

Dutrion North America Ltd

223077 Hwy 611

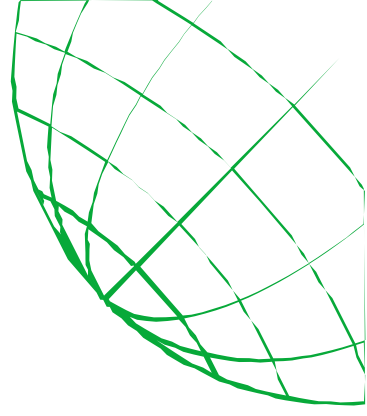
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CIO2 PROVEN TO ELIMINATE

To date, no organism has proven to be resistant to ClO₂.

Dutrion is registered with the United States Environmental Protection Agency (US EPA 89492-2), NSF International (NSF-60) and Organic Material Review Institute (OMRI) as a disinfectant, sanitizer, fungistatic, mildewstat, biocide, deodorizer, slimicide, algaestat, and descaler. It has the ability to destroy or eliminate all forms of microbial life including fungi, viruses, and all forms of bacteria and their spores.

This list documents the organisms our chemical has proven to eliminate.

BACTERIA

Bacillus anthracis Ames 30
Blakeslea trispora 28
Bordetellabronchiseptica 8
Brucellaisuis30
Burkholderiamallei36
Burkholderia pseudomallei 36
Campylobacter jejuni 39
Clostridium botulinum (Botulism) 32
Clostridium difficile 44
Clostridiumperfringens(EpsilonToxin)59
Corynebacterium bovis 8
Coxiella burnetii (Q-fever) 35
E. coli ATCC 11229 3
E. coli ATCC 51739 1
E. coli K12 1
E. coli O157:H7 13B88 1
E. coli O157:H7 204P1
E. coli O157:H7 ATCC 43895 1
E. coli O157:H7 C7927 1
E. coli O157:H7 EDL933 13
E. coli O157:H7 G5303 1
Erwinia carotovora (soft rot) 21
Francisella tularensis 30
Fusarium sambucinum (dry rot) 21
Fusariumsolani var. coeruleum(dryrot) 21
Helminthosporiumsolani(silvercruff) 21
Klebsiella pneumoniae 3
Lactobacillus acidophilus NRRL B1910 1
Lactobacillus brevis 1
Lactobacillus buchneri 1
Lactobacillus plantarum 5
Legionella 38
Legionellapneumophila42
Leuconostoc citreum TPB85 1
Leuconostocmesenteroides5
Listeriainnocua ATCC 33090 1
Listeria monocytogenes F4248 1
Listeria monocytogenes F5069 19
Listeriamonocytogenes LCDC-81-861 1
Listeria monocytogenes LCDC-81-886 19
ListeriamonocytogenesScottA 1
Methicillin-resistant Staphylococcus aureus (MRSA) 3
MultipleDrug Resistant Salmonella typhimurium (MDRS) 3
Mycobacterium bovis 8
Mycobacterium fortuitum 42
Pediococcus acidilactici PH3 1
Pediococcus pentosaceus 45 Pseudomonas aeruginosa 3
Psittacosis (Chlamydia psittaci) 58
Salmonella 1
Salmonella agona 1
Salmonellaanatum Group E 1
Salmonellaanatum Group E 1
Salmonella choleraesuis 8
Salmonella choleraesuis ATCC 13076 1
Salmonellaenterica(PT30)BAA-10451
Salmonella enterica S. Enteritidis 13
Salmonella enterica S. Javiana 13
Salmonella enterica S. Montevideo 13
Salmonellajaviana1
Salmonella newport 4 Salmonella paratyphi (Typhoid Fever) 52
Salmonella typhimurium C133117 1
Shigella 38
Staphylococcalenterotoxin B 56
Staphylococcus aureus 23
Staphylococcus aureus ATCC 25923 1
Staphylococcusepidermidis 45
StaphylococcusfaecalisATCC3441
Staphylococcus gallinarum 45
Staphylococcushominis 45
Staphylococcus xylosum 45
Streptococcus mutans 45
Tsukamurella inchenonensis 45
Tuberculosis 3
Vancomycin-resistant Enterococcus faecalis (VRE) 3
Vibrio cholerae 53
Vibrio strain Da-2 37
Vibriostain Sr-3 37
Yersiniaenterocolitica40
Yersiniapestis30
Yersinia ruckerii ATCC 29473 31

BACTERIAL SPORES

Alicyclobacillus acidoterrestris 17
Bacillus anthracis 10
Bacillus anthracis Ames 30
Bacillus atrophaeus 42
Bacillus atrophaeus ATCC 49337 31
Bacillus coagulans 12
Bacillus megaterium 12
Bacillus polymyxa 12
Bacillus pumilus ATCC 27142 12
Bacillus pumilus ATCC 27147 11
Bacillus subtilis (globigii)ATCC 9372 11
Bacillus subtilis5230 12
Bacillus subtilisATCC 19659 31
Bacillus thuringiensis 18
Clostridium sporogenes ATCC 19404 12
Geobacillus stearothermophilus ATCC 12980 11
GeobacillusstearothermophilusATCC795331
Geobacillus stearothermophilus VPHP 11

BETA LACTAMS

Amoxicillin 29
Ampicillin 29
Cefadroxil29
Cefazolin29
Cephalexin 29

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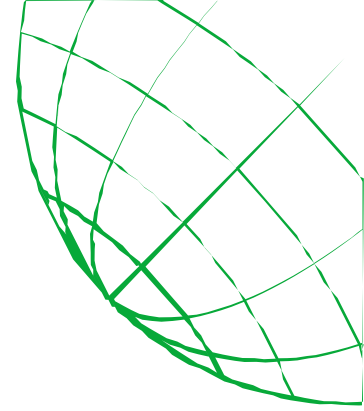
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ALGAE, FUNGI, MOLD, YEAST

Alternariaalternate 26
Aspergillus aeneus 28
Aspergillus aurulatus 28
Aspergillus brunneo-uniseriatus 28
Aspergillus caespitosus 28
Aspergillus cervinus 28
Aspergillusclavatonanicus28
Aspergillus egyptiacus 28
Aspergillus elongates 28
Aspergillusfischeri 28
Aspergillus fumigatus 28
Aspergillusgiganteus 28
Aspergillus longivesica 28
Aspergillus niger 12
Aspergillus ochraceus 28
Aspergillus parvathecius 28
Aspergillus sydowii 28
Aspergillus uniguis 28
Aspergillusustus28
Aspergillus versicolor 28
Botrytis cinerea 47
Botrytis spp. 3
Candidaalbicans 28
Candida dubliniensis 28
Candida edax 45
Candida maltose 28
Candida parapsilosis 28
Candida sake 28
Candida spp. 5
Candida tropicalis 28
Candida viswanathii 28
Chaetomium globosum 7
Cladosporium cladosporioides 7
Cryptococcus curvatus A 45
Cryptosporidium parvum Oocysts 9
Debaryomyces etchellsii 28
Eurotium spp. 5
Fusarium solani 3
Lodderomyces elongisporus 28
Mucor circinelloides 28
Mucor flavus 28
Mucor indicus 28
Mucor piriformis 47
Mucor rademosus 28
Mucor ramosissimus 28
Mucor saturnus 28
Penicillium chrysogenum 7
Penicillium digitatum 3
Penicillium expansum 47
Penicillium herquei 28
Penicillium spp. 5
Phormidium boneri 3
Pichia pastoris 3
Poitrasiacinans 28

VIRUSES

Adenovirus Canine 62
Adenovirus Human 62
Adenovirus Type 406
Arenaviridae (Arenavirus) including Gbagroube, Ippy, Kodoko, Lassa, Lujo,
Calicivirus 42
Canine Distemper Virus 62
Canine Parvovirus 8, 62
Coronavirus 3
Ebola Virus 61
Enterovirus including D68, D7160
Feline Calicivirus 3
Filoviridae (Filovirus) Marburg 54
Foot and Mouth Disease 8
H5N8, H5N9, H7N1, H7N2, H7N3, H7N4, H7N7, H9N2, H10N750
Hantavirus 8
Hepatitis A Virus 3
Hepatitis B Virus 8
Hepatitis C Virus 8
Herpes Virus 62
Human coronavirus 8
Human Immunodeficiency Virus 3
Human Rotavirus Type 2 (HRV) 15
Impipenem 29
Influenza A 22
Influenza H1N1, H1N2, H2N2, H3N1, H3N2, H3N8, H5N1, H5N2, H5N3
Influenza H1N1, H5N1 49
Influenza H7N9 51
Latino, Machupo, Oliveros, Parana, Pichinde, Pirital, Sabia, Tamiami,
Luna, Lunk, Lymphocytic Choriomeningitis, Merino Walk, Menekre,
Measles Virus 62
Minute Virus of Mouse (Parvovirus, MVM-I) 8
Minute Virus of Mouse (Parvovirus, MVM-P) 8
Möbala, Mopeia, Tacaribe, Amapari, Chapare, Flexal, Guanarito, Junin,
Mouse Hepatitis Virus (MHV-A59) 8
Mouse Hepatitis Virus (MHV-JHM) 8
Mouse Parvovirus type 1 (MPV-1) 8
Murine Parainfluenza Virus Type 1 (Sendai) 8
Newcastle Disease Virus 8
Norwalk Virus 8
Penicillin G 29
Penicillin V 29
Poliovirus 20
Rotavirus 3
Severe Acute Respiratory Syndrome (SARS) Coronavirus 43
Sialodacryoadenitis Virus (SDAV) 8
Simian rotavirus SA-11 15
Theiler's Mouse Encephalomyelitis Virus (TMEV) 8
Vaccinia Virus 10
Variola vera (Smallpox) 57
Whitewater Arroyo 54

PROTOZOA

Chironomid larvae 27
Cryptosporidium 34
Cryptosporidium parvum Oocysts 9
Cyclospora cayentanensis oocysts 41
Giardia 34
Rhizopus oryzae 28
Roridin A 33
Saccharomyces cerevisiae 3
Stachybotrys bisbyi 45
Stachybotrys chartarum 7
T-mentag (athlete's foot fungus) 3
Verrucaria A 33

MICROSPORIDIA

Chemical Decontamination:
Cylindrospermopsin (CYN) 25
Dihydrocotinamide adenine nucleotide 24
Encephalitozoon intestinalis 41
Microcystin-LR (MC-LR) 25
Mustard Gas 46
Ricin Toxin 10
Sarin 46
Soman (GD) 46
VX 46

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REFERENCES

1. Selecting Surrogate Microorganism for Evaluation of Pathogens on Chlorine Dioxide Gas Treatment, Jeongmok Kim, Somi Koh, Arpan Bhagat, Arun KBhunia and Richard H. Linton. Purdue University Center for Food Safety 2007 Annual Meeting October 30 - 31, 2007 at Forestry Center, West Lafayette, IN.
2. Decontamination of produce using chlorine dioxide gas treatment, Richard Linton, Philip Nelson, Bruce Applegate, David Gerrard, Yingchang Han and Travis Selby.
3. Chlorine Dioxide, Part 1 A Versatile, High-Value Sterilant for the Biopharmaceutical Industry, Barry Wintner, Anthony Contino, Gary O'Neill. BioProcess International DECEMBER 2005.
4. Chlorine Dioxide Gas Decontamination of Large Animal Hospital Intensive and Neonatal Care Units, Henry S. Luftman, Michael A. Regits, Paul Lorcheim, Mark A. Czarneski, Thomas Boyle, Helen Aceto, Barbara Dallap, Donald Munro, and Kym Faylor. Applied Biosafety, 11(3) pp. 144-154 © ABSA 2006
5. Efficacy of chlorine dioxide gas as a sanitizer for tanks used for aseptic juice storage, Y. Han, A. M. Guentert*, R. S. Smith, R. H. Linton and P. E. Nelson. Food Microbiology, 1999, 16, 53|61
6. Inactivation of Enteric Adenovirus and Feline Calicivirus by Chlorine Dioxide, Jeanette A. Thurston-Enriquez, Charles N. Haas, Joseph Jacangelo, and Charles P. Gerba. APPLIED AND ENVIRONMENTAL MICROBIOLOGY, June 2005, p. 3100-3105.
7. Effect of Chlorine Dioxide Gas on Fungi and Mycotoxins Associated with Sick Building Syndrome, S. C. Wilson*, C. Wu, L. A. Andrichuk, J. M. Martin, T. L. Brasel, C. A. Jumper, and D. C. Straus. APPLIED AND ENVIRONMENTAL MICROBIOLOGY, Sept. 2005, p. 5399-5403.*
8. BASF Aseptrol Label
9. Effects of Ozone, Chlorine Dioxide, Chlorine, and Monochloramine on *Cryptosporidium parvum* Oocyst Viability, D. G. KORICH, J. R. MEAD, M. S. MADORE, N. A. SINCLAIR, AND C. R. STERLING. APPLIED AND ENVIRONMENTAL MICROBIOLOGY, May 1990, p. 1423-1428.*
10. NHRSC's Systematic Decontamination Studies, Shawn P. Ryan, Joe Wood, G. Blair Martin, Vipin K. Rastogi (ECBC), Harry Stone (Battelle), 2007 Workshop on Decontamination, Cleanup, and Associated Issues for Sites Contaminated with Chemical, Biological, or Radiological Materials Sheraton Imperial Hotel, Research Triangle Park, North Carolina June 21, 2007.
11. Validation of Pharmaceutical Processes 3rd edition, edited by Aaloco James, Carleton Frederick J. Informa Healthcare USA, Inc., 2008, p.267
12. Chlorine dioxide gas sterilization under square-wave conditions. Appl. Environ. Microbiol. 56: 514-519 1990. Jeng, D. K. and Woodworth, A. G.
13. Inactivation kinetics of inoculated *Escherichia coli* O157:H7 and *Salmonella enterica* on lettuce by chlorine dioxide gas. Food Microbiology Volume 25, Issue 2, February 2008, Pages 244-252, Barakat S. M. Mahmoud and R. H. Linton.
14. Determination of the Efficacy of Two Building Decontamination Strategies by Surface Sampling with Culture and Quantitative PCR Analysis. APPLIED AND ENVIRONMENTAL MICROBIOLOGY, Aug. 2004, p. 4740-4747. Mark P. Butner, Patricia Cruz, Linda D. Stetzenbach, Amy K. Klima-Comba, Vanessa L. Stevens, and Tracy D. Cronin
15. Inactivation of Human and Simian Rotaviruses by Chlorine Dioxide. APPLIED AND ENVIRONMENTAL MICROBIOLOGY, May 1990, p. 1363-1366. YU-SHIAW CHEN AND JAMES M. VAUGHN
16. Information obtained from CSI internal testing with Pharmaceutical customer. May 2006 Pages 364-368
17. Efficacy of chlorine dioxide gas against *Alicyclobacillus acidoterrestris* spores on apple surfaces, Sun-Yong Lee, Genisis Iris Dancer, Su-sen Chang, Min-Suk Rhee and Dong-Hyun Kang, International Journal of Food Microbiology, Volume 108, issue 3, May 2006 Pages 364-368
18. Decontamination of *Bacillus thuringiensis* spores on selected surfaces by chlorine dioxide gas, Han Y, Applegate B, Linton RH, Nelson PE. J Environ Health. 2003 Nov;66(4):16-21.
19. Decontamination of Strawberries Using Batch and Continuous Chlorine Dioxide Gas Treatments, Y Han, T. L. Selby, K. K. Schultze, PE Nelson, RHLinton. Journal of Food Protection, Vol 67, NO 12, 2004.
20. Mechanisms of Inactivation of Poliovirus by Chlorine Dioxide and Iodine, MARIA E. ALVAREZ AND R. T. O'BRIEN, APPLIED AND ENVIRONMENTAL MICROBIOLOGY, Nov. 1982, p. 1064-1071
21. The Use of Chlorine Dioxide in potato storage, NORA OLSEN, GALEKLEINKOPF, GARY SECOR, LYNN WOODSELL, AND PHIL NOLTE, University of Idaho, BUL 825.
22. Protective effect of low-concentration chlorine dioxide gas against influenza A virus infection Norio Ogata and Takashi Shibata. Journal of General Virology (2008), 89, 60-67
23. Preparation and evaluation of novel solid chlorine dioxide-based disinfectant powder in single-pack Zhu M, Zhang LS, Pei XF, Xu X. Biomed Environ Sci. 2008 Apr; 21(2): 157-62.
24. Chlorine dioxide oxidation of dihydronicotinamide adenine dinucleotide (NADH), Bakmutova-Albert EV, Margerum DW, Auer JG, Applegate BM. Inorg Chem. 2008 Mar 17; 47(6): 2205-11. Epub 2008 Feb 16.
25. Oxidative elimination of cyanotoxins: comparison of ozone, chlorine, chlorine dioxide and permanganate, Rodrigue Z, Onstad GD, Kull TP, Metcalf JS, Acero JL, von Gunten U. Water Res. 2007 Aug; 41(15): 3381-93. Epub 2007 Jun 20.
26. Inhibition of hyphal growth of the fungus *Alternaria alternata* by chlorine dioxide gas at very low concentrations, Morino H, Matsubara A, Fukuda T, Shibata T. Yakugaku Zasshi. 2007 Apr; 127(4): 773-7. Japanese.
27. Inactivation of *Chironomid larva* with chlorine dioxide, Sun XB, Cui FY, Zhang JS, Xu F, Liu LJ, J. Hazard Mater. 2007 Apr 2; 142(1-2): 348-53. Epub 2006 Aug 18.
28. Information obtained from CSI decontamination at Pharmaceutical facility.
29. Information obtained from CSI beta-lactam inactivation at Pharmaceutical facility.
30. Decontamination of Surfaces Contaminated with Biological Agents using Fumigant Technologies, S Ryan, J Wood, 2008 Workshop on Decontamination, Cleanup, and Associated Issues for Sites Contaminated with Chemical, Biological, or Radiological Materials Sheraton Imperial Hotel, Research Triangle Park, North Carolina September 24, 2008.
31. Sporidial Action of CD and VPH Against Avirulent *Bacillus anthracis* - Effect of Organic Bio-Burden and Titer Challenge Level, Vipin K. Rastogi, Lanie Wallace & Lisa Smith, 2008 Workshop on Decontamination, Cleanup, and Associated Issues for Sites Contaminated with Chemical, Biological, or Radiological Materials Sheraton Imperial Hotel, Research Triangle Park, North Carolina September 25, 2008.
32. *Clostridium Botulinum*, ESR Ltd, May 2001.
33. Efficacy of Chlorine Dioxide as a Gas and in Solution in the Inactivation of Two Trichothecene Mycotoxins, S. C. Wilson, T. L. Brasel, J. M. Martin, C. Wu, L. Andrichuk, D. R. Douglas, L. Cobos, D. C. Straus, International Journal of Toxicology, Volume 24, Issue 3 May 2005, pages 181 - 186.
34. Guidelines for Drinking-water Quality, World Health Organization, pg 140.
35. Division of Animal Resources Agent Summary Sheet, M. Huerkamp, June 30, 2003.
36. NRT Quick Reference Guide: Glanders and Melioidosis
37. Seasonal Occurrence of the Pathogenic *Vibrio* sp. of the Disease of Sea Urchin *Strongylocentrotus intermedius* Occurring at Low Water Temperatures and the Prevention Methods of the Disease, K. TAJIMA, K. TAKEUCHI, M. TAKAHATA, M. HASEGAWA, S. WATANABE, M. IQBAL, Y. EZURA, Nippon Suisan Gakkaishi VOL. 66; NO. 5; PAGE. 799-804 (2000).
38. Biocidal Efficacy of Chlorine Dioxide, TF-249, Nalco Company, 2008.
39. Sensitivity of *Listeria monocytogenes*, *Campylobacter jejuni* and *Escherichia coli* to sublethal bactericidal treatments and development of increased resistance after repetitive cycles of inactivation, N. Srnigic, A. Rajkovic, H. Medic, M. Uyttendaele, F. Devlieghere, Oral presentation, Food Micro 2008, September 1st - September 4th, 2008, Aberdeen, Scotland.
40. Susceptibility of chemostat-grown *Yersinia enterocolitica* and *Klebsiella pneumoniae* to chlorine dioxide, M S Harakeh, J D Berg, J C Hoff, and A Martin, Appl Environ Microbiol. 1985 January; 49(1): 69-72.
41. Efficacy of Gaseous Chlorine Dioxide as a Sanitizer against *Cryptosporidium parvum*, *Cyclospora cayentensis*, and *Encephalitozoon intestinalis* on Produce, Y. Ortega, A. Mann, M. Torres, Y. Cama, Journal of Food Protection, Volume 71, Number 12, December 2008, pp. 2410-2414.
42. Inactivation of Waterborne Emerging Pathogens by Selected Disinfectants, J. Jacangelo, pg 23.
43. SARS Fact Sheet, National Agricultural Biosecurity Center, Kansas State University.
44. High sporocidal activity using dissolved chlorine dioxide (SanDes) on different surface materials contaminated by *Clostridium difficile* spores, Andersson J., Sjöberg M., Sjöberg L., Unemo M., Noren T. Oral presentation. 19th European Congress of Clinical Microbiology and Infectious Diseases, Helsinki, Finland, 16 - 19 May 2009.
45. Information obtained from CSI decontamination at Pharmaceutical facility
46. Systematic Decontamination of CWAs and TICs, S Ryan, E Snyder, H Stone, MacGregor, DKenny, THayes, JRogers, JCappello, RFitzpatrick, MStapleton, LOudejans, BPreston, MClayton, 2008 Workshop on Decontamination, Cleanup, and Associated Issues for Site Contaminated with Chemical, Biological, or Radiological Materials Sheraton Imperial Hotel, Research Triangle Park, North Carolina September 25, 2008
47. Chlorine Dioxide as an Effective Antimicrobial Pesticide for Sanitation and Disinfection, Griffith D., Mainz E., Etherington R., Vulcan Chemicals, Birmingham, AL (1999)
48. Study performed by the University of Tennessee at Knoxville.
49. Assessment of the Removal and Inactivation of Influenza Viruses H5N1 and H1N1 by Drinking Water Treatment, Lenés, D., Deboosere, N., Menard-Szczebara, F., Jossent, J., Alexandre, V., Machinal C., Viallette M. April 2010
50. Methods of Treating or Preventing Influenza Associated Illness with Oxidative Reductive Potential Water Solutions. Hojabr Alimi, Eileen Thatcher. May 2010.
51. Application of Chlorine Dioxide on the Disinfection of the Indoor Environment in the Elevator. Ching-Shan Hsu, Wei-Che Huang, Nai-Lin An, Ming-Chun Lu, Ming-Jer. Liou, Sheau-Long Lee.
52. EPA Guidance Manual Alternative Disinfectants and Oxidants Report April 1999 pg 4-18
53. Malaysia Journal of Analytical Sciences, Vol 10. No. 1 (2006): pg 83
54. CDC Website
55. Division of Animal Resources Agent Summary Sheet, M. Huerkamp, June 30, 2003
56. FDA Website
57. Biological Agents by S.K. Prasad
58. US National Library of Medicine
59. Biological Safety Manual University of Florida
60. CDC Website
61. CDC Website
62. Bioscience Control, 2010, Vol. 15, No. 2, 45-49