Electrolyzed Water

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Posts Tagged 'hypochlorous acid'

Chlorine – A Great Disinfectant!

December 16, 2010

There are distinct differences between a *Sodium Hypochlorite* solution, a *Calcium Hypochlorite* solution and an onsite generated *Hypochlorous Acid* solution.

***Sodium Hypochlorite* Solution (NAOCL)**

Sodium Hypochlorite solution often called bleach usually containing LYE is manufactured at a factory, stored, shipped to distribution centers, stored again and then sold.

***Calcium Hypochlorite* Solution (CAOCL)**

Dry *Calcium Hypochlorite* tablets produce a "FRESH" *Hypochlorite* solution when mixed with water. In tests done, a solution produced with the proper *Calcium Hypochlorite* tablet, can maintain "Free Available Chlorine" or *Hypochlorous Acid* the
active disinfectant in this *Calcium Hypochlorite* solution, for ONLY about 4 hrs, then it starts rapidly degrading.

Hypochlorous Acid Solution (HOCL)

Until now, HOCl has simply been thought of as a transient byproduct in the ubiquitous chlorine chemical family. However, HOCl generated by ECA technology carries with it fewer negative hydroxides than the previous HOCl formed via disassociation from sodium hypochlorite. Because of this, ECA-generated HOCl behaves uniquely and must be considered separately from chlorine. HOCl as a stand-alone chemical, separate from chlorine, has not been available in the market until now. This breakthrough results in a need for a paradigm shift in biocidal approaches. HOCl is an "old", well appreciated chemical but is now "new" availabie as onsite generated solution.

1. Free available Chlorine content

For a chlorine solution to be a good disinfectant it must meet the Chlorine Demand. The chlorine demand is the amount of Free Available Chlorine (FAC) often called *Hypochlorous Acid* (HOCl), needed to disinfect or oxidize organic matter before a FAC residual is reached. If the chlorine demand is not met then complete disinfection has not been obtained. One of the best signs that the Chlorine Demand has not been met is the strong chlorine odor.

If a chlorine solution is does not contain enough HOCl to satisfy the chlorine demand of the surface or product to be disinfected, chloramines will form as chlorine and nitrogen-based materials combine. Examples of nitrogen-based materials are proteins and blood. Chloramines are responsible for the obnoxious odor sometimes associated with chlorine disinfection. The obnoxious, pungent, eye-stinging smell of chloramines, mistakenly identified as free chlorine, indicates that the chlorine/water mix is not effective. There is not enough HOCl to satisfy the chlorine demand

2. Chlorine Efficacy determined by pH

Chlorine in water splits into two forms, *Hypochlorous Acid* (HOCl) and *Hypochlorite Ion* (OCl-). At the high pH the chlorine provided by bleach contains a maxiimum of Hypochlorite Ion. The chlorine produced by onsite Electrolyses in an Aquaox System contains a maximum concentration of *Hypochlorous Acid* (HOCl).

How much of each is present in a chlorine solution is totally dependent upon the pH of the solution. As pH rises, less *Hypochlorous Acid* and more *Hypochlorite Ion* is in the solution. As the pH rises, less germ killing power is available. According to a University of Illinois study, HOCl is 120 times more effective as a sanitizer than the -OCl ion. The ideal pH of a disinfecting chlorine solution is a pH of 6-7.

Most FRESH *Calcium Hypochlorite* solutions have a pH of between 7 and 8. ALL (fresh or old) *Sodium Hypochlorite* solutions, ("bleach") have a pH of 10.25+ producing NO HOCl at all! These solutions produce only the OCl- ion, a very poor disinfectant which is from 80 to 120 times less effective as a disinfectant than HOCl, providing that there is any chlorine left in the stock solution.

3. Contact time

The amount of time that chlorine is present during treatment is called the contact time. Contact times are calculated to determine the amount of time that a disinfectant must be present in the system to achieve a specific kill of microorganisms, for a given disinfectant concentration. A long contact time means that disinfection alone will not be sufficient treatment and additional methods will be necessary to eliminate the microorganisms. The contact time is directly related to the chemicals' efficiency of eliminating bacteria and viruses from the water. HOCl requires by far the shortest contact time to achieve a 99% kill of *E. coli* (Reynolds, 1996).

4. Shelf-life and added lye

Finally, just as champagne or carbonated water "go flat" on sitting as the bubbly carbon dioxide gas escapes into the air, chlorine escapes from a *Hypochlorite* solution thus weakening its germ killing value. In order to slow this escape, bleach manufacturers add *Sodium Hydroxide* (lye) to their product causing the pH to rise dramatically. Lye burns animal and plant tissues; it saponifies (converts) fats in poultry and meat products. *Hypochlorous Acid* dispensed from Aquaox Systems contains NO LYE!

According to all the technical literature, depending on storage conditions; ALL *Hypochlorite* solutions will lose half of their potency in less than thirty days. Light, temperature and age are the biggest factors. The biggest misconception is that liquid household bleach (*Sodium Hypochlorite*) does not loose potency until you make a *Sodium Hypochlorite* solution; "liquid household bleach" is already a *Sodium Hypochlorite* solution, that starts degrading soon after manufacture, so a "bleach" bottle bought at a retail store or chemical supply house is, NOT a FRESH *Hypochlorite* solution. It is a *Hypochlorite* solution with an unknown chlorine content, so when we make a solution all we are doing is diluting an already weak *Hypochlorite* solution even more. All literature recommends that if you are using “chlorine bleach”, daily tests should be conducted by a laboratory to assure its potency.

Why Use onsite produced *Hypochlorous Acid* solutions instead of *Calcium* or *Sodium Hypochlorite* solutions?

1. Onsite electrolyses of a brine solution in Aquaox Systems produce a maximum of *Hypochlorous Acid* whereas pH can be accurately set and controlled anywhere between 3-7.

2. At an pH of ~5 the *Hypochlorous Acid* solution consist almost solely of Free Available Chlorine and maximum disinfection is achieved.

3. *Hypochlorous Acid* requires the shortest contact time to eradicate a microorganism.

4. As *Hypochlorous Acid* is produced onsite, there is no need of mixing and dilution of *Hypochlorite* solutions with unknown chlorine content. Shelf life is no issue, as *Hypochlorous Acid* solutions are produced on demand. Therefore no addition of Lye is required, as shelf life became more or less irrelevant.

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George Clifford White, Handbook of Chlorination and Alternative Disinfectants. Third Edition, Van Nostrand Reinhold, New York, 1999.

George R. Dychdala. Chlorine and Chlorine Compounds. In: Block SS, ed. Disinfection, Sterilization, and Preservation, 5th ed. Philadelphia Lippincott Williams & Wilkins, 2001.

Tags:bleach, Calcium Hypochlorite, chlorine, chlorine efficacy, Free Available Chlorine, hypochlorous acid, sodium hypochlorite
Posted in Hypochlorous Acid, Sodium Hypochlorite and Chlorine | 1 Comment »

Cleaner and Greener – Electrolyzed Water in Hotels

May 21, 2010
The Oxford Hotel, Bend , OR, The Hyatt Regency hotel, Chicago, Il and the Sheraton Delfina, Santa Monica, CA all use Electrolyzed Water — basically saltwater charged with electricity — as a sanitizer, degreaser and cleaner.

“It has replaced 98 percent of all cleaning products and because it lacks the chemicals most commercially produced cleaning solutions contain, the Electrolyzed Water is healthier for employees and guests. It is produced on site, so it saves shipping costs, eliminates pollution that would be produced by trucks delivering commercial cleaners, and means no empty cleaning containers end up in landfills.

Attached Video, shows you a System that manually generates Electrolyzed Water onsite.

Cleaner and Greener – Electrolyzed Water (http://suprememastertv.com/bbs/board.php?bo_table=sos_tw&wr_id=1400). (Click on link to start video)

Aquaox Systems are designed to automatically generate HOCL (sanitizer) and NAOH (cleaner) onsite. Aquaox Systems are remotely controlled and its onsite generated Electrolyzed Water may not only used to surface cleaning and sanitation, but may used to disinfect (drink)-water, disinfect waterlines, pools and spa's. diluted with drinkwater, HOCL is used in foodcourts to sanitize vegetables, fruit and food contact surfaces. Onsite generated HOCL may also used to reduce aerosols and dust particles in HVAC-systems. Finally, NAOH and HOCL is used to significantly reduce laundry detergents.

For more information, visit http://www.aquaox.net (http://www.aquaox.net).

Tags:cleaning agents, Electrolyzed Water, hotels, hypochlorous acid, satitizing agents, sheraton delfina hotel
Posted in Facilities | Leave a Comment »

Gerbera's and Electrolyzed Water.

May 18, 2010
Electrolyzed Water used to prevent botrytus on Gerbera's (http://aquaox.files.wordpress.com/2010/05/aquarein-aquaox1.ppt)

Tags:anolyte, Botrytus, Electrolyzed Mist, Electrolyzed Water, Flowers, fogging, Gerbera, Gerbera's, hypochlorous acid, Industrial device for onsite generation of Electrolyzed Water, Sanitization, Ultrasonic humidifier
Posted in Fruit, Flowers & Produce | Leave a Comment »

EPA Regulations with regard to Onsite production, Usage, Storage and Transport of Onsite produced Hypochlorous Acid (HOCL).

May 10, 2010

M. van Schaik

Introduction

There is a lot of confusion whether Electrolyzed Water is allowed to be used as a disinfectant or sanitizer. EPA, FDA, USDA and local authorities have approved or allowed usage of Electrolyzed Water in many applications. Having said so, a few applications need more data about the efficacy of Electrolyzed Water and methods how disinfection or sanitation is guaranteed. Other applications may have a limitation on the HOCL concentration. The following article explain what is and what is not allowed by the US Environment Protection Agency.

EPA Regulation with regard to Onsite *PRODUCTION* of pesticides with AQUAOX Devices

Under Section 3 of the Pesticide Regulations under the Federal Insecticide Fungicide and Rodenticide Act, as amended (FIFRA), the EPA regulates pesticides, which are registered and sold in interstate commerce to control various forms of vermin.

Under these regulations (Subpart Z –Devices Part 152.500 'Requirement for devices") **Pesticide Devices are not required to be registered, but must have an approved label which meet the Section 3 Regulations, Part 162.10, and have a registered establishment in which they are produced.** Under Section 7 of the FIFRA each owner of a pesticide device must produce to the EPA enforcement program a report of products produced each and every year and to whom they are sold in a standard report form.

Devices which everyone has heard about are electrically generated, ozonators for use in treating drinking water, chlorinators which derive Free Available Chlorine from the electrolysis of water and sale, copper/silver cathodes which by electrically activity cause release of silver and cupper ions into drinking water in hotels and hospitals, invisible noise mechanisms which mediate insects and rodents in small areas. In each case the device is unique and based upon the data which the device originator has in hand or can reference to EPA has a product which is efficacious and safe when used as directed.

Devices are subject to labelling and misbranding requirements under FIFRA section 2(p) and 2(q); registration and reporting requirements under FIFRA section 7; recording keeping requirements under FIFRA section 8; inspection requirements under FIFRA section 9; import and expert restrictions under FIFRA section 17; and child resistant packaging requirements imposed pursuant to FIFRA section 25 (c)(3).

AQUAOX devices hava an EPA establishment number and we report pursuant to Section 7 of the Act. Basically our device, using electric current 230 volt, produces *Hypochlorous Acid (*HOCL) on demand on site, which kills bacteria, mold, mildew, viruses and surface filling algae. The device uses sodium chloride (table salt) in a liquid format in water and an electric charge to generate on demand HOCL-solution. HOCL (200ppm Free Available Chlorine) does the killing of the life forms. When the electric has been turned off the device produces no HOCL-solution and has no residual in it. Our device meets all the Section 3 labelling requirements and we pay close attention to all the FIFRA requirements so as to be fully compliant **No product is produced from our device for storage or later use per regulations.**

Electrolyzed water is approved under 21 CFR 173.315 for direct contact with processed foods. Electrolyzed water is approved for several indirect food contract applications under 21 CFR 172.892, 21 CFR 175.105, 21 CFR 176.170 and 21 CFR 177.2800. It is an approved sanitizer that meets 21 CFR 178.1010. The EPA has also given approval (40 CFR 180.1054) for washing raw foods that are to be consumed without processing.

40 CFR 180.940. HOCL when used as ingredient in an antimicrobial pesticide formulation may be applied to: **Food-contact surfaces in public eating places, dairy-processing equipment, and food-processing equipment and utensils. When ready for use, the end-use concentration of all *Hypochlorous Acid* chemicals in the solution is not to exceed 200 ppm determined as Free Available Chlorine**

AQUAOX device does not require a hazardous use permit whereas chlorine in bottles must be permitted for filling, transportation or storage.

In case of doubt or for clarification AQUAOX LLC should be consulted. We are unable to anticipate all conditions under which the product may be used, and users are advised to carry out an assessment of workplace risk and carry out their own tests to determine Safety and Suitability for the process and conditions of use.

EPA regulation with regard to the *USAGE* and *STORAGE* of Neutral Electrolyzed Water generated on-site from an AQUAOX device

Under the FIFRA, EPA does not regulate water or sodium chloride (table salt) as a pesticide when used in an AQUAOX device that generates a pesticidal solution (HOCL).

The 0.2% HOCL-solution generated by the AQUAOX device is not regulated by the EPA as a pesticide as long as the solution itself is used on-site (i.e. where it is generated). If however, the solution is packaged, distributed or sold for use other than the site at which it was generated, then the product is subject to registration as a pesticide under FIFRA.

Accordingly, applying the solution on-site in e.g. 1 gallon containers would not be subject to registration, but distributing and selling the product for use other than at the site of generation would be subject to registration. Finally, the AQUAOX Device is considered to be a pesticide device and is subject to the requirements specified in 40 CFR 152.500.

As long as the HOCL-solution is applied on-site, no EPA requirements under FIFRA apply other than those specified above. EPA recommends, however, that the operator of pesticide devices provide labels for plastic containers with HOCL-solutions, so that workers and others will know what is in the containers and what precautions and directions should be followed handling and using the solution.

Thus, temporary storage of the HOCL-solution is allowed, as long as HOCL-solution is used on-site.

Finally, the operator of the AQUAOX device should check as to state and local regulatory requirements that may apply to the AQUAOX device and the generated solution.

EPA regulation with regard to *TRANSPORT* of Neutral Electrolyzed Water generated on-site from an AQUAOX device.

Under FIFRA, EPA does not provide a clear rule and this need to be further investigated. Most probably EPA will NOT permit transport as onsite produced HOCL-solutions are strictly intended to be used on-site.

AQUAOX' interpretation of the FIFRA is that transport of HOCL-solution within the on-site location is permitted, as long as HOCL-solution is used on-site. Thus, transport of HOCL-solution in e.g. 1 gallon container to another department, building or place within the operator's organization, company and/or location is permitted, as long HOCL-solution is used within the operator's organization, company and/or location.

Accordingly, storage in trucks should be permitted, as long HOCL is used within the operator's organization, company and/or location. In AQUAOX' opinion Onsite generated HOCL is permitted to be transported over the public road to another location to be used within the operator's organization, company and/or location is. However, FIFRA is very unclear about this particularly kind of transport. Likewise the EPA, AQUAOX recommends to provide labels and a MSDS of HOCL on all containers or trucks filled with HOCL.

On top of this AQUAOX advices to have a FUNCTIONAL and WORKING AQUAOX device on each truck, to be used for onsite generation of HOCL, if a user is going to transport HOCL to a client for executing a service such as e.g. fogging a premises or spraying a surface.

EPA regulation on on-site generated pesticides *BOTTLED, PACKAGED, STORAGED* and *DISTRIBUTED (SOLD)*.

If the onsite produced HOCL is bottled, packaged, stored, distributed and sold, the HOCL-solution is subject to registration as a pesticide. Thus, if HOCL is bottled, packed and sold as a liquid, the user of AQUAOX' Device ***MUST*** register HOCL as a pesticide to obtain a registration number for HOCL.

The registration of the onsite generated HOCL ***MUST*** be in the operator's name and the operator will be exclusively responsible for the produced pesticide.

Footnotes:

AQUAOX is NOT involved in bottling, packaging and distributing ***pesticides.*** AQUAOX manufactures, distribute and sell AQUAOX devices which are regulated by the EPA as ***onsite pesticide devices***.

AQUAOX does not permit their distributors to register HOCL (onsite generated pesticide) as a pesticide.

AQUAOX does not advocate, nor promote users (owners/ final users of the AQUAOX Device) to register HOCL as pesticide. AQUAOX rejects all liability, if users do not comply with the FIFRA regulations for onsite pesticide devices. AQUAOX does not advocate or promote the usage of HOCL otherwise than used onsite.

For more information, visit www.aquaox.net (http://www.aquaox.net)

Tags:anolyte, bleach, chlorine, Electrolyzed Water, Electrolyzed water devices, EPA, FIFRA, HOCL, hypochlorous acid
Posted in Uncategorized | 4 Comments »

HOW SANITIZERS EXERT THEIR GERMICIDAL ACTIVITY

February 25, 2010

When bacterial cells are exposed to a sanitizers or disinfectant, various physical structures within the cell may sustain irreversible damage. The permanent loss of a bacterial cell's capability to reproduce is commonly referred to microbial death. In the presence of germicides, some bacteria, may only be partially damaged. A surface which is swabbed immediately after sanitization can often provide false or negative results, indicating that effective sanitization had occurred. However, depending on the degree, partially inactivated bacteria have the capacity to "heal" or regenerate within 18 to 24 hours and become viable. Such an "apparently" clean and bacteria free surface will show the presence of high levels of bacterial contamination the following day and if left unchecked, can contaminate food products which may come into contact with the surface during the normal course of food processing.

The effectiveness of a specific germicide is a function of several factors, including the number and type of microorganisms which are present on the surface being sanitized.

Some of the factors requiring consideration are whether they are the easy to kill bacteria in their vegetative state or whether they are present on the surface as highly resistant spores. A major consideration that also needs to be addressed is whether other materials such as blood, feces or organic matter are are present within the bacterial environment. These contaminants reflecting an unclean surface, can rapidly inactivate some germicides, such as hypochlorites, rendering them ineffective for their intended use.

In general however, germicides exert their effect by either attacking a specific part of the bacterial cell, or causing damage to some of its components. Germicides can fall into three classifications, based on the their method ot bacterial attack.

a. CELL MEMBRANE DESTRUCTION

Germicides such as sodium hypochlorite of peroxyacetic acid (PAA), are strong oxidizing agents and can cause total destruction of the cells membrane, resulting in vital bacterial components leaking out into their surrounding environment. This process results in a true microbial death.

b. INHIBITION OF FOOD UPTAKE AND WASTE EXCRETION

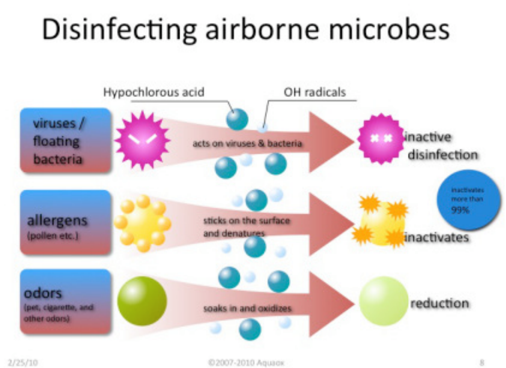
Some germicides, such as the quaternary ammonium compounds (quats), have the capacity to attach themselves onto specific sites on the bacterial cell membrane. They do this by virtue of the fact that the quats carry a positive electrical charge in solution and are attracted to the negatively charged portions of the bacterial membrane. The end result is that quats block the uptake of nutrients into the cell and prevent the excretion of waste products which accumulate within their structure.

In effect, the cell is both starved and internally poisoned from the accumulated wastes.

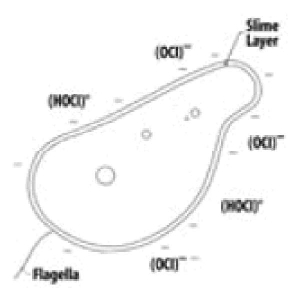
c. INACTIVATION OF CRITICAL ENZYMES
Biocides, such as phenolics, which exert their activity in this manner actually enter the cell and chemically react with certain key enzymes which support either cell growth or metabolic activities which supplies the bacteria with the energy needed for growth and multiplication. If inactivation is incomplete the injured bacteria can regenerate several hours later and recontaminate the surface.

ELECTROLYZED WATER: METHOD OF ACTION

It is presumed that viral infectivity is supressed, due to the denaturing and break down of the viral protein necessary for infection, though a reaction of that protein with two types of active oxygen present in the Water:
1.Electrolyzed Hypochlorous Acid (HOCL)
2.Hydroxyl radicals (OH)



(http://aquaox.files.wordpress.com/2010/02/slide08.jpg)
It is widely believed that the bactericidal effect of Electrolyzed Water (HOCL-solution) against various strains of bacteria is due to the combined action of hydrogen ion concentration, oxidation-reduction-potential (ORP-reactions) and dissolved chlorine (HOCL).
First, ORP-reactions at the cell membrane damage the outer and inner membrane and inactivate the microbes defense mechanism. Then HOCL can penetrate the cell and oxidize it.



(http://aquaox.files.wordpress.com/2010/02/bact.gif)

Hypochlorous Acid (HOCl, which is electrically neutral) and Hypochlorite Ions (OCl^-, electrically negative) will form Free Available Chlorine (FAC) when bound together. This results in disinfection. Both substances have very distinctive behavior.

The cell wall of pathogenic microorganisms is negatively charged by nature. As such, the negatively charged Hypochlorite Ion (OCL-) can only penetrate it by the neutral Hypochlorous Acid (HOCL), rather than.

HOCL itself can penetrate slime layers, cell walls and protective layers of microorganisms and effectively kills pathogens as a result. With the aid of ORP-reaction, HOCL can even easier penetrate cell membranes. The microorganisms will either die or suffer from reproductive failures.

According to Dr. Cloete, the advantages of onsite generated HOCL has been confirmed, wherein the biocidal activity of HOCL generated onsite, is 300 times more active than Sodium Hypochlorite at the same concentration of free available chlorine. Additionally, a concentration of 2% HOCL achieved same results than 0,05% Gluterhaldehyde. Similarly, it has been shown that a 5% solution of Sodium Hypochlorite (only to be used as disinfectant) has equal results than 0.03% HOCL (which can be used as disinfectant and as sporicidal agent).

Thus, Electrolyzed Water (HOCL-Solutions) have been conclusively shown to exceed chemically derived equivalents both in low dosage effectiveness as well as physico-chemical purity.

Michel van Schaik, http://www.aquaox.net (http://www.aquaox.net)

Tags:anolyte, Anolyte and Catholyte on Biofilms, Bacteria, Biofilm, bleach, chlorine, department of Microbiology, Disinfectant, disinfecting, dr. Cloete, Electrolyzed Water, Electrolyzed water devices, electrolyzed water effects, germicidal activity, h1n1, hypochlorous acid, oxidation-reduction-potential, Sanitization, sodium hypochlorite, University of Pretoria
Posted in Cleaning & Disinfecting | Leave a Comment »

HOW BACTERIA BUILD UP RESISTANCE TO SANITIZERS

February 20, 2010
There are three reasons that cause bacteria to become resistant against commercial available sanitizing or disinfecting products.

a. RESISTANT BACTERIA AND SUB-LETHAL SANITIZER DOSAGE

In any given population, bacteria exist within a wide range of sensitivities towards a specific sanitizer dose. Under normal conditions of exposure, sanitizers are capable of destroying 99.999% of the bacteria present. In essence, a surface which initially harbor 1,000,000 bacteria per square centimeter prior to sanitation may be expected to contain only 10 microorganisms per square centimeter afterwards. In such a scenario, the objective of the sanitation process has been achieved in the sense that the total bacterial population has been reduced to safe levels.

What may not be as evident is that the remaining 10 surviving microorganisms capable of withstanding the sanitization procedure, have the potential to act as a source of future contamination. If on subsequent clean up and sanitization, proper dosing or procedures were not adhered to, or the surface has not been adequately rinsed, the 10 surviving bacteria will survive a second cycle of sanitization, as will other bacteria. Over a period of time and

involving several cleaning and sanitization cycles, the resistant survivors have the capacity to proliferate, especially during periods in which they are exposed to food product. When this occurs the food processing plant is now dealing with a bacterial population which no longer responds to sanitizing doses of germicide, resulting in a failure of the sanitizer to achieve its objectives. In essence by applying the sanitizer at less than lethal doses or for shorter intervals, the end result is the same as if selective culturing of a resistant strain had been carried out with the possibility of the surface becoming enriched with pathogens and hard-to-kill microorganisms.
A surface which is allowed to deteriorate to such a level of poor hygiene, needs to be "shocked", by switching to high doses of an alternate product such as hypochlorite and dosing at disinfectant levels. It is not uncommon to require the use 400+ ppm of available chlorine over a period of a week before the surface can be returned to the desirable and bacterial free state.

b. BIOFILM FORMATION

Biofilm formation is another mechanism, in which bacterial resistance towards a sanitizer can occur. As previously indicated, proper cleaning is essential before effective sanitization can occur. Certain bacteria, secrete a polysaccharide which is a constituent of their membrane. These secretions are very sticky and attach themselves firmly to metal surface. The resulting film so formed containing trapped bacteria is referred to as a biofilm. Bacteria which are responsible for biofilm formation may in themselves not be harmful or pathogenic. However, the gelatinous matrix which they excrete is capable of attracting to itself and embedding pathogenic bacteria, such as Lysteria monocytogenes. Although the pathogens themselves do not contribute towards the integrity of the film, they nevertheless are capable of contaminating products which come into contact with the surface.
Biofilms are often very difficult to remove, since their matrix is very resistant to chemical attack by detergents. They often require higher than normal concentrations of alkaline detergents and strong oxidizing levels of sodium hypochlorite in order to remove them. Several applications may be required before the biofilm can be totally removed.

c. DETERGENT-SANITIZER INTERACTIONS

Most cleaning products contain either non-ionic surfactants (emulsifiers and detergents), anionic surfactants or a mixture of both in their composition. In solution, non ionic surfactants are electrically neutral, but anionic surfactants carry a negative charge within their structure. When detergent is applied to a soiled vertical surface the bulk of product runs of within 15 to 20 minutes. However, a small but finite amount of detergent remains on the surface and contains some of the anionic surfactant which was present in solution originally applied to the surface. If the surface is not thoroughly rinsed prior to the application of a quat sanitizer, the sanitizer can be totally inactivated. In solution, quats are positively charged and can therefore combine readily with the negatively charged anionic residue and become totally inactivated.

A metering system may be set to deliver the correct concentration of quat (200 ppm), but once the sanitizer comes into contact with the surface, it reacts with the anionic detergent, and the resulting anionic-quat residue or film so formed has no germicidal activity. Since an anionic-quat complex so formed also contains nutrients favoring microbial growth. Such a complex can actually support bacterial proliferation if left unchecked.

FUTURE DEVELOPMENTS

Neutral Electrolyzed Water (NEW) is a strong oxidizer with hypochlorous acid (HOCL) as active ingredient. HOCL has superior germicidal properties compared to commercial available products. Moreover, as NEW has a very high oxidation-reduction potential (ORP), microorganisms are effectively and **100.00%** destroyed. ORP reactions at the cell membrane are the main cause that microbial cells cannot defend themselves when exposed to NEW. Once ORP-reaction have weakened the cell membrane, HOCL is able to penetrate cells and destroy the microorganisms from inside. The last 25 years, a lot of research has been done to explain the superior biocidal activity of NEW. Most scientist believe that ORP reactions, dissolved chlorine (HOCL) and oxygen are the main reasons for NEW's superiority. Up to now, not a single occurence has been discovered whereas bacteria were able to become resistant against NEW. It is therefore that scientist who studied the unique features of NEW are convinced that NEW **IS** the answer to combat hard-to-kill organisms.

More information can be obtained by visiting http://www.aquaox.net. (http://www.aquaox.net)

Tags:anolyte, Bacteria, Disinfectant, disinfectants, Ecaflo Anolyte, Electrolyzed Water, hygiene, hypochlorous acid, resistant strains of bacteria, sanitizer
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Anti-microbials, disinfectants, sanitizers and sterilants

February 13, 2010
Introduction

An antimicrobial is a substance that kills or inhibits the growth of microorganisms such as bacteria, fungi, or protozoans. Antimicrobials either kill microbes (microbicidal) or prevent the growth of microbes (microbistatic). The terminology often associated with antimicrobials can be confusing or misleading and in many cases there is an overlap in function. Another word for microorganism is germ. Consequently, an antimicrobial is the same as a germicidal agent. Disinfectants are antimicrobials (or germicidal agents) used on non-living objects. Sometimes, an antimicrobial is considered a sanitizer, sometimes a sanitizer depending the use concentration of the antimicrobial.

In order to clarify some key terms which are often used interchangeably, I have attempted to define the meaning of the products under discussion in their legal sense.

Microorganisms

Microorganismes are too small to be seen by the naked eye.Microorganisms are very diverse; they include bacteria, fungi, archaea, and protists; microscopic plants (called green algae); and animals such as plankton and the planarian. Some microbiologists also include viruses, but others consider these as non-living.

Bacteria

Bacteria are unicellular microorganisms. Bacteria are either beneficial and protective to the immune systems or cause infectious diseases. Bacteria that causes infectious diseases are called pathogens.

Fungi

Fungi are eukaryotic organisms that includes microorganisms such as yeasts and molds, as well as the more familiar mushrooms.

Spores

In biology, a spore is a reproductive structure that is adapted for dispersal and surviving for extended periods of time in unfavorable conditions. Spores form part of the life cycles of many bacteria, plants, algae, fungi and some protozoans. Some pathogens transform from their normal or vegetative state to form spores and are difficult to eliminate since they can resist the effects that sanitizer or disinfectant exposures have on bacteria. Elimination of spores is carried out by specialized chemical agents or physical means, and require several hours for total microbial destruction.

Disinfectant

A disinfectant is a germicidal agent which is capable of destroying disease causing bacteria or pathogens, but not spores and not all viruses. From a technical and legal sense, a disinfectant must be capable of reducing the level of pathogenic bacteria by 99.999% during a time frame greater than 5 but less than 10 minutes. The main difference between a sanitizer and a disinfectant is that at a specified use dilution, the disinfectant must have a higher kill capability for pathogenic bacteria compared to that of a sanitizer.

Sanitizer

In general, to sanitize means to reduce the number of microorganisms to a safe level. One official and legal version states that a sanitizer must be capable of killing 99.999% known as a 5 log reduction, of a specific bacterial test population, and to do so within 30 seconds. A sanitizer may or may not necessarily destroy pathogenic or disease causing bacteria as is a criteria for a disinfectant. An alternate definition is that a hard surface sanitizer is a germicidal agent which is capable of killing 99.9% (3 log reduction), of the infectious organisms which may be present in a bacterial population, within 30 seconds.

Sterilants

Sterilants are specialized chemicals, such as glutaraldehyde or formaldehyde, which are capable of eliminating all forms of microbial life, including spores. The term sterilant conveys an absolute meaning; a substance can not be partially sterile.

Future developments of germicidal agents

The future effectiveness of antimicrobials is somewhat in doubt. Microorganisms, especially bacteria, are becoming resistant to more and more antimicrobial agents. Bacteria found in hospitals appear to be especially resilient, and are causing increasing difficulty for the sickest patients–those in the hospital. Currently, bacterial resistance is combated by the discovery of new drugs. However, microorganisms are becoming resistant more quickly than new drugs are being made available; thus, future research in antimicrobial therapy may focus on finding how to overcome resistance to antimicrobials, or how to treat infections with alternative antimicrobials.

Neutral Electrolyzed Water (NEW) also known as Anolyte is an activated aqueous solution of sodium chloride produced by passing a weak saline solution through an electrolytic cell and temporarily changing the properties of the salt water into a powerful oxidizing agent exhibiting antimicrobial properties. Neutral Electrolyzed Water (NEW) is produced near neutral 6.5 pH where the predominant antimicrobial agent is Hypochlorous Acid, the most efficient and efficacious specie of chlorine. Hypochlorous Acid kills microorganisms (bacteria, fungi, algae, spores and viruses).

The properties of NEW can be precisely controlled within Aquaox EC-Systems (http://www.aquaox.net/Systems.html). NEW can be applied as liquid, mist/fog or spray. NEW is a colorless, aqueous solution with a slight chlorine or ozone odor. NEW is produced on site and intended to be used soon after being produced. NEW must be used within 30 days of production.

NEW is convenient, used for general disinfecting, for use on nursery surfaces, use on bathroom surfaces, use in athletic facilities, for use on athletic equipment and suitable for hospital use. NEW will not harm hard non-porous surfaces including titanium-coated medical grade stainless steel. NEW can be used neat or diluted with drinking water to reduce the free available chlorine.

Alkaline Water (AW) also known as Catholyte consist of Sodium Hydroxide (NAOH), commonly known as caustic soda, lye, or sodium hydrate. Sodium Hydroxide is a caustic compound which attacks organic matter. Caustic soda is available commercially in various white solid forms and as a solutions of various concentrations in water.
Sodium hydroxide provides fuctions of neutralisation of acids, hydrolysis, condensation. saponification and replacement of other groups in organic compounds of hydroxyl ions. Sodium Hydroxide removes waxes and oils from fibre to make the fibre more receptive to washing, bleaching and dying. Sodium hydroxide is also widely used in in making soaps and detergents. Sodium hydroxide is occasionally used in the home as an agent for unblocking drains. The chemical mechanism employed is the conversion of grease to a form of soap, and so forming a water soluble form to be dissolved by flushing; also decomposing complex molecules such as the protein of hair. Sodium hydroxide is frequently used as an industrial cleaning agent where it is often called "caustic". It is added to water, heated, and then used to clean the process equipment, storage tanks, etc. It can dissolve grease, oils, fats and protein based deposits. The sodium hydroxide solution can also be added to surfactants. A sodium hydroxide soak solution is used as a powerful degreaser on stainless and glass bakeware. It is also a common ingredient in oven cleaners.

Alkaline Water (AW) is a less concentrated than commercial available Sodium Hydroxide solutions and has the same applications, although dosage is different. AW is a mild detergent and degreaser very useful for cleaning surfaces prior to sanitizing or disinfecting.

For more information, please contact aquaox@comcast.net or visit www.aquaox.net (http://www.aquaox.net)

Tags:antimicrobial agent, antimicrobials, bacterial resistant, disinfect, Electrolyzed Water, germicidal agetns, germs, HOCL, hypochlorous acid, mrsa, sanitizer, spores, sterilant
Posted in Cleaning & Disinfecting | 6 Comments »

Cleaning is a prerequisite for effective sanitization

February 8, 2010
Sanitization begins with an effective cleaning program. Organic deposits from food residues, such as oils, greases and proteins not only harbor bacteria but may actually prevent the sanitizer from coming into physical contact with the surface that needs to be sanitized. In addition, the presence of organic deposits may actually inactivate or reduce the effectiveness of some types of sanitizers such as hypochlorites, rendering the procedure ineffective.

In large food processing establishment, a general protocol for maintaining good hygiene works according to the following protocol: large soils and residues are initially removed by scraping or other mechanical means and usually followed by a high pressure water pre-rinse. The detergent, appropriate for the soil being removed is then applied for a specified period, usually 15 minutes, followed by a potable water rinse to flush away residual soil and detergent.

Once this process has taken place and the surface is visually clean, The sanitizer can then be applied for the specified time recommended by the manufacturer. With sanitizer applications, a further rinse with potable water is not required nor is it recommended, since there is a high probability that in doing so, might result in re-contamination of the surface with micro organisms present in the rinse water.

In the removal of soil, a detergent functions in various ways involving both physical and chemical actions. These functions do not occur separately or in any particular sequence, but in a complex and interrelated manner. For cleaning a particular type of soil, certain functions are emphasized more than others to arrive at a balanced product. Surfaces which contain oily food residues might require a product which exhibits a high level of emulsification for fatty material, whereas those contaminated with protein residues usually respond best to highly alkaline and chlorinated cleaners.

Alkaline Water (AW) produced onsite as by-product of Neutral Electrolyzed Water (NEW) is used as in significant a mild cleaning detergent and degreasing agent. AW, which consist of ~1000ppm Sodium Hydroxide (NAOH) is used prior to NEW, which consist 50-500ppm Hypochlorous Acid (HOCL) to clean and disinfect. AW is a reducing agent and chemically reduces other substances, especially by donating an electron or electrons. AW is capable of bringing about the reduction of another substance as it itself is oxidized. AW has a very low surface potential and therefore can penetrate into the smallest cell. AW is very effective in place whereas protein prevents effective sanitation.

Regardless of the product used, effective cleaning is dependent on temperature, water hardness, pH of the water used, contact time and method of detergent application. Each establishment will have its own Standard Operating Procedures (SOP), which has been worked out often by trial an error until a proper combination of the variables have found to be both efficient and cost effective.

For more information on cleaning and sanitizing using Alkaline and Electrolyzed Water, please contact aquaox@comcast.net

Tags:Alkaline Water, catholyte, cleaning, degreasing, detergents, Electrolyzed Water, hypochlorous acid, organic deposits, protein, Sanitization, Sodium hydroxide

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CHLORINE EFFICACY

January 27, 2010

Introduction

Chlorine is one of the most commonly used disinfectants for water disinfection. Chlorine can be applied for the deactivation of most microorganisms and it is relatively cheap. Chlorine is commercially available as gaseous Chlorine (CL2) and as Sodium Hypochlorite liquid or powder (NaOCL).

Both gaseous Chlorine (CL2) and Sodium Hypochlorite (NaOCL) have very limited disinfecting properties. It is the formation of chlorine by-products such as Hypochlorous Acid (HOCL), Hypochlorite Ion (OCL-), Hydrochloric Acid (HCL) and Oxygen (O) that inhibit disinfecting properties.

Gaseous Chlorine

Gaseous Chlorine (CL2) is commercially available and mostly used in disinfecting mains water.
When gaseous Chlorine (CL2) added to water (H2O) the following hydrolysis reaction takes place:

$Cl_2 + H_2O = H^+ + Cl^- + HOCl$

Sodium Hypochlorite

Sodium Hypochlorite is produced adding gaseous Chlorine (CL2) to caustic soda (NaOH). When this is done, Sodium Hypochlorite (NaOCL), water (H2O) and salt (NaCl) are produced according to the following reaction:

$Cl_2 + 2NaOH + \rightarrow NaOCl + NaCl + H_2O$

Chlorine reacts with sodium hydroxide to Sodium Hypochlorite (NaOCl). Sodium Hypochlorite is known as Bleach. Bleach (NaOCL) cannot be combined with acids. When NaOCL comes in contact with acids the hypochlorite becomes instable, causing poisonous gaseous Chlorine (CL2) to escape.

Hypochlorous Acid and Hypochlorite Ion formation

Hypochlorous Acid (HOCL) and Hypochlorite Ion (OCL-) are the by-products of Sodium Hypochlorite (NaOCL) in water (H2O). NaOCL reacts with water (H2O) to Hypochlorous Acid (HOCl) and Hypochlorite Ions (OCl-).

$NaOCl + H_2O \rightarrow HOCl + NaOH^-$

Hypochlorous Acid formation

Hypochlorous Acid (HOCL) is the by-product of gaseous Chlorine (CL2) in Water. Gaseous Chlorine (CL2) reacts with water to Hypochlorous Acid (HOCL).

$Cl_2 + H_2O \rightarrow HOCl + H^+ + Cl^-$

Oxygen formation

Depending on the pH value, Hypochlorous Acid (HOCL) expires to Hypochlorite Ions (OCL-).
$Cl_2 + 2H_2O \rightarrow HOCl + H_3O + Cl\text{-}HOCl + H_2O \rightarrow H_3O^+ + OCl^-$

This falls apart to Chlorine and Oxygen atoms:

$OCl^- \rightarrow Cl^- + O$

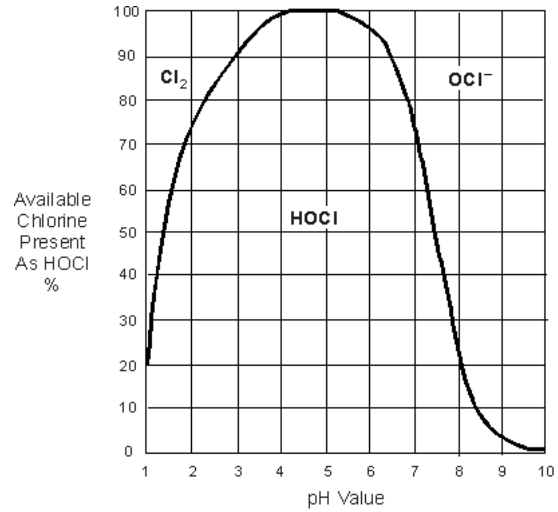
The efficacy of disinfection is determined by the pH.

Disinfection will take place optimally when the pH is between 5 and 7, as then a maximum of HOCL is present.
HOCL reacts faster than OCl- ; HOCL is 80-100% more effective than OCL-. HOCL does not evaporate and does not cause severe corrosion like CL2. CL2 exposed in air can be very explosive and evaporation should be avoided. For this reason, the ideal pH is between 6 and 7, as no CL2 is present.

The level of HOCL will decrease when the pH value is higher than 5. The level of HOCL will decrease when the pH value is lower than 5. With a pH value of 6.5 the level of HOCL is more than 90%, whereas the concentration of OCL- is less than 10%.

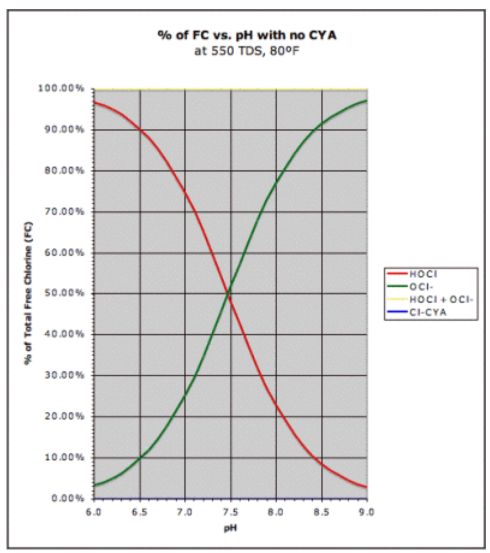
Free Available Chlorine

Free Available Chlorine (FAC) is chlorine that is present in the form of Hypochlorous Acid, hypochlorite ions or as dissolved elemental chlorine. FAC includes all chlorine species that are not combined with ammonia (or other nitrogenous compounds) to form chloramines. It is ‘free’ in the sense that it has not yet reacted with anything, and ‘available’ in the sense that it can and will react if needed.



(http://aquaox.files.wordpress.com/2010/01/r_wqb_chlorine_graph.gif)

A pH value of 6 to 7 is the most effective and the safest pH-range, due to absence of chlorine gas. Therefore when Free Available Chlorine is mentioned, it is assumed that Free Available Chlorine solely consists of HOCL and OCL-



(http://aquaox.files.wordpress.com/2010/01/hocl-ocl-nocya.gif)

Free Available Chlorine compounds with regard to pH .Hypochlorous Acid (red) and Hypochlorite Ion (green)

Superiority of Hypochlorous Acid compared to Hypochlorite Ion

Hypochlorous Acid (HOCl, which is electrically neutral) and Hypochlorite Ions (OCl-, electrically negative) will form Free Available Chlorine (FAC) when bound together. This results in disinfection. Both substances have very distinctive behavior.

The cell wall of pathogenic microorganisms is negatively charged by nature. As such, the cell wall only penetrated by the neutral Hypochlorous Acid (HOCL), not by negatively charged Hypochlorite Ion (OCL-).
HOCL can penetrate slime layers, cell walls and protective layers of microorganisms and effectively kills pathogens as a result. The microorganisms will either die or suffer from reproductive failures.

The pH neutral Hypochlorous Acid (HOCL) can penetrate cell walls of pathogenic microorganisms whereas the negatively charged Hypochlorite Ion (OCL-) cannot penetrate cell walls.

Besides the neutrality of HOCL, it is a much more reactive and is a much stronger disinfectant than OCL-, as HOCL is split into hydrochloric acid (HCl) and atom air Oxygen (O). Oxygen is a very powerful disinfectant.

Neutral Electrolyzed water (HOCL) guarantees optimal disinfecting

The disinfecting properties of Chlorine in water are based on the formation and oxidizing power of Oxygen and HOCL. These conditions occur when the pH is between 6 and 7.

Neutral Electrolyzed Water (NEW) produced onsite from a AQUAOX System has a pH of 6.5. At this pH more than 90% of the free available chlorine is HOCL, less than 10% OCL- and no CL2 are formed. The strength of Free Available Chlorine (FAC) in NEW is pre-set to 300+ppm. To make a solution with 300+ppm FAC from commercially available bleach (NaOCL), it is diluted in water (H2O).

The problem with diluting bleach in water is twofold:

1) The volume to dilute bleach is very small. Small differences in the volume of bleach added to water causes significant differences in terms of pH and Free Available Chlorine (FAC).
2) The fact that water has naturally different pH levels, causes that addition of the same volume of bleach still result in a different pH. Although at each dilution 300+ppm FAC can be measured, the pH of the mixture and consequently the amount of active compounds HOCL and OCL- may vary considerably.

Therefore, disinfecting properties using bleach vary whereas the disinfecting properties of NEW are kept stable. As a result NEW may exceed the disinfecting properties of bleach by 300 times.

Safety

When producing HOCL by acidifying NaOCL, relatively high prices and possibility of side reactions limit the use of weak organic acids; use of cheaper inorganic acids provokes gaseous chlorine discharge and a raise of toxicity level. Because of it, the method above is only used for water treatment, where residual chlorine concentration values do not exceed 0.5-5mg/l.

Dilution of gaseous chlorine in water to produce HOCL according to equation demands special safety measures and is only used for disinfecting large volumes of water, where active chlorine concentration is below 10-15mg/l. Nowadays all the companies that manufacture gaseous chlorine stopped gaseous chlorine production and started NaOCL manufacture exclusively because of safety considerations.

Neutral Electrolyzed Water onsite produced by AQUAOX Systems is a unique method of non-reagent synthesis of HOCL. We would like to point out once more that the unique quality of the AQUAOX System is the possibility of directed pH regulation in the 6.0-7.0 ranges, while working with solutions of any mineralization, whereas electrolyses of sodium chloride solutions have identical biocidal activity if pH and FAC concentration are equal.

For more information, please contact aquaox@comcast.net

Tags:anolyte, bleach, chlorine, chlorine efficacy, Electrolyzed Water, hydrochloric acid, hypochlorite ion, hypochlorous acid, oxygen, ozone, pH, sodium hypochlorite
Posted in Hypochlorous Acid, Sodium Hypochlorite and Chlorine | 1 Comment »

Aquaox EZ-400 Systems: Industrial Electrolyzed Water Systems

June 25, 2009
AQUAOX EZ-Systems are Mobile Disinfecting Systems that include one or more semi-automatic EZ-devices as well ancillary equipment to make AQUAOX EZ-Systems a reliable stand-alone 'plug & play' System.

Onsite generation of Electrolyzed Water

AQUAOX EZ-Systems consist of one of more EZ-devices along with ancillary equipment such as a water-softener, pre-filters, a well-pump, a pressure reducing valve, a flow-regulator, a brine-container, collecting tanks for the cleaning & disinfecting liquids and other measurement equipment to monitor the quality and quantity of the onsite produced anti-microbial liquid.

AQUAOX EZ-Systems are designed to produce anti-microbial liquids onsite for use in a multitude of applications where there is the need for water sterilization, disinfection, cleaning and purification.

EZ-devices

All Aquaox EZ-devices consist of 2 enclosures to keep electricity and water separated:

The electrical enclosure contains all printed circuit boards, power supply and all other electrical components needed to create a rectified AC-voltage.

The hydraulic enclosure contains e.g. the Electrolytic cell, an eductor, a solenoid valve and manual valves to adjust the parameters of the generated biocidal liquids.

The volume these EZ- devices generate can be manually adjusted. Factory set-up is:

85 – 100% NEW (Neutral Electrolyzed Water) with a pH between 6.5 – 7, an ORP over 900mV and with 50 to 500 ppm Free Available Chlorine.

0 – 15% AW (Alkaline Water) with a pH 11-13 and an ORP of approximately
-900mV.

Features

Automatic start/stop by means of level-switches, a flow-switch, pressure-switch and/or a timer.

For more details, visit http://www.aquaox.net/Systems.html (http://www.aquaox.net/Systems.html)

Tags:anolyte, chlorinator, electrochemical production, hypochlorous acid, Industrial device for onsite generation of Electrolyzed Water, industril devices
Posted in Systems and Devices | 3 Comments »