PURTABS™

EFFERVESCENT SANITIZING / DISINFECTION TABLETS

TECHNICAL AND EFFICACY DATA SHEET

- Hospitals
- Schools
- Nursing Homes
- Daycares
- Restaurants
- Kitchens
- Gyms
- Health Clubs
- Restrooms
- Dental Facilities
- Veterinary Clinics
- Beverage & Food Processing Plants

EARTHSAFE™
CHEMICAL ALTERNATIVES

How NaDCC Works – How it differs from Bleach

The active agent in PURTABS is sodium dichloroisocyanurate ($C_3Cl_2N_3NaO_3$) shortened to NaDCC the active ingredient in bleach is Sodium Hypochorite (NaOCl).

When dissolved in water both NaDCC and bleach produce the highly effective disinfecting agent hypochlorous acid (HOCl). The difference in the two chemistries is what comes with the HOCl, in the case of NaDCC we have an organic molecule in the case of bleach we get Sodium Hydroxide (NaOH) more commonly known as caustic.

NaDCC is an organic chlorine donor that forms a use-solution with a mildly acidic to neutral pH of 6 – 7, when mixed with water. Bleach, and other hypochlorites, form highly alkaline use-solutions, with a pH in the range of 11 to 12 when diluted with water (note pH is a logarithmic scale so if you start with a pH of 13 and dilute 10:1 with water that reduces the pH by approximately 1 depending on water quality). If drawing the chemical reactions it would look like this:

NaDCC

$C_3Cl_2N_3NaO_3 + H_2O \dashrightarrow C_3ClHN_3NaO_4 + HOCl$

Bleach

$NaOCl + H_2O \rightarrow NaOH + HOCl$

Caustic is highly corrosive and presents a significant health risk through both direct contact (especially eyes and mucus membranes) and through inhalation of the dried dust from bleach. There have been numerous studies showing a link between use of bleach and occupational asthma in medical staff, NaDCC on the other hand produces no caustic and is approved by both the Environmental Protection Agency (EPA) and the World Health Organization (WHO) as a disinfectant for potable water with no observable health effect over a life time of consumption. OSHA describes the health effect of caustic as ulceration of nasal passages, eye, skin, and respiratory irritation with a PEL of only 2 mg/m^3 in air. It is important to note the stoichiometric ratio (one to one) of caustic to HOCl. For every molecule of hypochlorous acid produced, one molecule of caustic is produced. Therefore, if you want to make a stronger disinfecting solution with bleach you inevitably get more caustic.

NaDCC contains no caustic and the in use diluted product causes only temporary mild eye irritation if directly impacting the eye. In this way, the product has an HMIS rating of

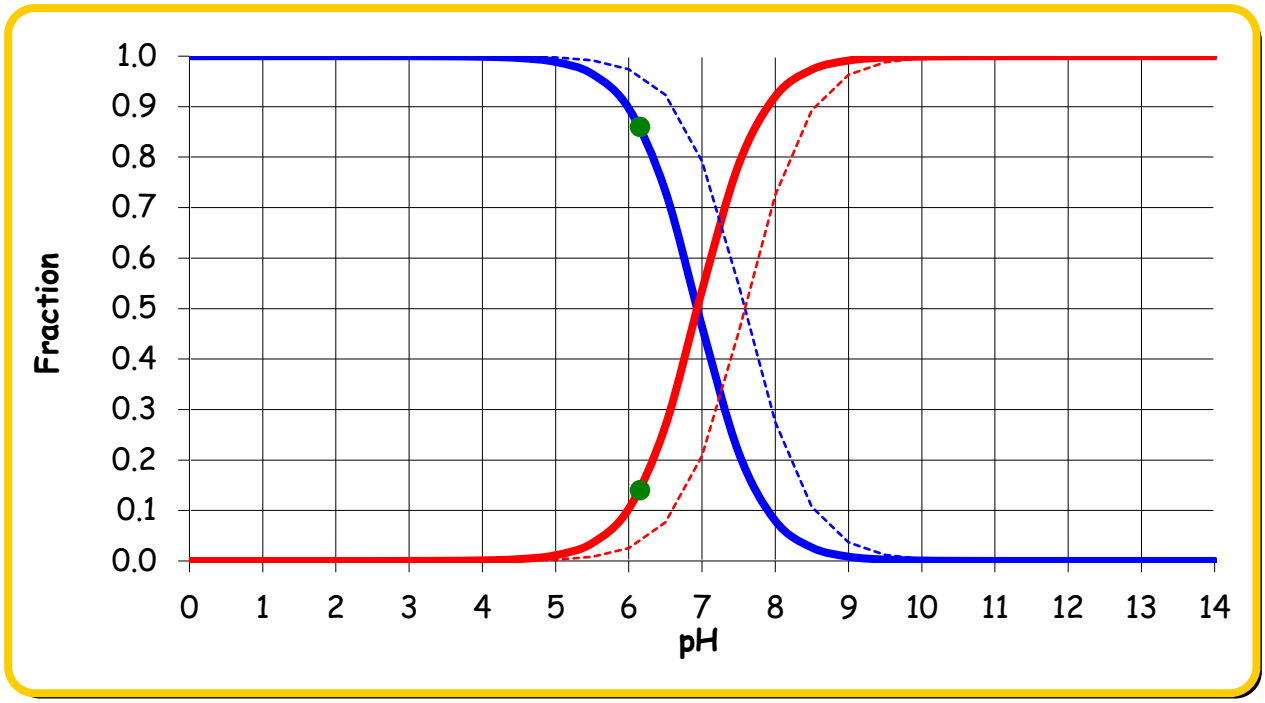
NaDCC contains no caustic and the in use diluted product causes only temporary mild eye irritation if directly impacting the eye. In this way, the product has an HMIS rating of 1/0/0 compared to 3/0/0 for bleach. Because there is no caustic produced, there is a significantly lower health risk.

Why pH is Important

The biologically active ingredient in both bleach and NaDCC is HOCl, when HOCL is in a solution it dissociates as follows:

$HOCl \leftarrow\!\rightarrow OCl^- + H^+$ note this is a reversible reaction

Studies show that undissociated (HOCl) has four times the anti-microbial killing power compared to the dissociated hypochorite ion (OCl^-). It is believed that this is due to the fact that HOCl is very similar to the structure of H_2O (water), of similar molecular size, and is electrically neutral – thus allowing it to penetrate cell membranes as easily as water. The ratio of HOCl to OCl^- in a solution is dictated by the solution pH. The more acidic a solution the more HOCl is present the more alkaline a solution the more OCl^- is present. The graph below demonstrates the dissociation constant:



As can be seen from the graph, a solution of NaDCC with a pH of 6 to 7 has 80 to 90 percent of the active disinfectant in the form of HOCl, a solution of bleach with a pH of 11 to 12 has less than 10 percent of the active disinfectant in the more effective HOCl form. Essentially this means that NaDCC is far more effective as a disinfectant than bleach at much lower concentrations.

Stability in Solution

When NaDCC is mixed with water, it yields hypochlorus acid (HOCL) and sodium monochloroisocyanurate in a slightly acidic use-solution. These two ingredients remain in a constant 50 – 50 ratio in the use-solution, so that as part of the free chlorine is used up (due to reaction with bacteria, organic material, etc), part of the combined chlorine in the NaOCl is freed to restore the 50 – 50 ratio and continue the disinfecting process. THIS IS AN IMPORTANT CHARACTERISTIC of NaDCC to note, because unlike bleach and all other hypochlorites, this product possesses a reserve killing power that continues to be made available even after contact with organic soils. *Bleach immediately releases all of the HOCL and has no residual to address organic soil rapidly becoming deactivated on contact with organic soils.*

Sodium hypochlorite solutions are inherently unstable. When open to the air, HOCl evaporates at a high rate from the solution, rapidly reducing the concentration of free chlorine. NaDCC in solution has a far lower loss rate. This breakdown of HOCL also happens when bleach comes in contact with acids, sunlight, certain metals and gasses. Because it is unstable, when used for disinfection, diluted bleach should be prepared fresh daily. Because NaDCC is inherently more stable than bleach solutions, NaDCC solutions in a sealed container have a 3-day shelf life. To improve the stability of bleach solutions, a number of manufacturers who produce ready to use wipes and dilute bleach liquids have increased the pH through addition of additional caustic. Increasing the pH may make their product more stable but it reduces the ratio of HOCl further reducing biocidal efficacy while increasing the corrosive nature of the product.

Because of NaDCC's inherent stability and greater proportions of HOCl, lower concentrations are required for effective kill times. This minimizes worker and patient exposures. The longer shelf life reduces waste and further reduces costs. Testing on metal substrates demonstrates that NaDCC is about 50% less corrosive then bleach, and does not produce any damage on vinyl and plastics.

EPA Regulations

The US EPA has registered a number of bleach based products as sporicidal disinfectants for use on hard surfaces and one NaDCC based product. The list of registered products can be found at: http://www.epa.gov/oppad001/list_k_clostridium.pdf. Review of the list shows the following registered claims for product efficacy against Clostridium difficile in the presence of soil load:

Product	Concentration	Required Contact time
NaDCC	1076 ppm	10 min
Bleach	5500 ppm	10 min
NaDCC	4306 ppm	4 min
Bleach	9000 ppm	5 min

As can be seen from the EPA registration documents NaDCC, PURTABS, is more effective than bleach at lower concentrations. Lower concentrations of disinfectant significantly reduce potential health hazards for personnel and collateral damage to equipment, in addition to making products more cost effective.

Third Party Air Sampling of PURTABS Applied with the Protexus PX200ES

On March 17, 2017, and Industrial Hygienist from American Environmental Consultants, Inc. (AEC) collected personal (and area) air samples. These samples were analyzed for Chlorine, at the request of EarthSafe Chemical Alternatives, LLC, as part of a worker exposure assessment during application of PURTABS using an electrostatic spraying application (Protexus Electrostatic Sprayer) in a variety of client settings (hospitals, kitchens, etc.). Samples of the Chlorine were collected according to National Institute of Occupational Safety and Health (NIOSH) Analytical Modified Method 6011. The collected samples were submitted to an experienced and accredited laboratory (SGS/Galson Laboratories).

Results

The following table presents the results of the personal sampling in mg/m3 and ppm compared to OSHA PEL ceiling values and the ACGIH TLV's for STEL's and 8-hour TWA's.

Sample Number	Volume (liters)	Sample Type	Sample Result (ppm)	OSHA PEL Ceiling (ppm)	ACGIH TLV (ppm)
17-0068320	15	STEL	<0.1	1	1
17-0068321	90	Personal	<0.2	1	0.5
17-0068319	15	STEL	<0.1	1	1
17-0068316	90	Personal	<0.02	1	0.5
17-0068317	30	Area/STEL	<0.06	1	1
17-0068318	15	STEL	<0.1	1	1
17-0068322	90	Personal	<0.02	1	0.5
17-0068314	0	Blank	NA	NA	NA
17-0068315	0	Blank	NA	NA	NA

Based on laboratory results, all Chlorine concentrations were below the OSHA Permissible Exposure Limits (PEL) and Threshold Limit Values (TLV), established by the American Conference of Governmental Industrial Hygienists (ACGIH).

Protexus Electrostatic Sprayers & Nozzles

For healthcare use, the Protexus Electrostatic Sprayers have been equipped with standard nozzles having one output of 60 microns. Usage guides and standard operating procedures (SOPs) developed for healthcare processes have been to disinfect with a 60-micron size nozzle to ensure simplified training, proper usage in any application -sanitizing or disinfecting – therefore providing repeatable results.

Users will continue to have the option for additional nozzle setting configuration with the availability of a tri-nozzle set at 60, 80, and 100 microns.

Recommended Personal Protective Equipment (PPE)

It is recommended to wear chemical-resistant gloves, safety glasses, and dust mask when diluting tablets.

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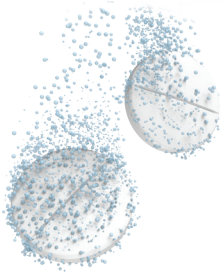

PURTABS Biological Efficacy Data

Pathogen	Minimum Dose required (ppm)	Minimum Contact time required (minutes)
FOOD CONTACT SANITIZER CLAIMS		
Staphylococcus aureus	**100 ppm**	1 minute
Salmonella enterica	**100 ppm**	1 minute
DISINFECTION CLAIMS-BACTERIA		
Staphylococcus aureus	**a) 538 ppm**	a) 10 minutes
	b) 4306 ppm	b) 2 minutes
Staphylococcus aureus – methicillin resistant (MRSA) & glycopeptide-resistant (GRSA)	**a) 538 ppm**	a) 10 minutes
	b) 4306 ppm	b) 2 minutes
Staphylococcus epidermidis	**1076 ppm**	10 minutes
Salmonella enterica	**a) 538 ppm**	a) 10 minutes
	b) 4306 ppm	b) 4 minutes
Pseudomonas aeruginosa	**a) 538 ppm**	a) 10 minutes
	b) 2153 ppm	b) 2 minutes
	c) 4306 ppm	c) 4306 ppm
Streptococcus pneumoniae	**4306 ppm**	4 minutes
Escherichia coli O157:H7	**1076 ppm**	10 minutes
Acinetobacter baumannii	**4306 ppm**	4 minutes
Vancomycin resistant *Enterococcus faecalis*	**a) 1076 ppm**	a)10 minutes
	b) 4306 ppm	b) 2 minutes
Carbapenem resistant *Klebsiella pneumoniae*	**4306 ppm**	2 minutes
Klebsiella pneumoniae	**1076 ppm**	10 minutes

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VIRUCIDAL CLAIMS		
Respiratory syncytial virus	**538 ppm**	10 minutes
Rhinovirus Type 14	**1076 ppm**	10 minutes
Influenza Virus H1N1	**a) 538 ppm** **b) 4306 ppm**	a) 10 minutes b) 1 minute
Human Immunodeficiency Virus Type 1 (HIV-1)	**a) 1076 ppm** **b) 4306 ppm**	a) 10 minutes b) 1 minute
Hepatitis A virus	**a) 1076 ppm** **b) 4306 ppm**	a) 10 minutes b) 1 minute
Hepatitis B virus	**a) 1076 ppm** **b) 4306 ppm**	a) 10 minutes b) 1 minute
Hepatitis C virus	**4306 ppm**	1 minute
Avian influenza A (H5N1)	**a) 1076 ppm** **b) 4306 ppm**	a) 10 minutes b) 1 minute
Norovirus	**2153 ppm**	a) 1 minute
Poliovirus Type 1	**1076 ppm**	10 minutes
Coxsackievirus [B3]	**4306 ppm**	1 minute
Herpes simplex virus type 1	**1076 ppm**	10 minutes
FUNGICIDAL/YEASTICIDAL CLAIMS		
Aspergillus fumigatus	**4306 ppm**	1 minute
Candida albicans	**4306 ppm**	1 minute
Trichophyton interdigitale	**a) 1076 ppm** **b) 4306 ppm**	a) 10 minutes b) 2 minutes
Herpes simplex virus type 1	**1076 ppm**	10 minutes
CLOSTRIDIUM DIFFICILE CLAIMS		
Clostridium difficile spores	**a) 2153 ppm** **b) 4306 ppm**	a) 10 minutes b) 4 minutes
MYCOBACTERICIDAL CLAIMS		
Mycobacterium bovis (TB)	**5382 ppm**	4 minutes

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ANIMAL PATHOGENS		
Canine Parvovirus [†]	**1076 ppm**	10 minutes
Newcastle Disease Virus [†]	**1076 ppm**	10 minutes
Pseudorabies [†]	**1076 ppm**	10 minutes
Feline Calicivirus [†]	**1076 ppm**	a) 10 minutes b) 1 minute
Canine Distemper virus [†]	**1076 ppm**	10 minutes
Infectious Canine hepatitis [†]	**1076 ppm**	10 minutes
Teschen/Talfan disease [†]	**1076 ppm**	10 minutes
Avian influenza virus [†]	**a) 1076 ppm**	a) 10 minutes
	b) 4306 ppm	b) 1 minute
Porcine parvovirus [†]	**1076 ppm**	10 minutes
Runting & Stunting virus [†] (tenosynovitis)	**1076 ppm**	10 minutes
Actinobacillus pleuropneumoniae [†]	**1076 ppm**	10 minutes
Bordetella bronchiseptica (rhinitis) [†]	**1076 ppm**	10 minutes
Brachyspira (Treponema/Serpulina) [†]	**1076 ppm**	10 minutes
Hyodysenteriae (swine dysentery) [†]	**1076 ppm**	10 minutes
Gumboro disease [†]	**1076 ppm**	10 minutes
Streptococcus uberis [†]	**1076 ppm**	10 minutes
Transmissible gastroenteritis (TGE) [†]	**1076 ppm**	30 minutes
Swine Vesicular disease [†]	**1076 ppm**	30 minutes
African swine fever [†]	**1076 ppm**	30 minutes
Hog cholera/Classical swine fever [†]	**1076 ppm**	30 minutes
Avipox (fowl pox) [†]	**1076 ppm**	30 minutes
Porcine epidemic diarrhea virus [†]	**1076 ppm**	10 minutes

[[†]Only approved for use against Canine Parvovirus, Newcastle Disease Virus, Pseudorabies, Canine Distemper Virus, & Feline Calicivirus in the state of California]

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Emerging Pathogen Claims – This product meets the criteria for use against emerging enveloped viral pathogens; large, non-enveloped viral pathogens; and small, non-enveloped viral pathogens when used in accordance with the use directions for Norovirus and Coxsackievirus B3, and Hepatitis A virus at a rate of 4306 ppm and a 1 minute contact time. Per the Guidance to Registrants, these statements will only be permitted as non-label claims when emerging viral pathogen conditions are met.

PURTABS Dilution Chart:

SOLUTION CONCENTRATION	PURTABS 3.3G TABLET	PURTABS 334MG TABLET	PURTABS 13.1G TABLET
100 ppm	1 tablet / 2.5 gal water	1 tablet / 32 oz water	1 tablet / 10 gal water
538 ppm	1 tablet / 64 oz water	6 tablets / 32 oz water	1 tablet / 2 gal water
1076 ppm	1 tablet / 32 oz water	N/A	1 tablet / 1 gal water
2153 ppm	2 tablets / 32 oz water	N/A	2 tablets / 1 gal water
4306 ppm	4 tablets / 32 oz water	N/A	4 tablets / 1 gal water
5382 ppm	5 tablets / 32 oz water	N/A	5 tablets / 1 gal water

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ANIMAL PATHOGENS

When used at 1076 ppm solution, applied as outlined under Disinfection/Virucidal Directions, PURTABS is effective against the following animal pathogens:

Actinobacillus pleuropneumoniae
African swine fever virus *
Avian influenza virus
Avipox-virus (Fowl pox virus) **
Bordetella bronchiseptica (Rhinitis)
Brachyspira hyodysenteriae (Swine Dysentery)
Infectious canine hepatitis
Clostridium perfringes
Feline calicivirus
Gumboro disease virus
*Classical swine fever virus (Hog cholera) **
Porcine parvovirus
Runting and stunting syndrome virus
(tenoysynovitis)
Streptococcus dysgalactiae
Streptococcus uberis
*Swine vesicular disease virus **
Teschen/Talfan disease
*Transmissable gastroenteritis (TGE) **

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** Requires 30 minute contact time*

STABILITY DATA

PURTABS solutions can be used for up to 3 days if stored in a closed container such as a spray bottle or buddy bottle at room temperature out of direct sunlight. Prepare a fresh solution twice weekly when using closed containers.

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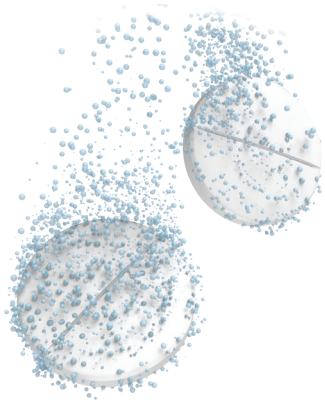
PHYSICAL AND CHEMICAL SPECIFICATIONS

Active ingredient: Sodium dichloro-s-triazinetrione	48.21%
Working pH	6.5 +/ -0.5
Color	Clear
Odor	Slight Chlorine
HMIS Health Rating Tablet	1
HMIS Health Rating In-Use	1



MATERIAL SUBSTRATE COMPATIBLITY

Sodium dichloro-s-triazinetrione tablets dissolved in water produce a solution of active chlorine. The following chart shows the compatability of a variety of materials with solutions up to 2,000 mg/L of active chlorine.

Plastics	Compatibility
ABS	A
CPVC	A
Hytrel®	A
HDPE	A
LDPE	A
Noryl®	A
Polycarbonate	A
Polypropylene	A
PPS	A
PTFE	A
PVC	A
PVDF	A

Elastomers	Compatibility
Nitrile (Buna N)	A
EPDM	A
Hypalon®	A
Kel-F®	A
Santoprene	A
Silicone	B
Tygon®	A
Viton®	A

Metals	Compatibility
SS 304	A
SS 316	A
Aluminum	B
Brass	B
Bronze	B
Carbon Steel	C
Cast Iron	C
Hasteloy C®	A
Titanium	A
Nonmetals	**Compatibility**
Carbon graphite	A
Ceramic A 1203	A
Ceramic magnet	A

Explanation of Ratings – Chemical Effect

A = Excellent.
B = Good – Minor effect, slight corrosion or discoloration.
C = Fair – Moderate effect, OK for short-term use.
Not recommended for continuous use. Some pitting may occur.
D = Severe effect, not recommended for any use.

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