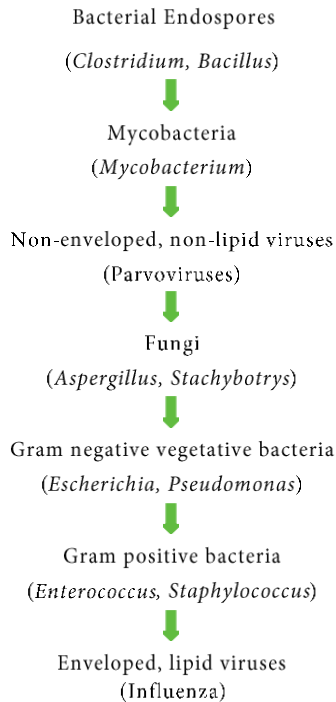


## Biological Efficacy of Chlorine Dioxide

### Spaulding Classification:



Chlorine Dioxide is a most unique molecule, being deliverable in both a gaseous and gas-in-water solution. In each form, it has been proven to be highly effective against all classifications of pathogens: protozoan, fungi, bacteria, viruses and spores. Over the decades, extensive testing has been done to validate the biological efficacy of this amazing molecule.

The list below is a good representation, but by no means is exhaustive, and the chart at the left is provided to assist the reader in understanding the degree of difficulty for each classification of organism, and it should be noted that the concentration necessary to dispatch the classes will vary.

***To date, no organism tested against Chlorine Dioxide has been proven to be resistant, or to have the capacity to build a resistance.***

Bacteria	Ref.
<i>Blakeslea trispora</i>	28
<i>Bordetella bronchiseptica</i>	8
<i>Brucella suis</i>	30
<i>Burkholderia mallei</i>	36
<i>Burkholderia pseudomallei</i>	36
<i>Campylobacter jejuni</i>	39
<i>Clostridium botulinum</i>	32
<i>Corynebacterium bovis</i>	8
<i>Coxiella burneti</i> (Q-fever)	35
<i>E. coli</i> ATCC 11229	3
<i>E. coli</i> ATCC 51739	1
<i>E. coli</i> K12	1
<i>E. coli</i> O157:H7 13B88	1
<i>E. coli</i> O157:H7 204P	1
<i>E. coli</i> O157:H7 ATCC 43895	1
<i>E. coli</i> O157:H7 EDL933	13

Bacteria	Ref.
<i>E. coli</i> O157:H7 G5303	1
<i>E. coli</i> O157:H7 C7927	1
<i>Erwinia carotovora</i> (soft rot)	21
<i>Franscicella tularensis</i>	30
<i>Fusarium sambucinum</i> (dry rot)	21
<i>Fusarium solani</i> var. <i>coeruleum</i> (dry rot)	21
<i>Helicobacter pylori</i>	8
<i>Helminthosporium solani</i> (silver scurf)	21
<i>Klebsiella pneumonia</i>	3
<i>Lactobacillus acidophilus</i> NRRL B1910	1
<i>Lactobacillus brevis</i>	1
<i>Lactobacillus buchneri</i>	1
<i>Lactobacillus plantarum</i>	5
<i>Legionella</i>	38
<i>Legionella pneumophila</i>	42
<i>Leuconostoc citreum</i> TPB85	1

Bacteria	Ref.
<i>Leuconostoc mesenteroides</i>	5
<i>Listeria innocua</i> ATCC 33090	1
<i>Listeria monocytogenes</i> F4248	1
<i>Listeria monocytogenes</i> F5069	19
<i>Listeria monocytogenes</i> LCDC-81-861	1
<i>Listeria monocytogenes</i> LCDC-81-886	19
<i>Listeria monocytogenes</i> Scott A	1
Methicillin-resistant <i>Staphylococcus aureus</i> (MRSA)	3
Multiple Drug Resistant <i>Salmonella typhimurium</i> (MDRS)	3
<i>Mycobacterium bovis</i>	8
<i>Mycobacterium fortuitum</i>	42
<i>Pediococcus acidilactici</i> PH3	1
<i>Pseudomonas aeruginosa</i>	3
<i>Pseudomonas aeruginosa</i>	8
<i>Salmonella</i>	1
<i>Salmonella</i> spp.	2
<i>Salmonella</i> Agona	1
<i>Salmonella</i> Anatum Group E	1
<i>Salmonella</i> Choleraesins ATCC 13076	1
<i>Salmonella choleraesuis</i>	8
<i>Salmonella</i> Enterica (PT30) BAA-1045	1
<i>Salmonella</i> Enterica S. Enteritidis	13
<i>Salmonella</i> Enterica S. Javiana	13
<i>Salmonella</i> Enterica S. Montevideo	13
<i>Salmonella</i> Enteritidis E190-88	1
<i>Salmonella</i> Javiana	1
<i>Salmonella newport</i>	4
<i>Salmonella</i> Typhimurium C133117	1
<i>Salmonella</i> Anatum Group E	1
<i>Shigella</i>	38
<i>Staphylococcus aureus</i>	23
<i>Staphylococcus aureus</i> ATCC 25923	1
<i>Staphylococcus faecalis</i> ATCC 344	1
<i>Tuberculosis</i>	3
Vancomycin-resistant <i>Enterococcus faecalis</i> (VRE)	3
<i>Vibrio</i> strain Da-2	37
<i>Vibrio</i> strain Sr-3	37
<i>Yersinia enterocolitica</i>	40
<i>Yersinia pestis</i>	30
<i>Yersinia ruckerii</i> ATCC 29473	31

Viruses	
<i>Adenovirus</i> Type 40	6
<i>Calicivirus</i>	42
<i>Canine Parvovirus</i>	8
<i>Coronavirus</i>	3
<i>Feline Calici Virus</i>	3
<i>Foot and Mouth disease</i>	8
<i>Hantavirus</i>	8
<i>Hepatitis A Virus</i>	3
<i>Hepatitis B Virus</i>	8
<i>Hepatitis C Virus</i>	8
<i>Human coronavirus</i>	8
<i>Human Immunodeficiency Virus</i>	3
<i>Human Rotavirus type 2 (HRV)</i>	15
<i>Influenza A</i>	22
<i>Minute Virus of Mouse (Parovirus)(MVM-i)</i>	8
<i>Minute Virus of Mouse (Parovirus)(MVM-p)</i>	8
<i>Mouse Hepatitis Virus (MHV-A59)</i>	8
<i>Mouse Hepatitis Virus (MHV-JHM)</i>	8
<i>Mouse Parvovirus type 1 (MPV-1)</i>	8
<i>Murine Parainfluenza Virus Type 1 (Sendai)</i>	8
<i>Newcastle Disease Virus</i>	8
<i>Norwalk Virus</i>	8
<i>Poliovirus</i>	20
<i>Rotavirus</i>	3
<i>Severe Acute Respiratory Syndrome (SARS) Coronavirus</i>	43
<i>Sialodscryoadenitis Virus (Coronavirus)(SDAV)</i>	8
<i>Simian rotavirus SA-11</i>	15
<i>Theiler's Mouse Encephalomyelitis Virus (TMEV)</i>	8
<i>Vaccinia Virus</i>	10

Algae/Fungi/Mold/Yeast	Ref.
<i>Alternaria alternata</i>	26
<i>Aspergillus aeneus</i>	28
<i>Aspergillus aurolatus</i>	28
<i>Aspergillus brunneo-uniseriatus</i>	28
<i>Aspergillus caespitosus</i>	28
<i>Aspergillus cervinus</i>	28
<i>Aspergillus clavatonanicus</i>	28
<i>Aspergillus clavatus</i>	28

Algae/Fungi/Mold/Yeast	Ref.
<i>Aspergillus egyptiacus</i>	28
<i>Aspergillus elongatus</i>	28
<i>Aspergillus fischeri</i>	28
<i>Aspergillus fumigatus</i>	28
<i>Aspergillus giganteus</i>	28
<i>Aspergillus longivesica</i>	28
<i>Aspergillus niger</i>	12
<i>Aspergillus ochraceus</i>	28
<i>Aspergillus parvathecius</i>	28
<i>Aspergillus sydowii</i>	28
<i>Aspergillus unguis</i>	28
<i>Aspergillus ustus</i>	28
<i>Aspergillus versicolor</i>	28
<i>Botrytis species</i>	3
<i>Candida spp.</i>	5
<i>Candida albicans</i>	28
<i>Candida dubliniensis</i>	28
<i>Candida maltosa</i>	28
<i>Candida parapsilosis</i>	28
<i>Candida sake</i>	28
<i>Candida sojae</i>	28
<i>Candida spp.</i>	5
<i>Candida tropicalis</i>	28
<i>Candida viswanathil</i>	28
<i>Chaetomium globosum</i>	7
<i>Cladosporium cladosporioides</i>	7
<i>Debaryomyces etchellsii</i>	28
<i>Eurotium spp.</i>	5
<i>Fusarium solani</i>	3
<i>Lodderomyces elongisporus</i>	28
<i>Mucor circinelloides</i>	28
<i>Mucor flavus</i>	28
<i>Mucor indicus</i>	28
<i>Mucor mucedo</i>	28
<i>Mucor rademosus</i>	28
<i>Mucor ramosissimus</i>	28
<i>Mucor saturnus</i>	28
<i>Penicillium chrysogenum</i>	7
<i>Penicillium digitatum</i>	3
<i>Penicillium herquei</i>	28
<i>Penicillium spp.</i>	5

Algae/Fungi/Mold/Yeast	Ref.
<i>Phormidium boneri</i>	3
<i>Pichia pastoris</i>	3
<i>Poitrasia circinans</i>	28
<i>Rhizopus oryzae</i>	28
<i>Roridin A</i>	33
<i>Saccharomyces cerevisiae</i>	3
<i>Stachybotrys chartarum</i>	7
<i>T-mentag (athlete's foot fungus)</i>	3
<i>Verrucarin A</i>	33

Bacterial Spores	Ref.
<i>Alicyclobacillus acidoterrestris</i>	17
<i>Bacillus coagulans</i>	12
<i>Bacillus anthracis</i>	10
<i>Bacillus anthracis Ames</i>	30
<i>Bacillus atrophaeus</i>	14
<i>Bacillus atrophaeus ATCC 49337</i>	31
<i>Bacillus megaterium</i>	12
<i>Bacillus polymyxa</i>	12
<i>Bacillus pumilus ATCC 27142</i>	12
<i>Bacillus pumilus ATCC 27147</i>	11
<i>Bacillus subtilis (globigii) ATCC 9372</i>	11
<i>Bacillus subtilis ATCC 19659</i>	31
<i>Bacillus subtilis 5230</i>	12
<i>Clostridium. sporogenes ATCC 19404</i>	12
<i>Geobacillus stearothermophilus ATCC 12980</i>	11
<i>Geobacillus stearothermophilus ATCC 7953</i>	31
<i>Geobacillus stearothermophilus VHP</i>	11
<i>Bacillus thuringiensis</i>	18

	Ref.
Mustard Gas	
Ricin Toxin	10
dihydrnicotinamide adenine dinucleotide	24
microcystin-LR (MC-LR)	25
cylindrospermopsin (CYN)	25

Beta Lactams	Ref.
Cephalexin	29
Imipenem	29
Penicillin G	29
Penicillin V	29

Protozoa	Ref.
<i>Chironomid larvae</i>	27
<i>Cryptosporidium</i>	34

Protozoa	Ref.
<i>Cryptosporidium parvum</i> Oocysts	9
<i>Cyclospora cayetanensis</i> oocysts	41
<i>Giardia</i>	34

Microsporidia	Ref.
<i>Encephalitozoon intestinalis</i>	27

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