TEST REPORT

Received Date： Dec. 17, 2013
Report Number： PX/2013/C0092A
Report Date： Feb. 10, 2014
The number of Page： 1 OF 1

Following Test Sample is provided and confirmed by client

Client: Geann Industrial Co., Ltd
Product Name: OZONE ANTI-BACTERIAL FAUCET
Model/Type： OZONE SERIES
Sample Number： PXC009201~02
Test Item and Method: Performance test

1. The test solution was prepared in SGS laboratory.
2. Using tap-water processing through the product continually for 30 seconds then collecting 2000mL water.
3. Put 0.4mL test solution into 2000mL water(after Step 2) and well mixed.
4. The test solution was analyzed after step 3 and control test.

Control test:
Put 0.4mL test solution into 2000mL DI water and well mixed

Test Result：

Test Item	Unit	Before processing	After processing	Elimination ratio(%)
Coliform	CFU/mL	3.6×10^3	<5	>99.9
Escherichia coli	CFU/mL	4.7×10^3	<5	>99.9
Total Plate Count	CFU/mL	8.8×10^3	<5	>99.9
Staphylococcus aureus	CFU/mL	4.0×10^5	<5	>99.9
Pseudomonas Aeruginosa	CFU/mL	5.1×10^5	<5	>99.9
Candida albicans	CFU/mL	3.3×10^4	<5	>99.9
Legionella pneumophila	CFU/mL	8.6×10^5	<5	>99.9

Remark： 1. This report is for reference, not for advertisement or publication.
2. Sample and title of the report are provided by the client. Environment Lab is only responsible for testing and analyzing.
3. Test results are valid only for test samples.
4. This test document cannot be reproduced in any way, except in full content, without the prior approval in writing of the laboratory.
5. If there are any discrepancies between the English and Chinese report, the Chinese version shall prevail.
6. The client entrusts the product or trademark of the examination, belonging to the client all, or have already got the ownership person's authorization.
7. The report number " PX/2013/C0092A " replaces the " PX/2013/C009201~08".

SGS TAIWAN LTD

Steven Chuang / Manager
SIGNED FOR AND ON BEHALF OF
SGS TAIWAN LTD.

M61-1406005630O3EN

The original report of:M61-1406005630O2EN

SUPER LAB
because results matter

CUSTOMER

Geann Industrial Co., LTD

No.29, Tou-Lun Lane, Tou-Lun Li, Lukang Town, Changhua 505, Taiwan

Client Specimen I.D.: Ozone Anti-Bacteria Faucet

Specimen description: as Appendix

Specimen collector: ■ Client □ Superlab

Date Received: Jun. 11, 2014 Date Tested: Jun. 11, 2014 Date Issued: Jun. 26, 2014

Item	Result	Unit	Method	LOQ
	>99.99	%	Refer to JIS Z2801	–

Bactericidal Activities : Multidrug-resistant

Staphylococcus aureus

XXX Null below XXX

Remark:

• The analytical report is the test result issued by the testing institutions as requested by the consignor. Regarding to the legitimacy of the product, it shall be determined by the authorities according to the law.

• Add the bacteria suspension into bottle, then the final concentration is around 10^4 CFU/mL.Cover with the lid immediately and interact with bacteria for 60 seconds (start from receive test article).

■ If the target organism is detected below the method detection limit (MDL) or the limit of quantification (LOQ),the test result will be expressed as "Negative" or "ND". ND: Not detected

■ Separately use the report and / or copy the report abstract is invalid.

■ If the test do not involve sampling, the test report is only responsible for the specimens provided by customer.

■ If customer have any question about the test result, please inquire us within seven days after receipt of the test report.

■ This report is for reference only, do not use these for advertising, sales promotion or notarial purpose

Authorized Signee : Etain Shen
Executive Business Secretary : Joan Lee
Study Personnel/Reviewer : Etain Shen

SIGNED ON BEHALF OF SUPERLAB
Wen-cherng Tsai, Ph. D.
Laboratory Director

SUPERLAB TESTING CENTER No.21, Wugong 5th Rd., Xinzhuang Dist., New Taipei City 24890, Taiwan (R.O.C.) T 886 2 2298-1887 F 886 2 2290-2510

M61-140600563003EN

The original report of:M61-140600563002EN

SUPER LAB
because results matter

Geann Industrial Co., LTD.

No.29, Tou-Lun Lane, Tou-Lun Li, Lukang Town, Changhua 505, Taiwan

Client Specimen I.D.: Ozone Anti-Bacteria Faucet

Specimen description: as Appendix

Specimen collector: ■ Client □ Superlab

Date Received: Jun. 11, 2014 Date Tested: Jun. 11, 2014 Date Issued: Jun. 26, 2014

Appendix

1. Abstract :

The antimicrobial activities of test article (Ozone Anti-Bacteria Faucet) was provided by Geann Industrial Co.,LTD against Multidrug-resistant *Staphylococcus aureus*, was evaluated according to the guideline of JIS Z2801. Results showed that the antimicrobial activities of the test article against Multidrug-resistant *Staphylococcus aureus* after 60 seconds, the reduction rate was>99.99% (Table 1).

2. Test information :

2.1 Client Specimen I.D : 「Ozone Anti-Bacteria Faucet」

2.2 Specimen I.D : M61-140600563

2.3 Test strains : Multidrug-resistant *Staphylococcus aureus*

2.4 Test condition : 25 ± 2°C for 60 seconds

2.5 Culture condition : 35 ± 2°C for 48 ± 2 hours

2.6 Test method : refer to JIS Z2801

2.7 Test article : Ozone Anti-Bacteria Faucet

2.8 Add 1 mL of bacteria suspension into bottle, then the final concentration is around 10^4 CFU/mL.

2.9 Add Test article(2,000mL) into bottle , and interact with bacteria for 60 seconds.

2.10 When incubation completed, Make serial dilution to determine the recover bacteria.

2.11 Report bacteria counts as the number of bacteria per sample.

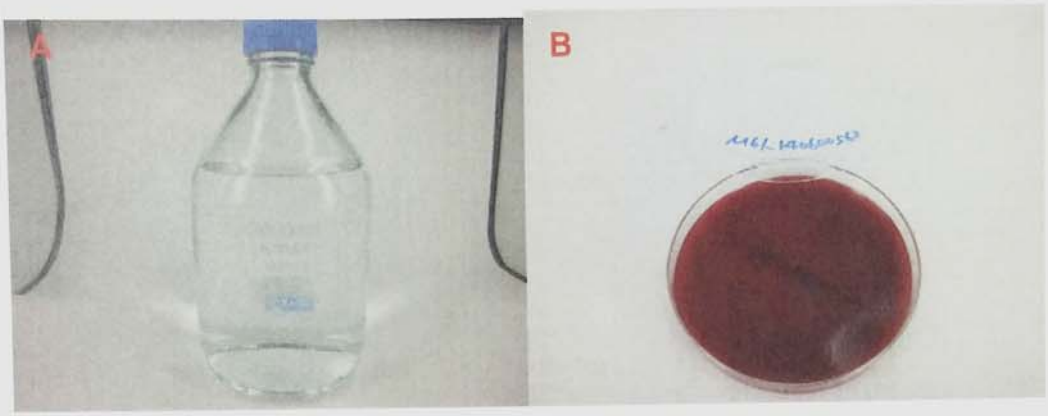
2.12 Calculation :

$$\text{Reduction rate (\%)} = \frac{(A-B)}{A} \times 100\%$$

A = Test design (Bacteria suspension before mixing the test article(2,000mL))

B = Test design (Bacteria suspension after mixing the test article(2,000mL))

3. Results :



A. M61-140600563 Antimicrobial activities against Multidrug-resistant *Staphylococcus aureus* : test article

B. M61-140600563 Bacteria level after incubated with test article (60 seconds).

Table 1. Antimicrobial activities of test article (M61-140600563) against Multidrug-resistant *Staphylococcus aureus* after 60 seconds incubation.

Test strain	Inoculated concentration (CFU/sample)	Bacterial concentration (CFU/sample)		Reduction rate (%)
		Before adding	After adding	
Multidrug-resistan *Staphylococcus aureus*	1.2×10^4	<5	1.2×10^4	>99.99

How Ozone Affects Bacteria, Fungus, Molds And Viruses

Posted by Susan Lillard

Sunday, 03 October 2004

Ozone is a naturally occurring gas created from oxygen atoms. The oxygen molecule is made up of 2 oxygen atoms. These oxygen molecules are broken into atoms by the corona discharge during lightning storms or by UV light from the Sun. Single oxygen atoms cannot exist alone without regrouping back into di-atomic oxygen molecules. During this recombination stage some atoms will regroup into loosely bonded tri-atomic oxygen. This new molecule is called Ozone, as seen to the right (d = 1.28 A, Theta = 116.5o). Due to the loose bond in this oxygen molecule - ozone is a very strong oxidant and an ideal chemical-free purification and a disinfecting agent.

Ozone is frequently misdiagnosed and equated to low-altitude pollution. Nothing could be farther from the truth. In fact, Ozone breaks down pollutants and should be welcomed when found in the air.

The most effective way to produce Ozone commercially is through the use of pulse injected corona discharge.

Disinfection by tri-atomic oxygen (Ozone) occurs through the rupture of the cell wall. This is a more efficient method than Chlorine, which depends upon diffusion into the cell protoplasm and inactivation of the enzymes. An ozone level of 0.4 ppm for 4 minutes has been shown to kill any bacteria, virus, mold and fungus. 1 parts per million is equivalent to: 8.345 pounds per million gallons (US).

When the effectiveness of Ozone as a disinfectant was measured, there was little or no disinfection up to a certain dosage. At higher levels the sanitizing effect increased greatly. For complete disinfection a surplus or residual Ozone has to be maintained in the solution to assure that every living microorganism has been contacted.

There has yet to be discovered any antibiotic that is truly effective in the virus arena. There are indications that DNA viruses such as Herpes are implicated in human cancers, since they organize the genetic material of the host cell to produce new viruses. Ozone will inactivate viruses on contact, even at very low residual concentrations. In case of polio, only 0.012 ppm removes all viral cells in less than 10 seconds.

Mold and mildew are easily controlled by Ozone present in air and in water. Giardia and Cryptosporidium cysts are susceptible to Ozone but not affected by normal levels of Chlorine.

The Effects of Ozone on Pathogens

The antipathogenic effects of ozone have been substantiated for several decades. Its killing action upon bacteria, viruses, fungi, and in many species of protozoa, serve as the basis for its increasing use in disinfecting municipal water supplies in cities worldwide.

Bacteria are microscopically small single-cell creatures having a primitive structure. They take up foodstuffs and release metabolic products, and multiply by division. The bacteria body is sealed by a relatively solid cell membrane. Their vital processes are controlled by a complex enzymatic system. Ozone interferes with the metabolism of bacterium cells, most likely through inhibiting and blocking the operation of the enzymatic control system. A sufficient amount of ozone breaks through the cell membrane, and this leads to the destruction of the

bacteria.

Viruses are small, independent particles, built of crystals and macromolecules. Unlike bacteria, they multiply only within the host cell. Ozone destroys viruses by diffusing through the protein coat into the nucleic acid core, resulting in damage of the viral RNA. At higher concentrations, ozone destroys the capsid or exterior protein shell by oxidation.

Indicator bacteria in effluents, namely coliformas and pathogens such as Salmonella, show marked sensitivity to ozone inactivation. Other bacterial organisms susceptible to ozone's disinfecting properties include Streptococci, Shigella, legionella pneumophila, Pseudomonas aerunginosa, Yersinia enterocolitica, Campylobacter jejuni, Mycobacteria, Kelbsiella pneumonia, and Escherichia coli. Ozone destroys both aerobic and importantly, anaerobic bacteria which are mostly responsible for the devastating sequel of complicated infections, as exemplified by decubitus ulcers and gangrene.

The mechanisms of ozone bacterial destruction need to be further elucidated. It is known that the cell enveloped of bacteria are made of polysaccharides and proteins and that in

Gram negative organisms, fatty acid alkyl chains and helical lipoproteins are present. In acid-fast bacteria, such as Mycobacterium tuberculosis, on third to one half of the capsule is formed of complex lipids (esterified mycolic acid, in addition to normal fatty acids), and glycolipids (sulfolipids, lipopolysaccharides, mycosides, trehalose mycolates). The high lipid content of the cell walls of these ubiquitous bacteria may explain their sensitivity, and eventual demise, subsequent to ozone exposure. Ozone may also penetrate the cellular envelope, directly affecting cytoplasmic integrity, disrupting any one of numerous levels of its metabolic complexities.

Numerous families of viruses including poliovirus I and 2, human rotavruses, Norwalk virus, Parvoviruses, and Hepatitis A, B and non-A non-B?, among many others, are susceptible to the virucidal actions of ozone.

Most research efforts on ozone's virucidal effects have centered upon ozone's propensity to break apart lipid molecules at sites of multiple bond configuration. Indeed, once the lipid envelope of the virus is fragmented, its DNA or RNA core cannot survive.

Non-enveloped viruses (Adenoviridae, Picornaviridae, namely poliovirus, Coxsachie, Echovirus, Rhinovirus, Hepatitis A and E, and Reoviridae (Rotavirus), have also begun to be studied. Viruses that do not have an envelope are called "naked viruses." They are constituted of a nucleic acid core (made of DNA or RNA) and a nucleic acid coat, or capsid, made of protein. Ozone, however, aside from its well-recognized action upon unsaturated lipids, can also interact with certain proteins and their constituents, namely amino acids. Indeed, when ozone comes in contact with capsid proteins, protein hydroxides and protein hydroxides and protein hydroperoxides are formed.

Viruses have no protections against oxidative stress. Normal mammalian cells, on the other hand possess complex systems of enzymes (i.e., superoxide dismutase, catalase, peroxidase), which tend to ward off the nefarious effects of free radical species and oxidative challenge. It may thus be possible to treat infected tissues with ozone, respecting the homeostasis derived from their natural defenses, while neutralizing offending and attacking pathogen devoid of similar defenses.

The enveloped viruses are usually more sensitive to physico-chemical challenges than are naked virions. Although ozone's effects upon unsaturated lipids is one of its best documented biochemical action, ozone is know n to interact with proteins, carbohydrates, and nucleic acids. This becomes especially relevant when ozone inactivation of non-enveloped virions is

considered.

Fungi families inhibited and destroyed by exposure to ozone include Candida, Aspergilus, Histoplasma, Actinomycoses, and Cryptococcus. The walls of fungi are multilayered and re composed of approximately 80% carbohydrates and 10% of proteins and glycoproteins. The presence of many disulfide bonds had been noted, making this a possible site for oxidative inactivation by ozone.

In all likelihood, however, ozone has the capacity to diffuse through the fungal wall into the organismic cytoplasm, thus disrupting cellular organelles.

Protozoan organisms disrupted by ozone include Giardia, Cryptosporidium, and free-living amoebas, namely Acanthamoeba, Hartmonella, and Negleria. The anit-protozoal action has yet to be elucidated.

Typical Dosage and Reaction Times

- Aspergillus Niger (black Mount): Destroyed by 1.5 to 2 mg/1.
- Bacillus Bacteria: Destroyed by 0.2 mg/1 within 30 seconds
- Bacillus Anthracis: Causes anthrax in sheep, cattle and pigs. A human pathogen. Ozone susceptible.
- Clostridium Bacteria: Ozone-Susceptible.
- Clostridium Botulinum Spores: Its toxin paralyzes the central nervous system, being a poison multiplying in food and meals. 0.4 to 0.5 mg/1.
- Diphtheria Pathogen: Destroyed by 1.5 to 2 mg/1.
- Eberth Bacillus (Typhus abdominalis): Destroyed by 1.5 to 2 mg/1.
- Echo Virus 29: This virus most sensitive to ozone. After a contact time of 1 Minute at 1 mg/1 of ozone, 99.999% killed.
- Escheriachia Coli Bacteria (from feces): Destroyed by 0.2 mg/1 within 30 seconds.
- Encephalomyocarditis Virus: Destroyed to zero level in less than 30 seconds with 0.1 to 0.8 mg/1.
- Enterovirus Virus: Destroyed to zero level in less than 30 seconds with 0.1 to 0.8 mg/1.
- GDVII Virus: Destroyed to zero level in less than 30 seconds with 0.1 to 0.8 mg/1.
- Herpes Virus: Destroyed to zero level in less than 30 seconds with 0.1 to 0.8 mg/1.
- Influenza Virus: 0.4 to 0.5 mg/1.
- Klebs-Loffler Virus: Destroyed by 1.5 to 2 mg/1.
- Poliomyelitis Virus: Kill of 99.999% with 0.3 to 0.4 mg/1 in 3 to 4 minutes.
- Proteus Bacteria: Very Susceptible.
- Pseudomonal Bacteria: Very Susceptible.
- Rhabdovirus Virus: Destroyed to zero level in less than 30 seconds.
- Salmonella Bacteria: Very Susceptible.
- Staphylococci: Destroyed by 1.5 to 2 mg/1.
- Stomatitis Virus: Destroyed to zero level in less than 30 seconds with 0.1 to 0.8 mg/1.
- Streptococcus Bacteria: Destroyed by 0.2 mg/1 within 30 seconds