

Hypochlorous acid – one of the most effective, fastest, broadest natural disinfectants.

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When you have the right tools there is no need to panic. We can be prepared and look at nature to provide the solution. I have collated a lot of researched backed information showing what you can implement right now in your home to protect you and your family. Finally, you can see how effective what you are currently using to protect yourself from germs and viruses.

Pathogen	Hypochlorous @ < 60 ppm	Hypochlorite (bleach) 1% 10,000ppm	Hydrogen peroxide (3-10%)	Colloidal silver >10-30ppm
Escherichia coli	10 sec ⁽²⁾	5 min ⁽²⁾	90 min ⁽²⁾	24 hours ⁽⁵⁾
Pseudomonas aeruginosa (-)	10 sec ⁽²⁾ ⁽³⁾	20 min ⁽²⁾	15 min ⁽²⁾	24 hour – not killed ⁽⁵⁾
Staphylococcus aureus	10 sec ⁽²⁾ ⁽³⁾	10 min ⁽²⁾	No kill at 90 min ⁽²⁾	5 days - reduced but not killed ⁽⁶⁾
MCRS – antibiotic resistant staph.	30 sec ⁽¹⁾	10ppm no kill ⁽⁷⁾ 100ppm no kill ⁽⁷⁾	No data	No data
Avian influenza virus	5 min ⁽⁴⁾	5 min ⁽⁹⁾	No data	No data

The comparative studies have demonstrated that Hydrogen Peroxide (H₂O₂) and Hypochlorite (OCl⁻) found in bleach can be effective against certain bacteria (gram negatives, but not gram positive). However, when using the effective concentration range needed, we see cytotoxic damage to our cells. This high concentration of bleach (hypochlorite) is not effective as it has a negative charge, so it is electrostatically repelled from the cell walls of bacteria, which are also negatively charged. It is much larger in size than an HOCL molecule so it cannot penetrate the cell membrane and acts only from outside. This means it is relatively a poor disinfectant ⁽¹⁰⁾. Let's compare this to hypochlorous acid (HOCL) which has no toxicity and is effective against all pathogens ⁽²⁾. This is what we now need to start using.

What about household vinegar and sodium bicarbonate?

Vinegar

Exposure to 6% acetic acid (high strength vinegar) for 30mins will only kill basic bacteria, and not useful for specific stronger microbes. Acetic acid has poor activity in organic material ⁽¹¹⁾. This means you must leave a surface covered in vinegar for 30mins for it to be effective against just the basic bacteria.

Sodium bicarbonate

It is more effective as a cleanser than a disinfectant since it lacks efficacy against some bacteria and most viruses. It has poor activity in the presence of organic material and can be deactivated by hard water ⁽¹¹⁾.

⁽¹⁾ <https://drive.google.com/file/d/1lqcps26iYo8Y-igo4VGkxmrwo2l33ZCJ/view>

⁽²⁾ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1853323/>

⁽³⁾ <https://h2opulence.squarespace.com/s/Bactericidal-Effects-of-Electrolyzed-Water>

⁽⁴⁾ <https://haccpper.co.jp/e/aboutcomfosy/comfosy.html>

⁽⁵⁾ <https://www.mdpi.com/2079-6382/9/1/36/htm>

⁽⁶⁾ <https://www.ncbi.nlm.nih.gov/pubmed/25643830/>

⁽⁷⁾ <https://www.ncbi.nlm.nih.gov/pubmed/25672403>

⁽⁸⁾ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4552962/>

⁽⁹⁾ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3852039/>

⁽¹⁰⁾ https://www.cleanroomtechnology.com/news/article_page/The_science_of_chlorine-based_disinfectant/93824

⁽¹¹⁾ <http://www.cfsph.iastate.edu/Disinfection/Assets/Disinfection101.pdf>

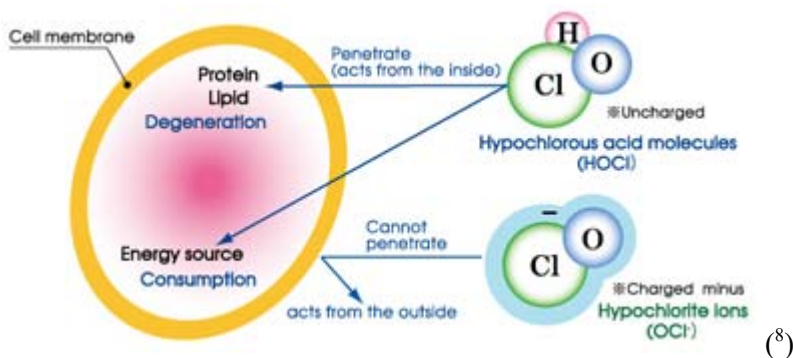
Hypochlorous acid is a natural highly effective sanitizer which is what our own immune system uses to kill germs. It is 80 to 120x more effective than bleach (hypochlorite)¹, 98x stronger for gram-negative bacteria and more than 1000x stronger than gram-positive organisms than hydrogen peroxide².

There is no toxicity for repeated use³, safe to use as a mouthwash, yet it has a 10 to 30 second kill rate for many pathogens including Escherichia coli⁴ which takes colloidal silver 24 hours to disinfect! ⁵

We now have the technology to make this substance called hypochlorous acid (HOCL) via a machine that Electrolyses water.

Electrolyzed oxidizing pH 2.5 water that produces Hypochlorous acid is a powerful oxidant that can kill microbial pathogens immediately upon contact by damaging cell walls or inactivating the pathogen by entering and disrupting proteins, lipids, and DNA⁶.

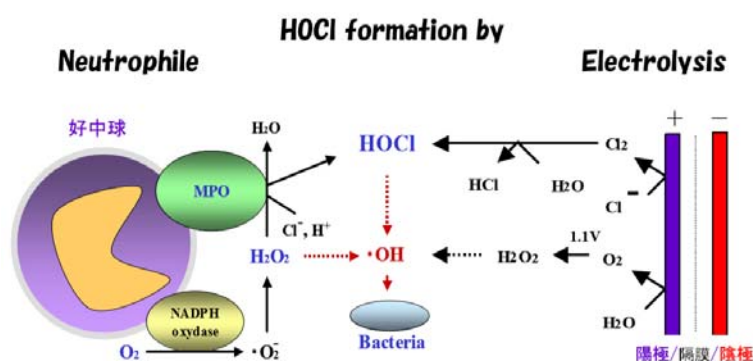
It is so effective due to a few reasons. It is a small molecule that can naturally get to 'hard to reach places' but more importantly the diagram below⁸ shows how it can get into cells. A cell membrane has a negative charge which repels other substances also with a negative charge (bleach). Hypochlorous acid (HOCL) has no charge so it can penetrate pathogens faster for a more rapid kill rate. It does this by producing hydroxyl radicals, which exerts a very strong oxidative antimicrobial action⁷.



When disinfecting you want to kill a pathogen as quick as possible. Bleach and other disinfectants must sit around for longer to have the same effect. HOCL also reacts rapidly than other disinfectants to oxidize organic matter of microbial cells (their internal nutrients, energy sources) and make them inactive or kill them⁷.

Now can we have all this and still have it safe to spray on us and our children?

This diagram below shows how our own white blood cells (neutrophils) utilize O_2 and convert it to hydrogen peroxide (H_2O_2) using a mitochondrial enzyme NADPHase. Then another enzyme converts hydrogen peroxide (H_2O_2) and Cl^- to generate Hypochlorous acid (HOCL)⁹. All while remaining safe to our cells while not promoting the emergence of resistant bacteria. This exact process can be replaced by electrolysis (our new water machine) !



Similarity between neutrophile (left) and HOCl water (right) in terms of elements for bactericidal mechanism

(9)

Here is what is exciting. It is not irritating to skin or mucous membranes, has proven highly effective in topical management of wound infections, and clears >95% of established biofilm after only 5 minutes of contact. It does not alter the appearance or characteristics of plastics, fabrics, stainless steel, or finished aluminium. The end products of its production are water and salt (NaCl), with no persistent residues and no hazardous waste management ¹⁰.

So, what exactly can Hypochlorous acid be used for?

I have compiled a few studies. 2 Studies are done on the exact machine we use to make hypochlorous acid, and the others use the same concentration of hypochlorous acid (50-60ppm) so can be compared.

The EPA required 4 pathogens to be killed within 30 seconds to be classed as an effective antimicrobial sanitizer¹¹.

This study using the same machine we have is shown here to kill the 4 pathogens in 30 seconds at room temp ¹².

Staphylococcus aureus (A TCC 6538)

Escherichia coli (A TCC 11229)

Salmonella typhi (A TCC 6539)

Methicillin Resistant Staphylococcus aureus- MRSA (ATCC 33592)

"Super Bug" - Carbapenem Resistant *Klebsiella pneumoniae* - CRKP (ATCC BAA-1705)¹⁹

Demonstrated a >99.999 percent reduction following a 30 second exposure time at room temperature

The second study with further pathogens testing using shorter time rates ¹³.

Staphylococcus aureus NBRC 12732 <10sec

Staphylococcus aureus ATCC 33591 (MRSA) <10sec

Escherichia coli ATCC 8739 <10sec

Escherichia coli ATCC 35150 (O157) <10sec

Pseudomonas aeruginosa IFO 13275 (=NBRC 13275) <10sec

Salmonella serotype enteritidis IFO 3133 (=NBRC 3133) <10sec

Legionella pneumophila ATCC 33153 <10sec

Mycobacterium bovis BCG RIMD 1314006 (*bovine tuberculosis BCG strain*) <10mins

Demonstrated a >99.999 percent reduction following mostly less than 10 second exposure at room temperature.

Other studies using a similar concentration.

Hypochlorous acid at 38-50ppm exhibits strong bactericidal, fungicidal, and virucidal effects in various sectors such as medicine and dentistry as well as on fruits, vegetables, seafood, eggs, poultry, utensils, agriculture, raw meat, and carcasses ¹⁴.

Yeast and mould

Listeria. monocytogenes

Vibro parahaemolyticus

Salmonella Typhimurium

Morganella morganii

Klebsiella pneumoniae

Proteus hauseri

Enterobacter cloacae

Enterobacter aerogenes

Proteus hauser

Total mesophiles

Total aerobic bacteria

Hypochlorous acid is shown to have a superior effect against bacteria (Gram-positive bacteria, Gram-negative bacteria and bacterial spores), yeasts and fungi @50ppm ¹⁵.

Bacillus subtilis spore >10mins

Bacillus subtilis >10mins

Escherichia coli <10sec

Staphylococcus aureus <10sec

Saccharomyces cerevisiae <60sec

Cladosporium cladosporioides >60sec to <10mins

Anti-viral at 50 to 200ppm ¹⁵.

Avian Influenza virus @ 50ppm < 5mins

HSV - Herpes simplex virus @ 50ppm <1min

HIV - Human Influenza virus @ 100ppm <3mins

Feline calicivirus @ 200ppm < 10mins

As you can see there are many organisms with a very quick kill rate that this natural substance is able to sanitize. It can be used not only for sanitizing but for wound care², scar prevention¹⁶, nasal irrigation¹⁷, and fogging¹⁸.

(¹) https://www.cleanroomtechnology.com/news/article_page/The_science_of_chlorine-based_disinfectant/93824

(²) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1853323/>

(³) <https://www.ncbi.nlm.nih.gov/pubmed/12637967>

(⁴) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1853323/>

(⁵) <https://www.mdpi.com/2079-6382/9/1/36/htm>

(⁶) https://www.researchgate.net/publication/267709415_Electrolyzed_Oxidized_Water_EOW_Non-Thermal_Approach_for_Decontamination_of_Food_Borne_Microorganisms_in_Food_Industry

(⁷) <https://onlinelibrary.wiley.com/doi/full/10.1111/1541-4337.12200#crf312200-bib-0052>

(⁸) <https://haccpper.co.jp/e/aboutcomfosy/comfosy.html>

(⁹) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4363024/>

(¹⁰) <https://infectioncontrol.tips/2017/10/06/hypochlorous-innate-response/>

(¹¹) <https://www.cdc.gov/infectioncontrol/guidelines/disinfection/healthcare-equipment.html>

(¹²) <https://drive.google.com/file/d/1lqcps26iYo8Y-igo4VGkxmrwo2I33ZCJ/view>

(¹³) <https://h2opulence.squarespace.com/s/Bactericidal-Effects-of-Electrolyzed-Water>

(¹⁴) <https://onlinelibrary.wiley.com/doi/full/10.1111/1541-4337.12200#crf312200-bib-0102>

(¹⁵) <https://haccpper.co.jp/e/aboutcomfosy/comfosy.html>

(¹⁶) <https://www.ncbi.nlm.nih.gov/pubmed/28370943>

(¹⁷) <https://onlinelibrary.wiley.com/doi/abs/10.1002/lary.25605>

(¹⁸) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1932820/>

(¹⁹) <https://static1.squarespace.com/static/5879c888e4fcb54334f8d43f/t/59b9eae44a7e24090f738148/1505374874961/enagic-super+501-germicidal-sanitizing-lab+tests.pdf>