 0.3	4.6 ± 0.2	4.6 ± 0.6
Cl (mEq/l)	104.6 ± 1.4	102.6 ± 2.4	105.1 ± 0.7	102.2 ± 1.2	103.9 ± 1.7	102.1 ± 2.0
PT (sec)	15.9 ± 2.0	10.6 ± 0.6	15.0 ± 1.6	10.7 ± 0.7	15.6 ± 1.7	11.6 ± 3.2
APTT (sec)	22.7 ± 3.1	24.9 ± 6.0	20.6 ± 2.1	22.5 ± 3.1	21.1 ± 2.3	24.0 ± 12.3
IL-6 (pg/ml)	ND	ND	ND	ND	63.8 ± 34.1	ND
TNF-α (pg/ml)	ND	ND	ND	ND	ND	ND

Each value represents mean ± standard deviation of 10 rats.
* Significantly different from control, $p < 0.05$.
ND: Not detected (below the lower quantification limit: TNF-α, < 11.5 pg/ml, IL-6, < 62.5 pg/ml).

Table 3 Hematology and BALF Values of Rats Exposed to CD Gas for 6 Months

Group	Control		Low		High	
Analyte	Male	Female	Male	Female	Male	Female
Blood Cell Counts						
RBC (10^4/μl)	1188 ± 85	942 ± 124	1039 ± 111	894 ± 72	1069 ± 117	861 ± 100
WBC (10^2/μl)	89 ± 20	62 ± 15	94 ± 28	56 ± 18	90 ± 21	63 ± 22
Hb (g/dl)	18.1 ± 1.6	16.8 ± 1.8	17.3 ± 2.2	15.2 ± 1.3	17.1 ± 2.0	16.8 ± 2.6
HTC (%)	54.4 ± 5.0	49.5 ± 5.9	52.1 ± 6.6	44.6 ± 4.0	51.7 ± 6.4	47.3 ± 7.5
PLT (10^4/μl)	70.4 ± 10.0	62.4 ± 16.7	66.5 ± 20.9	58.9 ± 16.7	69.2 ± 31.2	81.2 ± 19.5
MCH (pg)	16.3 ± 0.4	17.9 ± 0.6	16.8 ± 0.6	18.3 ± 0.8	16.8 ± 0.7	18.3 ± 0.9
NEs (%)	14.9 ± 5.8	12.5 ± 6.3	10.4 ± 3.1	13.7 ± 3.5	17.1 ± 4.8	17.5 ± 6.5
EOs (%)	0.9 ± 0.6	1.2 ± 0.9	0.2 ± 0.4*	0.7 ± 0.6	0.3 ± 0.3*	1.1 ± 0.6
BAs (%)	0.5 ± 0.6	0.5 ± 0.5	0.5 ± 0.4	0.6 ± 0.3	0.5 ± 0	0.2 ± 0.5
MOs (%)	1.2 ± 4.2	1.5 ± 3.5	8.6 ± 2.4*	13.7 ± 5.0	11.5 ± 4.0	13.1 ± 6.3
LYs (%)	68.3 ± 7.9	71.9 ± 4.6	75.6 ± 5.3	67.9 ± 6.3	68.5 ± 4.6	66.2 ± 8.9
BALF Cell Counts						
BC (10^2/ml)	89.4 ± 45.1	12.5 ± 10.0	27.1 ± 37.6	88.9 ± 18.1*	21.8 ± 15.5	28.4 ± 25.5
WBC% (%)	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0

Each value represents mean ± standard deviation of 10 rats.
* Significantly different from control, $p < 0.05$.

▣ Chlorine Dioxide Studies

Protective effect of low-concentration chlorine dioxide gas against influenza A virus infection

DOI 10.1099/vir.0.83393-0
Journal of General Virology (2008), 89, 60 – 67

Influenza virus infection is one of the major causes of human morbidity and mortality. Between humans, this virus spreads mostly via aerosols excreted from the respiratory system. Current means of prevention of influenza virus infection are not entirely satisfactory because of their limited efficacy. Safe and effective preventive measures against pandemic influenza are greatly needed. We demonstrate that infection of mice induced by aerosols of influenza A virus was prevented by chlorine dioxide (ClO2) gas at an extremely low concentration (below the long-term permissible exposure level to humans, namely 0.1 p.p.m.). Mice in semi-closed cages were exposed to aerosols of influenza A virus (1 LD50) and ClO2 gas (0.03 p.p.m.) simultaneously for 15 min.

Three days after exposure, pulmonary virus titre (TCID50) was 102.6 ± 1.5 in five mice treated with ClO2, whilst it was 106.7 ± 0.2 in five mice that had not been treated (P50.003). Cumulative mortality after 16 days was 0/10 mice treated with ClO2 and 7/10 mice that had not been treated (P50.002). In in vitro experiments, ClO2 denatured viral envelope proteins (haemagglutinin and neuraminidase) that are indispensable for infectivity of the virus, and abolished infectivity. Taken together, we conclude that ClO2 gas is effective at preventing aerosol-induced influenza virus infection in mice by denaturing viral envelope proteins at a concentration well below the permissible exposure level to humans. ClO2 gas could therefore be useful as a preventive means against influenza in places of human activity without necessitating evacuation.

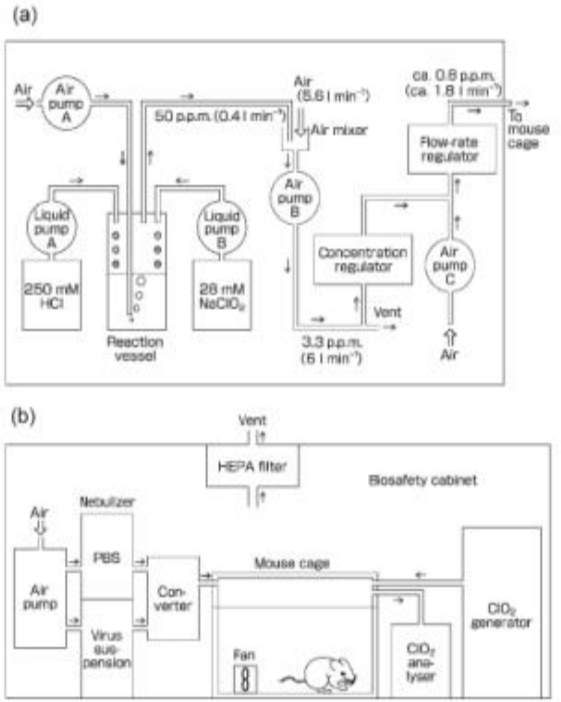


Fig. 1. (a) Schematic structure of a ClO_2 generator. (b) Experimental set-up for exposure of mice to influenza A virus aerosols and ClO_2 gas.

Table 1. Pulmonary virus titres of each mouse challenged with influenza A virus aerosols in the absence or presence of 0.03 p.p.m. ClO_2 gas

[ClO_2 gas] (p.p.m.)	Virus titre in each mouse (log_{10})*					Mean ± SD
0	6.3	6.8	6.8	6.8	6.8	6.7±0.2†
0.03	1.3	2.1	3.6	4.8	1.3	2.6±1.5†

*Virus titre, expressed as $TCID_{50}$, was measured 72 h after challenge by virus aerosols (n=5 mice per group).
†P=0.003 when the means of two groups were compared (Student's t-test).

Table 2. Mortality of mice exposed to aerosols of influenza A virus in the absence or presence of 0.03 p.p.m. ClO_2 gas

Values are the number of mice that died at each time point after virus challenge.

[ClO_2 gas] (p.p.m.)	Time after virus challenge (days)							Total
	1–10	11	12	13	14	15	16	
0	0	3	0	0	1	1	2	7*
0.03	0	0	0	0	0	0	0	0*

*P=0.002 when the 0 and 0.03 p.p.m. groups on day 16 were compared (Fisher's exact test, n=10 for each group).

Table 3. Body mass of mice 1 week after challenge with influenza A virus in the absence or presence of 0.03 p.p.m. ClO_2 gas

[ClO_2 gas] (p.p.m.)	Body mass (g) at day:		Relative body mass*
	0	7	
0	28.4±1.2	25.7±1.3	0.90±0.04†
0.03	26.0±1.8	28.3±2.1	1.09±0.08†

*Ratio of body mass on day 7 to that on day 0 in each group.
†P=0.002 when relative body masses of the 0 and 0.03 p.p.m. ClO_2 groups were compared (Student's t-test, n=5 in each group).

Table 4. Mortality of mice challenged with influenza A virus aerosols in the absence or presence of 0.03 p.p.m. ClO_2 gas that was delivered for 15 min at various delay times after commencement of the delivery of virus aerosols

Values are the number of mice that died at each time point after virus challenge.

ClO_2 gas delay time (min)	Time after virus challenge (days)							Total
	8	9	10	11	12	13	14	
0	0	0	0	0	0	0	0	0*
5	0	1	0	0	0	0	0	1†
10	2	2	0	0	0	0	0	4
15	2	1	0	0	0	0	0	3
No ClO_2	0	2	2	1	0	0	0	5

*P=0.022 when compared with the no-ClO_2 group (Fisher's exact test, n=10 in each group).
†P=0.081 when compared with the no-ClO_2 group (Fisher's exact test, n=10 in each group).

▣ Chlorine Dioxide Studies

Disinfection effect of chlorine dioxide on air quality control in Armed Forces General Hospital of Taiwan

Nature and Science, 5(4), 2007, Kuen Song Lin, Ming June Hsieh, Ming Jer Liou, Sheau Long Lee, Cheng-Kuo Lai. Disinfection effect of chlorine dioxide on air quality control in Armed Forces General Hospital of Taiwan

Abstract: Under the increasing threat of various global infectious diseases, the importance of epidemic prevention and air quality control in hospital is accented. Four disinfectants were prepared and tested to verify the disinfection effect of air environment in Taoyuan Armed Forces General Hospital (TAFGH). STB bleach powder (1417 ppm), Type 82 disinfectant (4877 ppm), NaOCl bleacher (1386 ppm) and chlorine dioxide disinfectant (193 ppm) were all capable to sterilize medical disposal of 3.2 × 105 CFU/mL with disinfection efficiency higher than 99.9% were observed from the environmental specimen and disinfection tests in the physician out-patient department. Before sterilization, the average residual colony was 180 per handset, which were higher than the value of 15 on door knob. After spraying 1 mL of 200 ppm chloride dioxide solution twice onto the surfaces of different objects using the hand-held sprayer, the comparison for average disinfection efficiencies of the samples was door knob (100%) = handset of telephone (100%) > chair cushion (90.3%) > floor (20.5%) in series. In addition, the background data of biological aerosols also revealed that the comparison of average space colony numbers was semi-closed out-patient area in the physician department (318 CFU/m3) > semi-closed out-patient area in the surgical department (183 CFU/m3) > open-space emergency ward (58 CFU/m3) in series. After using ultrasonic aerosol and handheld sprayer ways to sprinkle the chlorine dioxide solution into hospital spaces for 30 minutes, the average colony number in the physician out-patient area decreased from 421 to 21 CFU/m3, approaching to a disinfection efficiency of 95.0 %. The disinfection efficiency of chlorine dioxide in gas or solution phase is notably affirmative and available for the infection control of hospital. [Nature and Science. 2007;5(4):94-99].

Table 1. Disinfection rate of chloride dioxide and bleacher solution

EP 606 Chlorine dioxide solution				NaOCl bleacher solution			
Conc. (ppm)	Total colony (CFU/mL)	Coliform (CFU/100mL)	Disinfect. rate (%)	Concentration (ppm)	Total colony (CFU/mL)	Coliform (CFU/100mL)	Disinfect. rate (%)
Control	3.2×10^5	2.0×10^4	-	Control	3.2×10^5	2.0×10^4	-
100	0	0	100	200	0	0	100
51	150	0	99.95	139	0	0	100
10	600	80	99.81	30	216	20	99.93

Table 2. Time effect on the disinfection rate of four disinfectants

Disinfectant	STB		Type 82		NaOCl bleacher		EP 606 disinfectant		ClO_2
Conc.	1417 ppm		4877 ppm		1386 ppm		193 ppm		
microbe	Total*	Coliform*	Total	Coliform	Total	Coliform	Total	Coliform	
Control	3.2×10^5	2.0×10^4	3.2×10^5	2.0×10^4	3.2×10^5	2.0×10^4	3.2×10^5	2.0×10^4	
2 min.	500	0	250	0	150	0	500	0	
5 min.	300	0	250	0	0	0	400	0	
10 min	250	0	200	0	0	0	300	0	
Disinfection rate (10 min.)	99.92 %	100 %	99.94 %	100 %	100 %	100 %	99.91 %	100 %	

* Unit for total colony is CFU/mL; Unit for coliform is CFU/100mL.

Table 3. Disinfection rate of chlorine dioxide (200ppm) in the physician department

Room no. Test against		7	8	9	10	11	12	13	Average	Disinfection rate (%)
Knob (m^2)	Background (CFU)	2	50	4	50	0	2	0	15	100
	Disinfected (CFU)	0	0	0	0	0	0	0	0	
Handset (m^2)	Background (CFU)	360	264	38	300	98	150	50	180	100
	Disinfected (CFU)	0	0	0	0	0	0	0	0	

Out-patient area		Sampling spot A	Sampling spot B	Average	Disinfection rate
Cushion (m^2)	Background (CFU)	40	82	62	90.3
	Disinfected (CFU)	2	10	6	
Floor (m^2)	Background (CFU)	306	16	161	20.5
	Disinfected (CFU)	245	11	128	

Table 4. Disinfection rate of chlorine dioxide (200ppm) of the aerosol in physician department

Physician out-patient	Sampling spot A		Sampling spot B		Average	Averaged disinfection rate
Background (CFU/m^3)	50	581	117	936	421	94.9 %
Disinfected (CFU/m^3)	23	6	50	5	21	

▣ Chlorine Dioxide Studies

Antiviral Effect of Chlorine Dioxide against Influenza Virus and Its Application for Infection Control

Takanori Miura and Takashi Shibata
The Open Antimicrobial Agents Journal, 201,2, 71-8 7

Abstract: Influenza is respiratory tract infection, causing pandemic outbreaks. Spanish flu(A/H1N), a pandemic occurred between 1918and 1919, tolled patients fatalities of 500 million and 50 million, respectively. Recently, human infection with highly pathogenic avian influenza A/H5N1 and swine influenza [Pandemic (H1N) 2009] was reported.

Because of the population explosion and busy global aircraft traffics, Pandemic (H1N) 2009 is rapidly spreading world- wide. In addition, it is seriously concerned that H5N1 influenza pandemic would emerge in the very near future. The pandemic will cause the freeze of social activity and the crisis of business continuity, having a serious impact on the global economy consequently. It is fervently desired the efficient methods of infection control against influenza pandemic be developed.

Chlorine dioxide (ClO2) has strong antiviral effect, and can disinfect the surface of object and the air in space. In recent study on interaction between ClO2 and protein, ClO2 oxidatively modified tyrosine and tryptophan residues, and the protein was structurally denatured. Since hemagglutinin and neuraminidase of influenza virus A/H1N1 were inactivated by the reaction with ClO2, it is likely that denaturation of the proteins caused inactivation of the virus. A low concentration (0.03 pm)of ClO2 gas, where people can stay for a long period of time without any harmful effect, prevented the death of mice caused by infection of influenza virus delivered aerosol. We review current information based on the efficiency of ClO2 solution and gas, and also discuss the application of ClO2 against influenza pandemics outbreak.

Table 1. Relation between Disinfectant Concentration and FBS Added to Inactivate ≥99.999% Influenza A Virus without Added NaCl for 1 min at 25°C

Disinfectant Name	[Disinfectant] (ppm)	[FBS] (%)
Cleverin	1	ND[a]
	10	1
	100	10
NaClO	10	NI[b]
	100	1

[a]Not done, [b]Not inactivated.

Table 2. Relation between Disinfectant Concentration and NaCl Added to Inactivate ≥99.999% Influenza A Virus without Added FBS for 1 min at 25°C

Disinfectant Name	[Disinfectant] (ppm)	[NaCl] (M)
Cleverin	1	1
	10	>1
	100	>1
NaClO	10	NI[a]
	100	>1

[a]Not inactivated.

Table 3. Relation between Disinfectant Concentration and Reaction Temperature to Inactivate ≥99.999% Influenza A Virus without Added FBS and NaCl for 1 min

Disinfectant Name	[Disinfectant] (ppm)	Temperature (°C)
Cleverin	1	10-50
	10	4-50
	100	4-50
NaClO	10	NI[a]
	100	4-50

[a]Not inactivated.

Table 4. Relation between Disinfectant Concentration and Reaction pH to Inactivate ≥99.99% Influenza A Virus without Added FBS and NaCl for 1 min at 25°C

Disinfectant Name	[Disinfectant] (ppm)	pH
Cleverin	1	5-6
	10	5-10
	100	ND[a]
NaClO	1	NI[b]
	10	5-6
	100	ND[a]

[a]Not done, [b]Not inactivated.

Table 5. Effect of ClO_2 Gas on Pulmonary Titer, Mortality and Body Mass of Mouse Challenged with Influenza A Virus

[ClO_2 gas] (ppm)	Pulmonary Virus Titer[a] (log_{10})	Mortality[b]	Relative Body Mass[c]
0	6.7±0.2[d]	7/10[d]	0.9±0.04[d]
0.03	2.6±1.5[d]	0/10[d]	1.09±0.08[d]

[a]Virus titer ($TCID_{50}$) was measured 72 hours after a challenge of virus aerosols (n = 5 in each group). [b]Mortality was measured until 10 days after the challenge (n = 10 in each group). [c]Ratio of body mass on day 7 to that on day 0 in each group (n = 5 in each group). [d]P = 0.003, [d]P = 0.002.

Table 6. Effect of ClO_2 Gas on Cumulative Absenteeism Rate

Cleverin, G	Cumulative Attendance Rate (%)	Cumulative Absenteeism Rate (%)
Placed	98.5	1.5[a]
Not placed	96.0	4.0[a]

[a]P = 0.0009.

Table 7. Toxicology Study of Cleverin Solution[a]

Test	Animal	Result
Acute oral toxicity	Mouse	$LD50 > 5000$ mg/kg
Acute inhalation toxicity	Mouse	$LC50 > 12000$ mg/m^3
Single dose skin irritation	Rabbit	No irritation
Multiple dose skin irritation	Rabbit	No irritation
Ophthalmological eye irritation	Rabbit	No irritation
Single dose mucosal irritation	Rabbit	Mucosal irritation
Subchronic oral toxicity	Rat	$LD50 > 1000$ mg/kg
Skin allergic reaction	Guinea pig	No allergic reaction
Micronucleous test	Mouse (bone marrow)	No induction

[a]ClO_2 concentration: 100 ppm.

▣ Chlorine Dioxide Studies

H. Morino, T.Fukuda, T.Miura and T.Shibata
The Society for Applied Microbiology: Letters in applied Microbiology **53** , 628-634

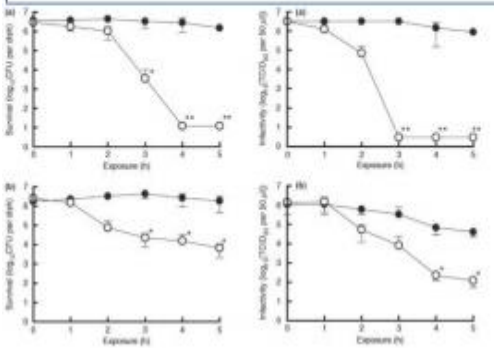
Abstract

Aims: To evaluate the efficacy of low-concentration chlorine dioxide (ClO_2) gas against model microbes in the wet state on a glass surface.

Methods and Results: We set up a test room (39 m^3) and the ClO_2 gas was produced by a ClO_2 gas generator that continuously releases a constant low-concentration ClO_2 gas. Influenza A virus (Flu-A), feline calicivirus (FCV), *Staphylococcus aureus* and *Escherichia coli* were chosen as the model microbes. The low-concentration ClO_2 gas (mean 0·05 ppmv, 0·14 mg m^{-3}) inactivated Flu-A and *E. coli* (>5 $\log_{10}$ reductions) and FCV and *S. aureus* (>2 $\log_{10}$ reductions) in the wet state on glass dishes within 5 h.

Conclusions: The treatment of wet environments in the presence of human activity such as kitchens and bathrooms with the low-concentration ClO_2 gas would be useful for reducing the risk of infection by bacteria and viruses residing on the environmental hard surfaces without adverse effects.

Significance and Impact of the Study: This study demonstrates that the low-concentration ClO_2 gas (mean 0·05 ppmv) inactivates various kinds of microbes such as Gram-positive and Gram-negative bacteria, enveloped and nonenveloped viruses in the wet state.



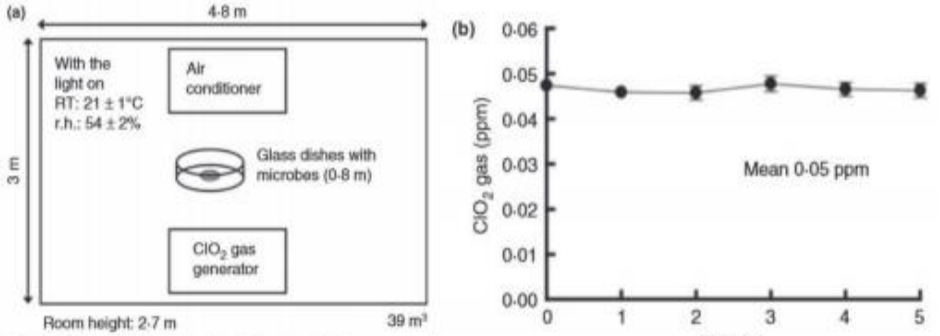


Figure 1 Schematic diagram of a test room and time course of changes in concentration of ClO_2 gas. (a) Schematic diagram of bacteria and viruses on the glass surface in a test room. The microbes in the wet state on the glass dishes were placed at the centre of the room. The 0·8 m given in a parenthesis in the figure shows the height of glass dishes with the microbes placed above the floor. (b) Time course of changes in concentration of ClO_2 gas in the test room. The graph presents the mean of eight experiments; each error bar indicates the SD. The background level of ClO_2 gas in ordinary air was below 0·01 ppmv.

Table 1 Effect of organic load on inactivation of bacteria and viruses in the wet state by low-concentration ClO_2 gas

		Bacteria survival ($\log_{10}$ CFU per dish)				Viruses infectivity ($\log_{10}$[$TCID_{50}$ per 50 µl])			
		Escherichia coli		*Staphylococcus aureus*		Flu-A		FCV	
Exposure time (h)	FBS concentration in microbes suspension (%)	Air	ClO_2	Air	ClO_2	Air	ClO_2	Air	ClO_2
5	0	4·9	1·1 (3·9)*	6·0	2·1 (3·9)*	5·6	<0·5 (5·1)*	5·0	2·3 (2·7)*
	0·1	4·9	1·1 (3·8)*	6·1	3·3 (2·8)*	6·3	<0·5 (5·8)*	5·1	2·6 (2·5) *
	0·25	4·8	2·2 (2·7)*	6·1	4·4 (1·7)	6·4	0·6 (5·8)*	5·4	3·1 (2·3)*
	0·5	4·7	1·3 (3·5)*	6·2	4·4 (1·8)	6·3	<0·5 (5·8)*	5·3	3·6 (1·8)
	0·75	4·7	2·3 (2·4)*	6·3	5·0 (1·3)	6·2	<0·5 (5·7)*	5·2	4·8 (0·4)
	1	4·9	2·0 (2·8)*	6·1	5·1 (1·0)	6·3	0·6 (5·7)*	5·3	5·3 (0·0)

CFU, colony-forming units; TCID, tissue culture infectious dose.
Values are the mean of four experiments.
The values given in parentheses show $\log_{10}$ reduction.
*Values indicate reductions of >2 $\log_{10}$ as compared with control values (in ordinary air).

CHLORINE DIOXIDE(CLO2)

Where is it Used? How does it Work?

GENERAL

Chlorine dioxide (ClO2) is a yellow-green gas with an odor similar to chlorine with excellent distribution, penetration and sterilization abilities due to its gaseous nature. Although chlorine dioxide has chlorine in its name, its properties are very different, much like carbon dioxide is different than elemental carbon. Chlorine dioxide has been recognized as a disinfectant since the early 1900s and has been approved by the US Environmental Protection Agency (EPA) and the US Food and Drug Administration (FDA) for many applications. It has been demonstrated effective as a broad spectrum, anti-inflammatory, bactericidal, fungicidal, and virucidal agent, as well as a deodorizer, and also albe to inactivate beta-lactams and destroy both pinworms and their eggs

MOLECULAR SIZE MATTERS

As can be seen in the chart above, the size of a chlorine dioxide gas molecule is 0.124 nm, much smaller than microorganisms and viruses, allowing the gas to easily penetrate into any areas where these microorganisms might be concealed.

CHEMICAL PROPERTIES

Although chlorine dioxide has "chlorine" in its name, its chemistry is radically different from that of chlorine. When reacting with other substances, it is weaker and more selective, allowing it to be a more efficient and effective sterilizer. For example, it does not react with ammonia or most organic compounds. Chlorine dioxide oxidizes products rather than chlorinating them, so unlike chlorine, chlorine dioxide will not produce environmentally undesirable organic compounds containing chlorine. Chlorine dioxide is also a visible yellow-green gas allowing it to be measured in real-time with photometric devices.

▣ CHLORINE DIOXIDE(CLO2)

PURE O2

INACTIVATION OF SPORES VS. BACTERIA

The difference between spore and bacterial inactivation is the same as the difference between sterilization and disinfection. For a chemical agent to be classified as a sterilant, it must be demonstrated to be effective at inactivating spores. Spores are among the hardest organisms to kill and for this reason sterilizing agents are considered the most rigorous decontaminating agents and offer complete kill of all antimicrobial life. Disinfection, on the other hand, does not require the complete inactivation of spores or all microbial life and is normally validated against a few vegetative bacteria species. For this reason, disinfecting agents are less rigorous decontaminating agents and are not as effective as sterilizing agents.

"Bacterial endospores are one of the most persistent forms of microbial life and typically require aggressive inactivation procedures. Vegetative bacteria are generally much more easily inactivated than are bacterial endospores. This is primarily because the sensitive areas of bacteria are easily contacted by chemosterilizing agents. The spore, however, has a more complex structure than the vegetative bacterial cell. Its sensitive material is contained within a core and that core is surrounded by a cortex and spore coats. These coats tend to act as a permeability barrier to the entry of chlorine dioxide and other compounds" (Knapp, 2000).

ENVIRONMENTAL IMPACT

Chlorine dioxide's special properties make it an ideal choice to meet the challenges of today's environmentally concerned world and is an environmentally preferred alternative to elemental chlorine. When chlorine reacts with organic matter, undesirable pollutants such as dioxins and bio-accumulative toxic substances are produced. Thus, the EPA supports the replacement of chlorine with chlorine dioxide because it eliminates the production of these pollutants. It is a perfect replacement for chlorine, providing all of chlorine's benefits without any of its weaknesses and detriments. Most importantly, chlorine dioxide does not chlorinate organic material, eliminating the formation of trihalomethanes (THMs), haloacetic acids (HAAs) and other chlorinated organic compounds. This is particularly important in the primary use for chlorine dioxide, which is water disinfection. Other properties of chlorine dioxide make it more effective than chlorine, requiring a lower dose and resulting in a lower environmental impact.

USES

Chlorine dioxide is widely used as an antimicrobial and as an oxidizing agent in drinking water, poultry process water, swimming pools, and mouthwash preparations. It is used to sanitize fruit and vegetables and also equipment for food and beverage processing and widely used in life science research laboratories. It is also employed in the health care industry to decontaminate rooms, passthroughs, isolators and also as a sterilant for product and component sterilization. It is also extensively used to bleach, deodorize, and detoxify a wide variety of materials, including cellulose, paper-pulp, flour, leather, fats and oils, and textiles. Approximately 4 to 5 million pounds are used daily.

▣ CHLORINE DIOXIDE(CLO2)

PURE O2

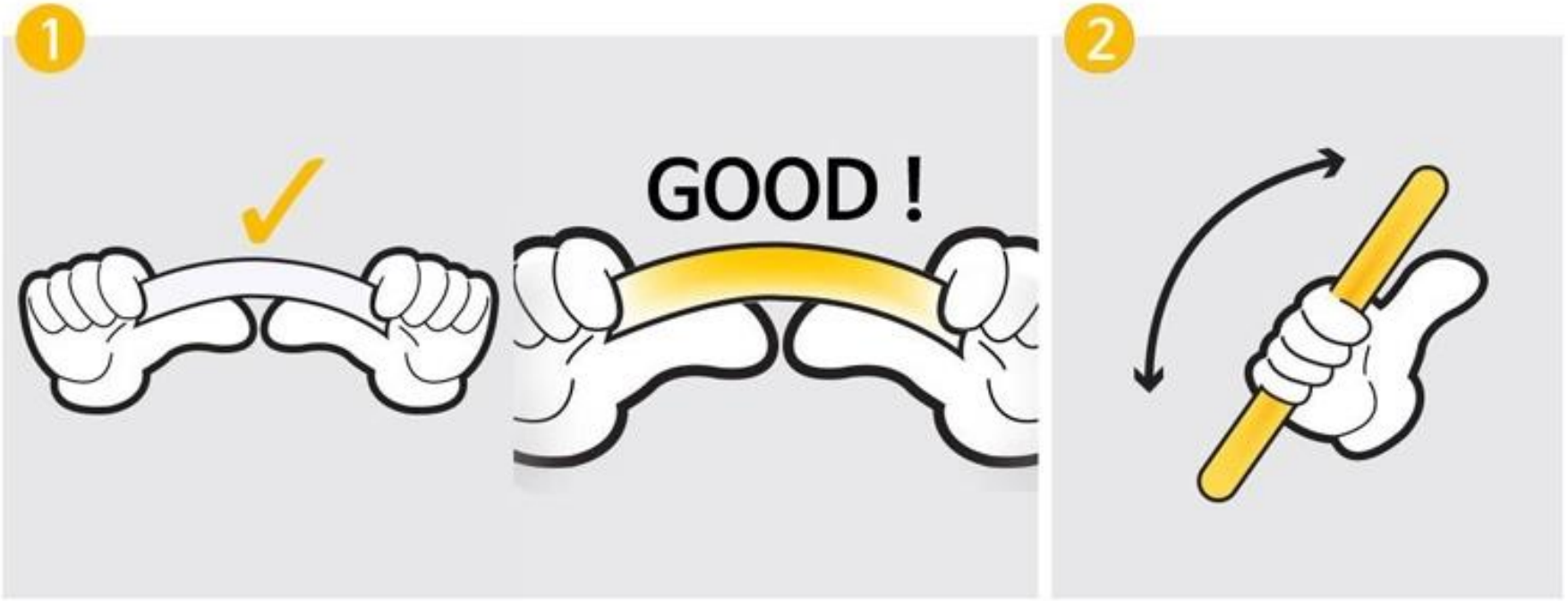
ANTIMICROBIAL PROPERTIES / MODE OF ACTION

Chlorine dioxide(ClO2) acts as an oxidizing agent and reacts with several celluar constituents, including the cell membrane of mircobes. By "stealing" electrons from them(oxidation), it breaks their molecular bonds, resulting in the death of the organism by the breakup of the cell. By altering the proteins involved in the structure of microorganisms, their enzymatic function is broken and causes very rapid bacterial kills. This oxidative attack on many proteins simultaneously is behind the potency of chlorine dioxide and also prevents microorganisms from mutating to a resistant form. Because of the selective reactivity of chlorine dioxide, its antimicrobial action is retained longer in the presence of organic matter than most other decontaminating agents.

WATER SOLUBILITY

Unlike many decontaminating agents, chlorine dioxide has the unique ability to retain its sterilization capacity in water. In order to maximize process reproducibility and minimize materials effects when using the chlorine dioxide gas it is best to avoid pools or puddles of water. However, if small amounts of water are present the efficacy of chlorine dioxide is not affected. The reason that small amounts of water will not impact sterilization efficacy is that chlorine dioxide is readily soluble in water. The partition coefficient (CClO2(H2O)/CClO2(air)) of chlorine dioxide at 22°C and 101 kPa is about 38 (Masschelein). And provided that the quantity of water is small the gas concentration in the water reaches equilibrium quickly.

How to use PUREO2STiCK



① Take out the product, lay it horizontally on the left and right side, and bend the ampule in the center part until it "sounds".
② After rocking the stick a few times up and down, if the stick turns yellow, put it in the desired place.
- After about 3 to 4 weeks, replace the stick when it turns white.

TEL : 82 31 1833-9947
H.P : 82-10-4236-4560

경기장(인조단디)
이산화염소수 세균 측정

이산화염소 스틱 및 이산화염소수 실험 데이터
Stadium grass bacteria measurement

퓨어오투 스틱, 팩솔리드 세균제거실험
Pure O2 Stick, Pack Solid bacteria removal experiment

휴대폰 스틱 사용전
Before using cell phone stick

스틱사용 측정후
After using the cell phone stick

화장실 팩솔리드 사용전

팩솔리드 사용후

Before and after using the toilet pack solid

PURE O2 STICK USES

PURE O2 STICK USES

Chlorine dioxide is globally recognized for its safety.

WHO(World Health Organization)
Grade A1, the safest grade of plant additives

FDA(United States Food and Drug Administration)
NO. 10049-04-4, Permitted to disinfect food additive, medical use, medical device

NASA(National Aeronautics and Space Administration)
Space shuttle inside and space food to fully sterilize

EU(European Union)
Recommendation to member countries as disinfectant for drinking water

KFDA(Korea Food and Drug Administration)
The purpose of sterilization of food such as fruits and vegetables
Notice No. 2007-74 /No. 2009-66

PRODUCT PHOTO

Product Name	**PUREO2STiCK**
Category	**Disinfectant, Deodorant**
Volume / Size	**10ml / 6inch(15∅)**
Shelf Life	**2 years from date of manufacture**
Period of use	**About 3~4week**
Proper use space	**About 3.3~6.6m² per Stick**
Consumer price	**$17.00**

OTC Drug
(HUMAN)
Registered

Certificate of Establishment and Product Listing Registration

Awarded to

PURE O2

F334, 45, Jojeong-daero, Hanam-si, Gyeonggi-do, Republic of Korea

FDA Registration DUNS Number : 695881145

This is to certify that the OTC drug establishment of PURE O2 and their product listing has been registered with FDA. It has giving the permission to start marketing in the United States of America.(HUMAN OTC DRUG)

NDC Number	*Product Name*
75124-0001-1	*PURE O2-S F*
75124-0002-1	*PURE O2 Pack-Solid*
75124-0003-1	*PURE O2 STICK*
75124-0004-1	*EASY STICK*
75124-0005-1	*Doctor Guard Stick*
75124-0006-1	*V Doctor pure chlorine dioxide*
75124-0007-1	*PURE O2 S*
75124-0008-1	*iSTICK*
75124-0009-1	*NARYN CARE Stick*
75124-0010-1	*QVE - S*

This certificate does not represent or endorse any person or company other than the owner of the specified certificate. Issued for the purpose of verifying corporate and product registration. This certificate indicates that the U.S. Food and Drug Administration has registered and approved the registration of the certificate holder or facility. The U.S. Food and Drug Administration is not responsible for any personal or organizational issues related to the above. The U.S. Food and Drug Administration does not issue a separate OTC registration certificate, and a certificate for company registration and item registration verification is issued by PURE O2.

https://www.accessdata.fda.gov/scripts/cder/ndc/index.cfm

International Certification Registrar International Certification Registrar International Certification Registrar

Verification of Conformity

ICR Polska/VC/S200809

Name and address of the Applicant:	Pure O2 F334, 45, Jojeong-daero, Hanam-si, Gyeonggi-do, Republic of Korea
Name and address of the Manufacturer:	Pure O2 F334, 45, Jojeong-daero, Hanam-si, Gyeonggi-do, Republic of Korea
Product name:	Antibacterial STICK (Disinfectant)
Product types:	PURE O2 STICK
Product trademark:	Pure O2

The verification of the product has been performed on provided product technical files and conformity demonstrated by test reports within below scope:

Test report:	Test name:	Test performed by:
200100475	Chlorine Dioxide Gas effectiveness on Disinfectant and Spray Sterilizer	ChonBuk National University Research Institute for Common Infectious Diseases
KR-2007-024-PUR01-C	Virucidal Activity Test for sterilization and disinfectant of the product	KR Biotech Co., Ltd
CT18-036387	The deodorization test method (Open pace condition)	Korea Conformity Laboratories (KCL)
M287-20-01301	Antimicrobial activity of antimicrobial agents under dynamic contact conditions (modified ASTM E2149 – 13a): CFU/mL, % reduction of bacteria	FITI Testing & Research Institute

Issue date: 31.08.2020

Expiration date: 30.08.2025

The verification has been carried out in accordance with individual rules and conditions agreed with the applicant.

Remarks
This document refers to the above mentioned product and its conformity in regards of above mentioned standard(s) was proven on test sample.
This document was issued on voluntary basis and does not imply meeting relevant legal requirements.

CE marking remarks:
mark is not sanctioned by the following verification of conformity
mark given here as reference, can be only use by the manufacturer after applying all essential requirements from relevant directives

document status can be search: https://cert.icrpolska.com/

CERTIFIED

ICR Polska Co. Ltd.
www.icrpolska.com
icrpolska@icrqa.com

Director: Rafał Kalinowski

Warsaw, 31.08.2020

NTREE

Certificate of Registration

PURE O2

F334, 3F, 45, Jojeong-daero, Hanam-si, Gyeonggi-do, Republic of Korea

has been approved by NTREECERT Co., Ltd. to the following environmental management system standards :

ISO 14001:2015

The scope of environmental management system is applicable to :

Design, Development and Manufacture of Sterilized Water(Pure Water Chlorine Dioxide) Manufacturing Equipment and Chlorine Dioxide Generator

Valid Date

From 11 August 2020 To 10 August 2023

Former Certificate : 11 August 2020

Certificate No. : NTE-1837 Date of last Issue : 11 August 2020

Rev. 00

President of NTREE Cert

www.ntreecert.kr
NTREE Certification Co.,Ltd

Accreditation by the Joint Accreditation System of Australia and New Zealand. www.jas-anz.org/register

30, Pajangcheon-ro 44beon-gil, Jangan-gu, Suwon-si, Gyeonggi-do, Republic of Korea

NTREE

Certificate of Registration

PURE O2

F334, 3F, 45, Jojeong-daero, Hanam-si, Gyeonggi-do, Republic of Korea

has been approved by NTREECERT Co., Ltd. to the following quality management system standards :

ISO 9001:2015

The scope of quality management system is applicable to :

Design, Development and Manufacture of Sterilized Water(Pure Water Chlorine Dioxide) Manufacturing Equipment and Chlorine Dioxide Generator

Valid Date

From 11 August 2020 To 10 August 2023

Former Certificate : 11 August 2020

Certificate No. : NTQ-3688 Date of last Issue : 11 August 2020

Rev. 00

President of NTREE Cert

www.ntreecert.kr
NTREE Certification Co.,Ltd

Accreditation by the Joint Accreditation System of Australia and New Zealand. www.jas-anz.org/register

30, Pajangcheon-ro 44beon-gil, Jangan-gu, Suwon-si, Gyeonggi-do, Republic of Korea

PURE O2
F334, 45 Jojeong-daero
Hanam-si, Gyeonggi-do
Korea

The following sample(s) was/were submitted and identified by/on behalf of the client as:-

SGS File No. : AYAA20-59401
Product Name : PURE O2 STICK
Item No./Part No. : N/A
Received Date : 2020. 10. 28
Test Period : 2020. 10. 28 to 2020. 11. 02
Test Results : For further details, please refer to following page(s)

SGS Korea Co., Ltd.

Tommy Oh / Chemical Lab Mgr

SGS Korea Co.,Ltd. 322, The O valley, 76, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 14117
t +82 (0)31 4608 000 f +82 (0)31 4608 059 http://www.sgsgroup.kr

SGS

Sample No. : AYAA20-59401.001
Sample Description : PURE O2 STICK
Item No./Part No. : N/A
Materials : N/A

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to IEC 62321-5 : 2013, by ICP-OES	0.5	N.D.
Lead (Pb)	mg/kg	With reference to IEC 62321-5 : 2013, by ICP-OES	5	N.D.
Mercury (Hg)	mg/kg	With reference to IEC 62321-4 : 2013+A1 : 2017, by ICP-OES	2	N.D.
Hexavalent Chromium (Cr VI)*	mg/kg	With reference to IEC 62321-7-2 : 2017, by UV-Vis and/or with reference to IEC 62321-5 : 2013, by ICP-OES	8	N.D.

Flame Retardants-PBBs/PBDEs

Test Items	Unit	Test Method	MDL	Results
Monobromobiphenyl	mg/kg	With reference to IEC 62321-6 : 2015, by GC-MS	5	N.D.
Dibromobiphenyl	mg/kg	With reference to IEC 62321-6 : 2015, by GC-MS	5	N.D.
Tribromobiphenyl	mg/kg	With reference to IEC 62321-6 : 2015, by GC-MS	5	N.D.
Tetrabromobiphenyl	mg/kg	With reference to IEC 62321-6 : 2015, by GC-MS	5	N.D.
Pentabromobiphenyl	mg/kg	With reference to IEC 62321-6 : 2015, by GC-MS	5	N.D.
Hexabromobiphenyl	mg/kg	With reference to IEC 62321-6 : 2015, by GC-MS	5	N.D.
Heptabromobiphenyl	mg/kg	With reference to IEC 62321-6 : 2015, by GC-MS	5	N.D.
Octabromobiphenyl	mg/kg	With reference to IEC 62321-6 : 2015, by GC-MS	5	N.D.
Nonabromobiphenyl	mg/kg	With reference to IEC 62321-6 : 2015, by GC-MS	5	N.D.
Decabromobiphenyl	mg/kg	With reference to IEC 62321-6 : 2015, by GC-MS	5	N.D.
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321-6 : 2015, by GC-MS	5	N.D.
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321-6 : 2015, by GC-MS	5	N.D.
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321-6 : 2015, by GC-MS	5	N.D.
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321-6 : 2015, by GC-MS	5	N.D.
Pentabromodiphenyl ether	mg/kg	With reference to IEC 62321-6 : 2015, by GC-MS	5	N.D.
Hexabromodiphenyl ether	mg/kg	With reference to IEC 62321-6 : 2015, by GC-MS	5	N.D.
Heptabromodiphenyl ether	mg/kg	With reference to IEC 62321-6 : 2015, by GC-MS	5	N.D.
Octabromodiphenyl ether	mg/kg	With reference to IEC 62321-6 : 2015, by GC-MS	5	N.D.
Nonabromodiphenyl ether	mg/kg	With reference to IEC 62321-6 : 2015, by GC-MS	5	N.D.
Decabromodiphenyl ether	mg/kg	With reference to IEC 62321-6 : 2015, by GC-MS	5	N.D.

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SGS Korea Co.,Ltd. 322, The O valley, 76, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 14117
t +82 (0)31 4608 000 f +82 (0)31 4608 059 http://www.sgsgroup.kr

Member of the SGS Group (Société Générale de Surveillance)

CERTIFICATE OF PATENT

Patent Number 10-2298630

Application Number 10-2020-0037955

Filing Date 2020. 03. 30.

Registration 2021. 08. 31.

Title of the Invention

POWDER AND LIQUID REACTION TYPE STERILIZING GAS DIFFUSING STICK

Patentee

Patentees are filled out in a registration page.

Inventor

Inventors are filled out in a registration page.

This is to certify that, in accordance with the Patent Act, a patent for the invention has been registered at the Korean Intellectual Property Office.

특허청
Korean Intellectual Property Office

2021. 09. 02.

Check your current registration with QR code

COMMISSIONER,
KOREAN INTELLECTUAL PROPERTY OFFICE
김 용래

Global Inter Certification

Management System Certification Body No.MSCB-108

CERTIFICATE

No. 21-B-0260 Rev.0

This is to certify that the Medical Devices-Quality Management Systems of

Pureo2 Co.

#F334, F335, 45, Jojeong-daero, Hanam-si, Gyeonggi-do, Republic of Korea

Company Reg. No.: 734-23-00515

has documented and implemented system in compliance with the requirements of

ISO 13485:2016
Medical Devices-Quality Management Systems

for

Development, Manufacture and Sales of Disinfectant

The certificate is issued on the basis of the results mentioned in the pertinent audit report. Validity of the certificate is conditionally limited by positive results of surveillance audits, which the certified company is committed to undergo.

This certificate can be invalid if the certificate holder does not fulfill the conditions set out in the certification agreement.

GIC ISO 13485 CERTIFIED

IAS ACCREDITED Management Systems Certification Body MSCB 108

IAF MEMBER OF MULTILATERAL RECOGNITION ARRANGEMENT

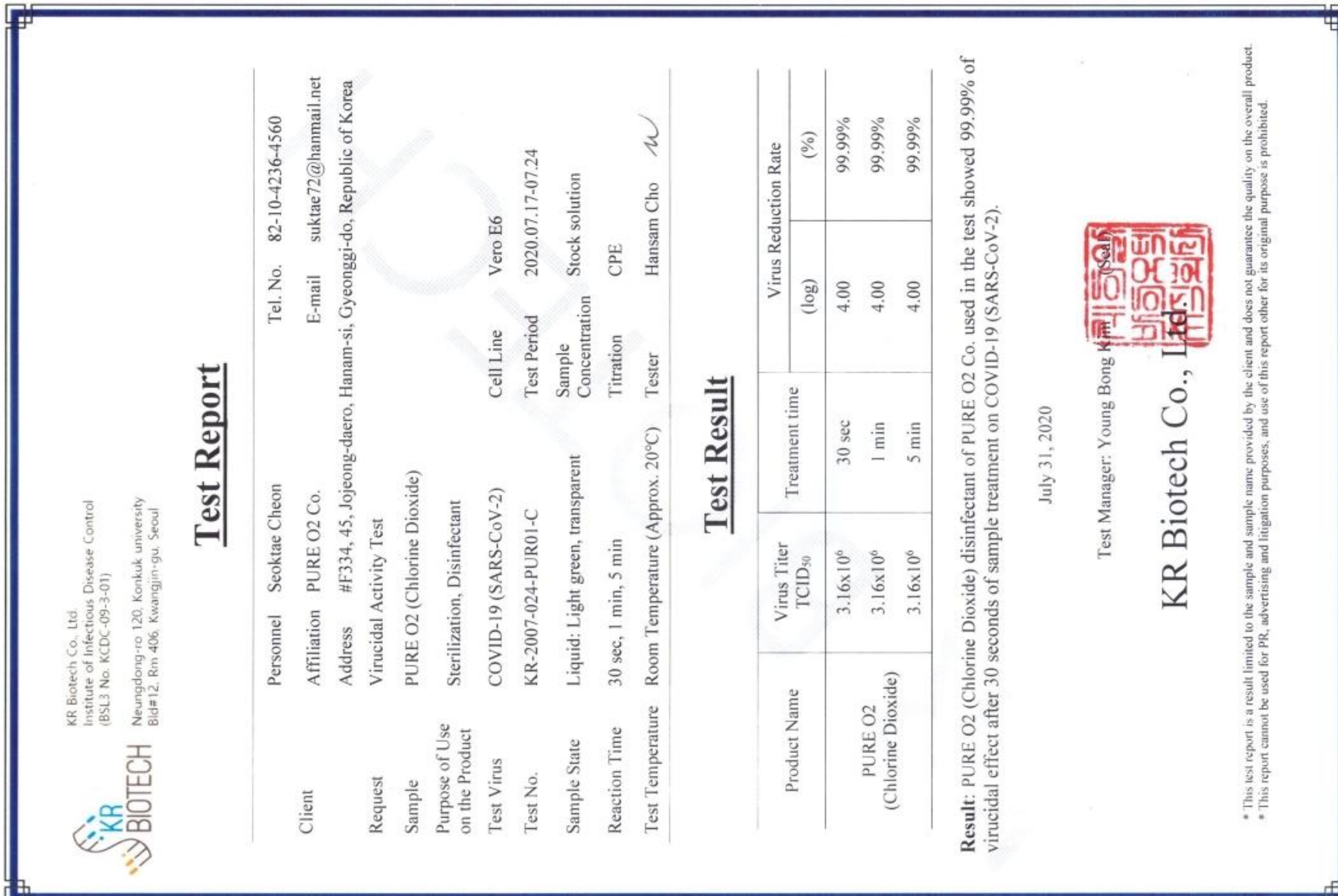
Initial issue date: Sep. 24. 2021
Expire date: Sep. 23. 2024

Tyrone Dyse
Tyrone Dyse
Head of Certification Body

904 E. Windsor Road #102, Glendale, CA 91205, U.S.A.
http://www.gicert.org/

▣ PureO2 COVID19 Test Report

The SARS-CoV-2 (Severe acute respiratory syndrome-related coronavirus) virus reduction rate (virucidal rate) for PURE O2 Co. disinfectant (PURE O2 (Chlorine Dioxide)) samples under guideline test conditions was 4.00 after 30 seconds of sample treatment, confirming the virus killing efficacy of 99.99% or more.



KR BIOTECH

KR Biotech Co., Ltd
Institute of Infectious Disease Control
(BSL3 No. KCDC-09-3-01)

Neungdong-ro 120, Konkuk university
Bld#12, Rm 406, Kwangjin-gu, Seoul

Test Report

Client	Personnel	Seoktae Cheon	Tel. No.	82-10-4236-4560
	Affiliation	PURE O2 Co.	E-mail	suktae72@hanmail.net
	Address	#F334, 45, Jojeong-daero, Hanam-si, Gyeonggi-do, Republic of Korea		
Request	Virucidal Activity Test			
Sample	PURE O2 (Chlorine Dioxide)			
Purpose of Use on the Product	Sterilization, Disinfectant			
Test Virus	COVID-19 (SARS-CoV-2)		Cell Line	Vero E6
Test No.	KR-2007-024-PUR01-C		Test Period	2020.07.17-07.24
Sample State	Liquid: Light green, transparent		Sample Concentration	Stock solution
Reaction Time	30 sec, 1 min, 5 min		Titration	CPE
Test Temperature	Room Temperature (Approx. 20℃)		Tester	Hansam Cho

Test Result

Product Name	Virus Titer $TCID_{50}$	Treatment time	Virus Reduction Rate (log)	Virus Reduction Rate (%)
PURE O2 (Chlorine Dioxide)	3.16×10^6	30 sec	4.00	99.99%
	3.16×10^6	1 min	4.00	99.99%
	3.16×10^6	5 min	4.00	99.99%

Result: PURE O2 (Chlorine Dioxide) disinfectant of PURE O2 Co. used in the test showed 99.99% of virucidal effect after 30 seconds of sample treatment on COVID-19 (SARS-CoV-2).

July 31, 2020

Test Manager: Young Bong Kim (Seal)

KR Biotech Co., Ltd.

* This test report is a result limited to the sample and sample name provided by the client and does not guarantee the quality on the overall product.
* This report cannot be used for PR, advertising and litigation purposes, and use of this report other for its original purpose is prohibited.

CERTIFICATE OF VIRUCIDAL EFFICACY TEST

Assignment Number	200100475	Ordering company	**** Inc.
Assignment Subject	Efficacy assessment for SARS-CoV-2(causes Corona19) by gas-generating composition type disinfectant and spray type disinfectant.		
Assignment Term	2020-04-20 ~ 2020-10-20	Total research budget	
Host Organization	Name	Location	Representative
	Chonbuk National University Industry-University Cooperation Foundation	Jeonju	Cho, Jae Young
Host Research Director	Name	Department	Position/Major
	Lyoo, Kwang Soo	Chonbuk NationalUniversity/Korea Zoonosis Research Institute(KoZRI)	Veterinary Research Director/Veterinary Virology
	Contact	E-mail	
		@jbnu.ac.kr	
Research participants	Total 3 people		

The result report of the 2020 research project is submitted as attached

July 15,2020

Chonbuk National University/Korea Zoonosis Research Institute (KoZRI)

Principle Investigation Lyoo,Kwang Soo

Model name : ProVtect Zone Defence(Gas-generating Compositions)

1. Test Objective

Virus inactivation efficacy for substances developed by **** Inc. was evaluated by in-vitro.

2. Test Method

① Test virus

- SARS-CoV-2(causes COVID-19)

② Cultured cells

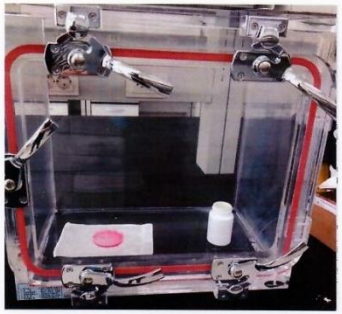
- Vero E6 cell

③ Candidate Substance

- 1 type of raw material for gas-generating compositions provided by **** Inc.

④ Experiment method

- SARS-CoV-2 is placed in the chamber as shown in the figure below, and the gas generating compositions provided by IGNAL Inc. is placed for 2 , 4 hours each to allow the virus to contact with the generated gas.
- As a control virus, apply SARS-CoV-2 to the chamber under the same conditions without disinfectants left for 2, 4 hours each.



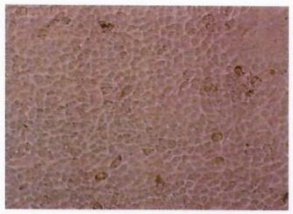
⑤ Virus quantitative analysis

- Dilute the gas-generating composition reacted virus and controlled virus to 10^1, 10^2, 10^3, 10^4, 10^5 using DMEM.
- Inoculate diluted virus after culturing 60-70% Vero cell per a well of 96-well plate
- Daily observation of the cytopathic effect of SARS-CoV-2 every day for 4 days.

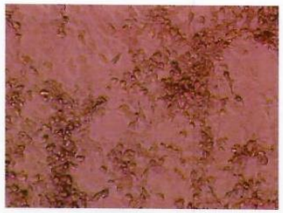
3. Research Results

A. Virus removal efficiency confirmation test result

1) Effect of cell denaturalization by SARS-CoV-2 in Vero E6 cells



Normal cell



cytopathic effect of cells by viral infection

2) SARS-CoV-2 inactivation efficacy

- 1st test

Reaction time	$log_{10}TCID_{50}/m\ell$	Virus inactivation efficacy(%)
2-hour reaction	**1.83**	**>99.99**
4-hour reaction	**<1.5**	**>99.99**
Control	**6.5**	
Average		**>99.99**

- 2nd test

Reaction time	$log_{10}TCID_{50}/m\ell$	Virus inactivation efficacy(%)
2-hour reaction	**2.00**	**>99.99**
4-hour reaction	**<1.5**	**>99.99**
Control virus	**6.5**	
Average		**>99.99**

- 3rd test

Reaction time	$log_{10}TCID_{50}/m\ell$	Virus inactivation efficacy(%)
2-hour reaction	**1.67**	**>99.99**
4-hour reaction	**<1.5**	**>99.99**
Control virus	**6.5**	
Average		**>99.99**

※ We confirmed that the inactivation efficacy performance test using SARS-CoV-2 and 3 times repeated tests for the candidate substance developed by ******** Inc. resulted 99.99% virus inactivation efficacy against the virus.

This research project was carried out in Chonbuk National University biosafty level 3(BL-3) facility.

(28115) 충북 청주시 청원구 오창읍 양청 3 길 21
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안전확인대상생활화학제품 확인결과서

발행번호 : M287-19-04555		접수번호 : M287-19-04555	
확인 완료일 : 2019. 12. 05.		접수 연월일 : 2019. 11. 25.	
신청인	상호(명칭) 퓨어오투	법인등록번호(사업자등록번호) 734-23-00515	
	성명(대표자) 유숙정	담당자 성명 및 연락처 담당자 : 천석태 연락처 : 010-4236-4560 (전자우편 : lu7207@naver.com)	
	소재지(사업장) 경기도 하남시 조정대로 45, 3층 F334호 (풍산동,미사센텀비즈)	전화번호 : 1833-9947 팩스번호 : 070-4015-9947	
확인 제품	제조・수입 [O] 제조 [ ] 수입	품목 살균제	
	제품명 퓨어오투 스틱(STICK)	용도 일반물체용	
	제형 비분사형(액체형)	중량・용량・매수 10 g	
	제조국명(수입의 경우) -	제조회사명(수입의 경우) -	

확인 결과

▪ 검사방법
(1) 안전확인대상생활화학제품 지정 및 안전·표시기준(환경부고시 제2019-45호, 2019.2.12.)
(2) 안전확인대상생활화학제품 시험 검사 기준 및 방법 규정(국립환경과학원고시 제2018-71호, 2018.12.31.)
▪ 환경조건: 온도 (21.1) ℃, 습도 (30) % R.H.

검사 구분	판정	부적합 사항	비고	종합판정
화학물질 확인결과	적합	-	-	[O] 적합 [ ] 부적합
용기・포장 및 중량 확인결과	적합	-	-	
어린이보호포장	적합	-	-	

작성자 : 박성열 (서명생략) 기술책임자 : 오영환 (서명)

확인성적서 유효기간 : 2019년 12월 5일 ~ 2022년 12월 4일

※ 위 판정은 신청인이 제시한 제품에 한정하여 확인된 결과입니다.

「생활화학제품 및 살생물제의 안전관리에 관한 법률」 제10조제1항, 같은 법 시행령 제5조제2항 및 같은 법 시행규칙 제5조제2항에 따라 안전확인대상생활화학제품 확인결과서를 발급합니다.

2019 년 12 월 5 일

FITI 시험연구원장

※ 문서 확인 번호 : PEUH-817I-2QSQ ※
(홈페이지에 접속 후 "성적서확인"메뉴에서 문서 확인 번호를 통해 위 변조 여부를 확인할 수 있습니다.)

(28115) 충북 청주시 청원구 오창읍 양청 3 길 21
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안전확인대상생활화학제품 확인결과서

1. 화학물질 확인결과

연번	확인항목	단위	확인기준	확인결과	판정	비고
1	폼알데하이드	mg/kg	100 이하	불검출	적합	함량제한물질 (필수)
2	아세트알데하이드	mg/kg	200 이하	불검출	적합	함량제한물질 (필수)
3	클로로포름	mg/kg	30 이하	불검출	적합	함량제한물질 (필수)
4	함유금지물질	-	비함유	비함유	적합	비함유·비사용 확약서 제출

e-DOCUMENT SERVICE

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안전확인대상생활화학제품 확인결과서

2. 용기・포장 및 중량 확인결과

연번	확인항목	확인기준	확인결과	판정	비고
1	겉모양	외관은 깨끗하여야 하며 날카로운 부위 등 위험부위가 없어야 한다.	이상없음	적합	-
		구조는 변형·파손 등이 없어야 하고, 내용물이 새지 않아야 한다.	이상없음	적합	-
		고압가스를 이용한 스프레이형 제품의 경우에는「고압가스안전관리법」에 따른 적합한 용기를 사용하여야 하며, 분사 후 흐름현상이 없어야 한다.	해당없음	해당없음	-
2	강도 및 누수	용기 강도 시험을 실시할 때 마개 또는 몸체 등 용기의 파손이 없어야 하며 제품의 내용물이 새어나오지 않아야 한다.	이상없음	적합	-
		누수 시험을 실시할 때 제품의 내용물이 새어 나오지 않아야 한다.	이상없음	적합	-
		20 ℃의 물에서 30초 이상 내용물이 유지되어야 한다.	해당없음	해당없음	-
		표준시험조건[온도 (23 ± 2) ℃, 상대습도 (50 ± 5) %] 하에서 최소한 300 N 의 기계적 압축강도를 견뎌야 한다.	해당없음	해당없음	-
3	중량 또는 용량	「계량에 관한 법률 제41조 및 시행령 제36조」에 따른 허용오차를 초과하지 아니하여야 한다.(허용부족량 9 %(9.1 g))	10.7 g	적합	-
			10.7 g	적합	
			10.7 g	적합	

3. 어린이보호포장 확인결과

연번	확인항목	확인기준	확인결과	판정	비고
1	필수 품목기준 (pH)	2.0 초과 11.5 미만	2.4	적합	비대상
2	적용 물질기준	어린이보호포장에 관한 안전기준	해당없음	적합	제출서류 확인

(28115) 충북 청주시 청원구 오창읍 양청 3 길 21
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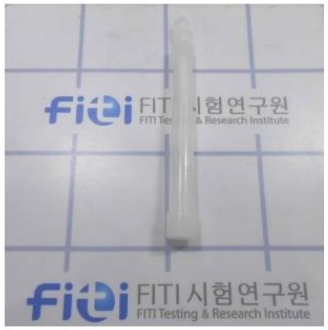
안전확인대상생활화학제품 확인결과서

4. 제품 사진

전면	후면
	

- 이하 여백 -

■ 생활화학제품 및 살생물제의 안전관리에 관한 법률 시행규칙[별지 제4호서식]

(앞쪽)

신고번호 제 GB19-21-0096 호

안전기준 적합확인 신고증명서

신고인	상호(명칭) 퓨어오투	법인등록번호(사업자등록번호) 7342300515
	성명(대표자) 유숙정	담당자 성명 및 연락처 031-1833-9947 천석태 (전자우편 :suktae72@hanmail.net)
	소재지(사업장) (12918) 경기도 하남시 조정대로 45 미사센텀비즈 F334호	(전화번호 :031-1833-9947) (팩스번호 :070-4015-9947)
신고 제품	제조 수입 [√] 제조 [ ] 수입	품목 살균제
	제품명 퓨어오투 스틱(STICK)	용도 일반용(일반물체용)
	제형 비분사형 액체형	증량·용량·매수 20g/8개 개입
	제조국명(수입의 경우)	제조회사명(수입의 경우)
	신고사항	

「생활화학제품 및 살생물제의 안전관리에 관한 법률」 제10조제4항 및 같은 법 시행규칙 제5조제5항에 따라 안전기준 적합확인 신고증명서를 발급합니다.

2019 년 12 월 19 일

한국환경산업기술원장

210mm×297mm[백상지(150g/㎡)]

(뒤쪽)

<기재사항>

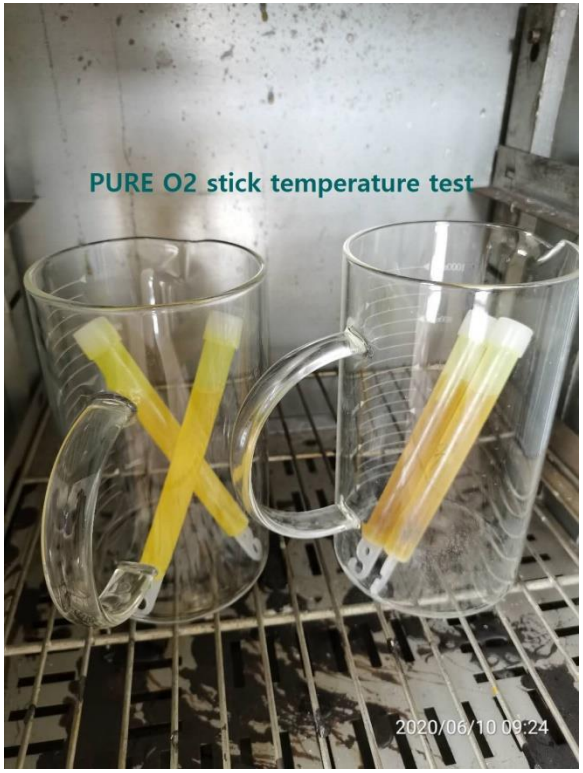
연 월 일	내용	확 인
2019.12.19	최초 대표제품 신고 - 용도: 살균제품-살균제(일반용-일반물체용) ※ 2), 3)번의 경우 해당시 준수하여야함 1) 제품 판매 시, 화학제품관리시스템을 통해 승인된 표시사항을 표시하지 아니하거나 거짓으로 표시하는 경우, "생활화학제품 및 살생물제의 안전관리에 관한 법률" 제57조제1항에 의거 5년 이하의 징역 또는 5천만원 이하의 벌금에 처해질 수 있음 2) 2020년 1월 1일 이후 제조하거나 수입하는 어린이보호포장 대상제품의 경우, "안전확인대상생활화학제품 지정 및 안전.표시기준" [별표 4]에 따른 어린이보호포장에 관한 안전기준에 적합하여야 함 3) 제품 내 함유물질 성분 중 "중점관리물질의 지정" [별표 1]에 해당하는 물질을 사용한 경우, 2019년 7월 1일 이후 생산되는 제품은 "안전확인대상생활화학제품 지정 및 안전.표시기준" [별표 6] 안전확인대상생활화학제품의 표시방법의 "기타물질" 표시방법을 준수하여야 함 - 이 하 여 백 -	

210㎜×297㎜[백상지(150g/㎡)]

PURE O2 stick temperature test

1

2



4