

CITRICIDAL

Product Description

CITRICIDAL® is a broad spectrum antimicrobial compound synthesized from the seeds and pulp of grapefruit.

Application

CITRICIDAL® is an extremely potent and effective broad spectrum bactericide, fungicide, antiviral and antiparasitic compound. CITRICIDAL® is environmentally safe with a low toxicity to man and animals.

Mode of Activity

Studies indicate that the antimicrobial activity of CITRICIDAL® is in the cytoplasmic membrane where the uptake of amino acids is prevented and disorganization of the cytoplasmic membrane and leakage of low molecular weight cellular contents.

Biodegradability

CITRICIDAL® is biodegradable according to the "Standard Test Methods for Determining the Anaerobic Biodegradation Potential of Organic Chemicals", ASTM Standards, Section 11, Water and Environmental Technology, Procedure E 1196-2, pp. 879-901,1993.

Uses

Agriculture: Bactericide and fungicide in both pre-harvest and post-harvest treatment - *range: 50 ppm to 250 ppm**

Fish & Poultry: Disinfectant for fresh fish and poultry, preservative for processed fish and poultry - *range: 100 ppm to 1000 ppm**

Animal Feed: Mold inhibitor and antiparasitic - *range: 50 ppm to 250 ppm**

Food: Preservative and antioxidant- *range: 10 ppm to 250 ppm**

Cosmetics: Preservative and antimicrobial - *range: 1000 ppm to 10,000 ppm*

Water Treatment: Disinfectant for contaminated water - *range: 50 ppm to 250 ppm**

Therapeutic: - *range: 50 to 200 mg/dose**

Physical Properties

Citricidal® Liquid Extract

Grapefruit Extractives	60%
Glycerin-USP	40%

Total 100%

Citricidal Powder Extract

Grapefruit Extractives	50%
Silicon Dioxide - USP	30%
Glycerin-USP	20%

Total 100%

Chemical Description: Diphenol hydroxybenzene complex

Appearance (liquid): Liquid/heavy viscous

Color (Gardner): 2, Lemon Yellow

Odor: Mild citrus

Specific Gravity (d25 °C): 1.110

Density (lbs./gal.): 9.5

pH (d25 °C): 2.0 - 3.0

Flash Point (°F): 292

Viscosity (Centistoke): 134.91

Molecular Weight: 565

Solubility: Water, alcohol and organic solvents

**International registrations only*

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Citricidal Toxicity

Acute Oral Toxicity	LD ₅₀ over 5,000 mg/kg of live weight
Chronic Toxicity (Acute oral with continuous feeding and reproduction study for 24 months)	LD ₅₀ 2,500 mg/kg of live weight (Rats and guinea pigs)
Acute Oral Toxicity (Continuous feeding study with fishmeal for 12 months)	LD ₅₀ 5,000 mg/kg of live body weight (Adult rats, 12months) LD ₅₀ 400 mg/kg of live weight (Newborn rats)
Dermal Toxicity	Not a primary skin irritant and is non-corrosive
Carcinogenicity	12 month tests in mice show no carcinogenic effect 24 month test in rats show no carcinogenic effect
Long-Term Inhalation Study	Closed chamber exposure for 8 hours a day, 5 days a week for 90 days - No effect at 100-150 mg/m ³ air
Dermal Toxicity Carcinogenicity	2 year studies with rats and mice. No carcinogenic, toxicity or systemic effects seen
Eye Irritation	Full strength - severe irritation with slight corneal iris injury. 0.5%, 1% and 2% concentrations produce irritation and moderate erythema
Human Patch Studies	1 % and 2% concentrations produced no irritation or sensitization. 3% concentration produced very mild irritation by allergic humans.

Test Results

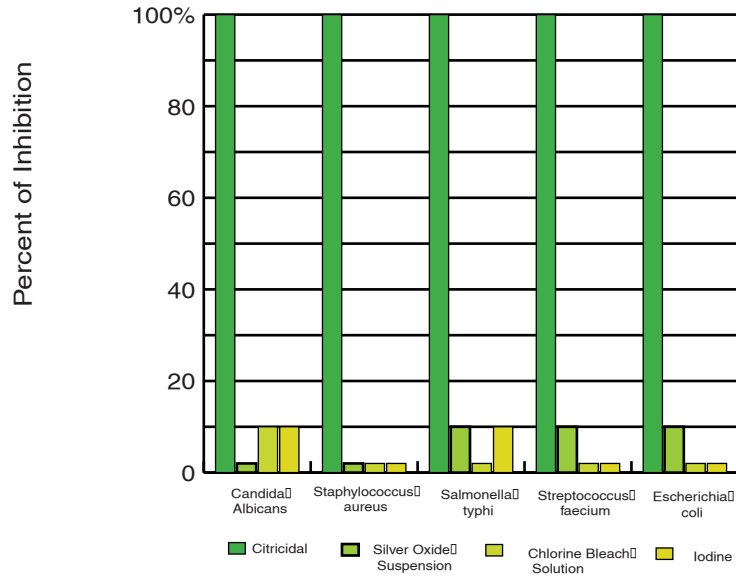
The following analytical results illustrate that CITRICIDAL® can have a broad and efficacious range of applications, offering superior performance compared with commonly used antimicrobial agents, while fulfilling standard performance criteria. The following information is representative of additional test results, including safety data, which are available upon request from **bio/chem**.

Relative Potency of Anti-Microbial Agents

The Minimum Inhibitory Concentration Study is a microbiological assay used to evaluate the relative potency of CITRICIDAL® compared to other antimicrobial agents. This study demonstrates CITRICIDAL® to be a minimum of ten (10X) to one hundred times (100X) more effective than other agents tested against the organisms used in this study.

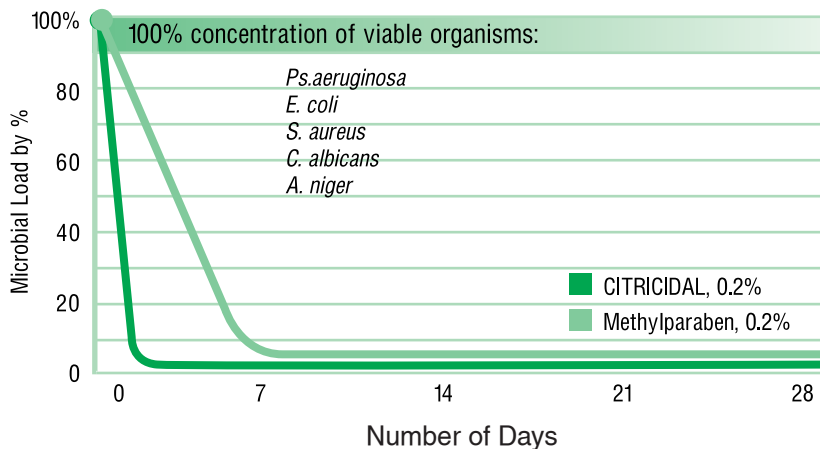
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USP Preservative Challenge Test

The USP Preservative Challenge test evaluates the ability of a product to withstand microbial insult. It is designed to determine whether the product is protected from microorganisms, which would alter the quality and integrity of a finished formulation. This study demonstrates that CITRICIDAL® is as effective as methylparaben in meeting the requirements of the USP Preservative Effectiveness Test. It also demonstrates that CITRICIDAL® has a more rapid onset of activity in reducing the concentration of viable organisms. (Please note: CITRICIDAL® is cationic.)

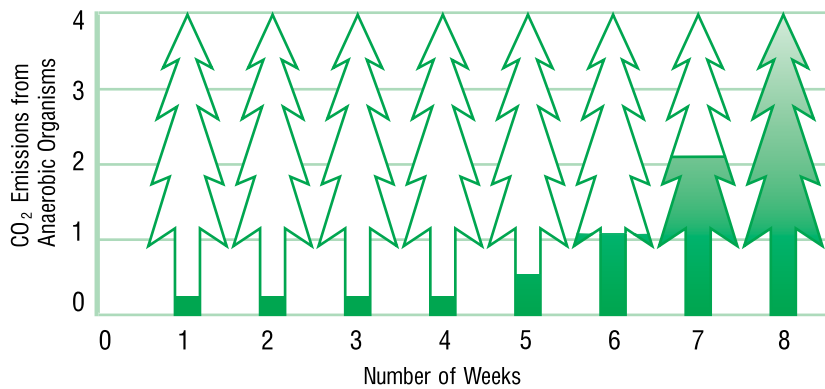


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Test Results (Continued)

Biodegradability Assessment of CITRICIDAL®

The biodegradability of CITRICIDAL® Liquid is established by the “Standard Test Methods for Determining the Anaerobic Biodegradation Potential of Organic Chemicals”, ASTM Standards, Section II, Water and Environmental Technology, Procedure E 1196-2, pp 879-901, 1993. CITRICIDAL® has an inhibitory effect on carbon dioxide production in an anaerobic digestion system for the first four weeks. At the end of eight weeks, gas production reached the theoretical maximum demonstrating that CITRICIDAL® is biodegradable using accepted testing procedures.



Complete test results available upon request.

CITRICIDAL® Packaging Specifications

Liquid Extract

5 Gallon Plastic Pail
11" x 14 1/2" x 16"
Net wt. 50 lbs.
Gross wt. 55 lbs.

55 Gallon Plastic Drum
23 1/2" x 36"
Net wt. 500 lbs.
Gross wt. 550 lbs

Powder Extract

30 Gallon Fiber Drum
16" x 29"
Net wt. 110 lbs.
Gross wt. 120 lbs

CITRICIDAL® (as a natural extractive) is listed as GRAS (Generally Recognized as Safe) under the Code of Federal Regulations as 21 CFR 182.20. CITRICIDAL® has been tested for safety in both human and animals, including the environment. CITRICIDAL® is considered non-toxic and a non-irritant at dilutions up to 2%. CITRICIDAL is also considered non-corrosive.

CAS NO.: 90045-43-5

CTFA listing: Grapefruit Extract

Note: CITRICIDAL® should be handled with care in full strength. Avoid contact with the eyes and avoid breathing vapors at full strength. Any direct contact with the skin should be thoroughly rinsed with water.

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CITRICIDAL® Minimum Inhibitory Concentration In-Vitro (MIC)

Gram-negative bacteria	Origin & strain No.	MIC (ppm)	Gram-positive bacteria	Origin & Strain No.	MIC (ppm)
Aerobacter aerogenes	CITM 413	20	Bacillus subtilis	NCTC 8236	2
Alcaligenes faecalis	A	2000	bacillus megatherium	A	60
Brucella intermedia	A	2	bacillus cereus	A	60
Brucella abortus	NCTC 8226	2	bacillus cereus var. mycoides	A	60
Brucella melitensis	A	2	Clostridium botulinum	NCTC 3805	60
Brucella suis	A	2	Clostridium tetani	NCTC 9571	60
Cloaca cloacae	NCTC 8155	6	Corynebacterium acnes	ATCC 6919	60
Escherichia coli	NCTC 86	2	Corynebacterium diphtheriae	ATCC 6917	60
Escherichia coli	ATCC 9663	6	Corynebacterium diphtheriae	NCTC 3984	60
Escherichia coli	NCTC 9001	6	Corynebacterium diphtheriae	A	60
Haemophilus influenzae	A	660	Corynebacterium minutissium	ATCC 6501	100
Klebsiella edwardsii	NCTC 7242	6	Diplococcus pneumoniae	NCTC 7465	60
Klebsiella aerogenes	NCTC 8172	6	Lactobacillus arabinosus	CITM 707	66
Klebsiella pneumoniae	ATCC 4352	6	Lactobacillus arabinosus	ATCC 8014	66
Legionella pneumoniae	isolate	200	Lactobacillus casei	CITM 707	100
Loefflerella mallei	NCTC 9674	6	Listeria monocytogenes	ATCC 15313	20
Loefflerella pseudomallei	NCIB 10230	20	Mycobacterium tuberculosis	A	2000
Moraxella duplex	A	2	Mycobacterium smegmatis	NCTC 8152	20
Moraxella glucidolytica	A	6	Mycobacterium phlei	A	6
Neisseria catarrhalis	NCTC 3622	660	Sarcina lutea	NCTC 196	60
Pseudomonas capacia	C-175	5000	Sarcina ureae	ATCC 6473	2
Pasteurella septica	NCTC 948	2	Staphylococcus aureas	NCTC 7447	2
Pasteurella pseudotuberculosis	S.-G.	200	Staphylococcus aureas	NCTC 4163	2
Proteus vulgaris	NCTC 8313	2	Staphylococcus aureas	NCTC 6571	6
Proteus mirabilis	A	6	Staphylococcus aureas	NCTC 6966	2
Pseudomonas aeruginosa	NCTC 1999	2000	Staphylococcus aureas	ATCC 13709	2
Pseudomonas aeruginosa	ATCC 12055	20,000	Staphylococcus aureas	ATCC 6538	2
Pseudomonas fluorescens	NCTC 4755	2000	Staphylococcus albus	NCTC 7292	2
Salmonella choleraesuis		50	Staphylococcus albus	C.-G.	6
Salmonella enteritidis	A	6	Streptococcus agalactiae	NCTC 8181	60
Salmonella gallinarum		50	Streptococcus haemolyticus A	A	20
Salmonella typhimurium	NCTC 5710	6	Streptococcus faecalis	NCTC 8619	200
Salmonella typhi	NCTC 8384	6	Streptococcus faecalis	ATCC 10541	60
Salmonella paratyphi A	NCTC 5322	6	Streptococcus pyogenes	NCTC 8322	60
Salmonella paratyphi B	NCTC 3176	6	Streptococcus viridans		20
Salmonella pullorum	ATCC 9120	6			
Serratia marcescens	A	2000			
Shigella flexneri	NCTC 8192	6			
Shigella sonnei	NCTC 7240	3			
Shigella dysenteriae	NCTC 2249	2			
Vibrio cholerae	A	200			
Vibrio eltor	NCTC 8457	200			

Fungi and Yeasts	Origin & strain No.	MIC (ppm)
Aspergillus niger	ATCC 6275	600
Aspergillus fumigatus	ATCC 9197	200
Candida albicans	A	60
Candida albicans	ATCC 10259	60
Epidermophyton floccosum	ATCC 10227	200
Keratinomyces ajelloi	A	200
Monilia albicans		10
Saccharomyces cerevisiae		60
Trichophyton mentagrophytes	ATCC 9533	20
Trichophyton rubrum	A	200
Trichophyton tonsurans	A	200

Additional Organisms
Giardia lamblia
Entamoeba histolytica
Chlamydia trachomatis
Herpes simplex virus type 1
Influenza A ₂ virus
Helicobacter pylori
Campylobacter jejuni

The data presented herein is based on experiments and information believed to be accurate and reliable. However, no warranty is made, either expressed or implied, regarding the accuracy of the results to be obtained from the use of such date. Bio/Chem Research will assume no responsibility for the results of performance in products and applications over which Bio/chem Research has no control.



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