

1 Oxidized Water

- **Strong oxidized water and weak oxidized water**

There are two types of water that are antibacterial and disinfect (oxidative water), strongly acidic "strong oxidized water" and mildly basic or acidic "weak oxidized water". Oxidized Water is a form of the latter, weak oxidized water.

Traditionally, oxidative water always referred to strong oxidized water. This is because the technology to create safe, stable weak oxidized water had not yet been developed.

However, there are now two techniques that have been developed to create weak oxidized water (electrolyzation and mixing) and increasing environmental awareness has brought attention to antibacterial, disinfectant water.

- **Powerfully antibacterial weak oxidized water**

In the beginning, the main force behind disinfectants was thought to be pH and redox potential. Thus, everyone believed that strong oxidized water would have a high antibacterial potential. However, while both types of water were able to disinfect general types of bacteria like staphylococcus, E. coli, and salmonella, when testing on spores from spore-forming grass bacilli, it was found that strong oxidized water had no antibacterial effect, but weak oxidized water had an antibacterial effect given time (one minute) and a chlorine concentration of over 30ppm.

In addition, while strong oxidized water had no antibacterial effect in tests mixing in organic material, weak oxidized water, while requiring time, again displayed antibacterial ability. This became clear through a number of reproducibility tests. The results of these tests were a beginning, and we wanted to learn if weak oxidized water had more antibacterial effect than strong oxidized water.

Through research, we confirmed that pH and redox potential, previously held to be the primary factor in antibacterial efficacy, did not in fact disinfect, but worked only to curb growth and propagation, and that chlorine was the true primary force in disinfecting.

We also confirmed that what held stable disinfectant ability was hypochlorous acid (HClO), and that water between pH5.0 and pH7.0 could contain a large amount of it. (Fig. 1)

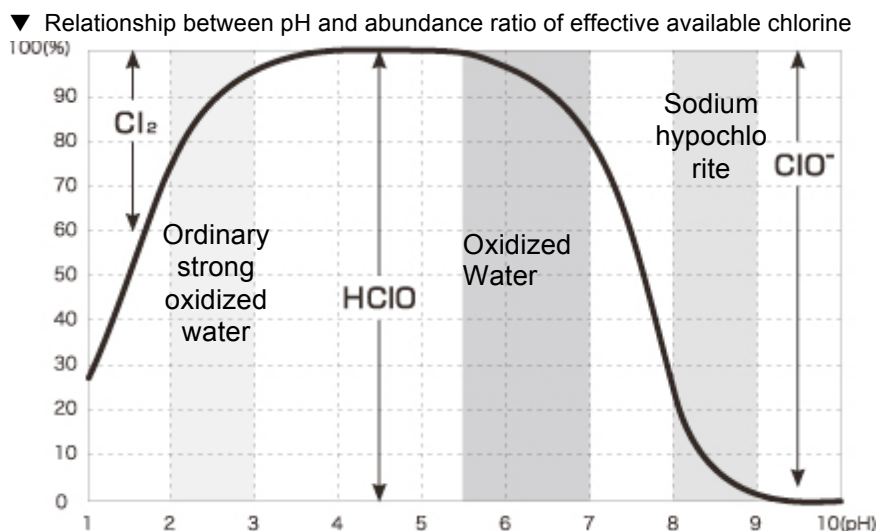


Fig. 1 Effective chlorine abundance ratio graph

2 Characteristics of Oxidized Water

1. Extremely safe and effective disinfectant water

The safety and disinfectant power of Oxidized Water has been verified by Japan Food Research Laboratories.

- **Does not affect the human body**

Oxidized Water will not cause inflammation or other skin problems when used to wash hands because of its near-neutral levels of acidity together with the ability to be used at low levels of concentration. Additionally, its main antibacterial ingredient, hypochlorous acid (HClO), will fight bacteria and other foreign substances within the body, but will not have a persistent effect on the body, making it harmless.

<Hypochlorous acid is created and has a disinfectant function within the body>

Not much is known beyond the fact that hypochlorous acid appears in blood. Some say that active oxygen breaks down bacteria and other foreign substances invading the body, and the fact is that it works in the form of hypochlorous acid. A large amount of an enzyme called myeloperoxidase exists in neutrophils and reacts with hydrogen peroxide, a type active oxygen, and chlorine ions to create hypochlorous acid. Neutrophils create hypochlorous acid in order to safely disinfect. Life has been using hypochlorous acid as a disinfectant for hundreds of millions of years.

- **Increasing antibacterial power through heat**

For an increase in temperature of 10°C, antibacterial power increases by 2.5 times. For example, If antibacterial power is 1 at 20°C, then it increases 2.5 times at 30°C, and at 40°C is multiplied another 2.5 times for a total of roughly 6 times the power.

For comparison, Oxidized Water heated to 35°C was able to completely wipe out endospore-producing bacteria after one minute, which is the same level of antibacterial efficacy as sterilized water heated under pressure to 121°C.

<Comparison of heat sterilization>

Disinfectant	Temp.	Number of viable bacteria			
		Test start	1 min.	3 min.	5 min.
Oxidized Water (pH 6.5, 60ppm)	35°C	3.5×10^7	ND	ND	ND
Sodium hypochlorite (pH 8.7, 100ppm)	35°C	3.0×10^6	4.4×10^6	2.7×10^6	6.9×10^4
Sterile purified water	83°C	3.4×10^6	4.3×10^6	2.2×10^6	2.6×10^6
Sterile purified water	121°C	5.2×10^6	ND	ND	ND

Note: ND = Not determined

2. Powerful deodorant

Below are the four common methods of deodorizing

1 Combining the deodorizing agent with the source of the odor, creating an odorless compound.

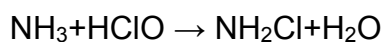
(* Oxidized Water easily combines with odor sources and creates odorless oxidized low-molecular compounds through oxidative breakdown.)

2 Shutting out or enveloping the source of the odor.

3 Inhibiting the growth of bacteria in kitchen waste, etc.

4 Enveloping the odor in a perfume. (Masking)

The method used by Oxidized Water is number 1 above. Ammonia, for example is deodorized by being changed into dichloramine.



✘ After Oxidized Water contacts organic matter and disinfects, it becomes ordinary water, so it can be used safely.

3. A Wide Range of Uses

- **Misting**

Oxidized Water can be used in misting to sanitize an area. When using a specialized mister, airborne bacteria can be reduced, and in a month of intermittent use, brought to nearly zero.

This is also effective in raising pigs and cattle, especially in windowless barns. For cows, you can expect milk quantity and quality to increase, and pigs can be fattened more healthily, which will result in higher quality meat.

We had revolutionary results in the medical field. Patients testing positive for antibiotic-resistant, major contributors to in-hospital infection like MRSA (methicillin-resistant staphylococcus aureus) and VRE (vancomycin-resistant enterococcus) were placed in isolated rooms that were intermittently misted with Oxidized Water daily. After two weeks, a great majority of the patients were free from major contributors to in-hospital infection. These results greatly surprised the doctors. It is currently impossible to mist with strong oxidized water.

In these areas, strong oxidized water is not as general purpose, nor as easily handled as Oxidized Water.

- **Sanitizing Cleaner**

If the location of harmful bacteria is known, it would be easy to use a powerful disinfectant on that spot, but in a factory you can never know where or how much bacteria might be hiding. At the same time, one can't use an expensive, powerful disinfectant on the entire factory, as it would have an effect on the people working there.

In cases like this, washing it all away with Oxidized Water is incredibly effective. No additional work is necessary, just use it instead of ordinary water and you can create a sanitary environment.

- **Usable Locations**

Oxidized Water can be used in many places where sanitary controls are important.

1. Medical and related institutions
2. Welfare facilities for the elderly / nursing facilities
3. Food processing plants
4. Dairy product factories
5. Bottling plants
6. Restaurant kitchens
7. Food courts and back areas of supermarkets and department stores
8. Pet shops and veterinary hospitals
9. Hotel kitchens
10. School lunch center and food preparation facility kitchens
11. Dairy, pork and poultry farms
12. Public restrooms
13. Garbage collection areas
14. Hot spring facilities
15. And many more

4. Safety and All-Purpose Power that Surpasses Sodium Hypochlorite

• Sodium hypochlorite and Oxidized Water

Sodium hypochlorite, found in chlorine bleach, is commonly used in the food industry, but in both the medical and food industries is ordinarily thought to be a slow-acting disinfectant and prone to leave residue. Because it doesn't work quickly, higher concentrations are used, making it more strongly basic and weakening the effect of the more antibacterial hypochlorous acid (HClO). In other words, increasing the concentration like in fig. 1 only increases weakly antibacterial hypochlorite ions (ClO^-), which means the higher the concentration, the less effective it becomes. Hypochlorite ions are stable, and if we give them an antibacterial strength of 1, then unstable hypochlorous acid molecules (HClO) have an antibacterial strength of 80. Therefore, if you try to increase antibacterial power by simply increasing concentration, the ratio of hypochlorite ions will increase, and the level of antibacterial power will not rise much.

A production facility reported that in tests, Oxidized Water at 50ppm had the same antibacterial effect as sodium hypochlorite at 4000ppm.

1. An Example in the Difference in Antibacterial Power

Only 1% of the army of sodium hypochlorite is armed and the other 99% of the army goes unprepared. In other words, the 40-50ppm of hypochlorous acid (HClO) goes forward to fight, while the remaining 99% of the army, hypochlorite ions, lines up and awaits their turn. When the powerfully antibacterial hypochlorous acid molecules disinfect and break down, the extremely weak hypochlorite ions become hypochlorous acid and their disinfectant power increases dramatically. When there is no more bacteria left to fight, the remaining majority of hypochlorite ions are left behind. (Fig. 2-a)

The army of Jiamover Oxidized Water at 50ppm, on the other hand, is almost totally armed (hypochlorous acid) and fights all at once, making it nearly as effective as sodium hypochlorite at 4000ppm. However, new reinforcements will not come if they cannot wipe out all the bacteria they are fighting (Fig. 2-b). At the same time, very little hypochlorous acid will be left behind.

2. Safety Comparison

Highly concentrated sodium hypochlorite is also strongly basic and worsens skin problems and other damage to users. The pH of Oxidized Water is at slightly acidic to neutral levels, greatly lessening fears of skin damage. However, a small percentage of people are sensitive to chlorine (even tap water can cause skin problems), so it is not 100% worry-free.

When talking about chlorine, some may be worried about the production of carcinogenic trihalomethanes, but trihalomethanes are largely produced on the basic side of the pH scale, and Oxidized Water is a near-neutral disinfectant, so this is not a concern.

3 Oxidized Water Production Technology and Equipment

- **High Levels of Safety**

Oxidized Water is created through by mixing already available sodium hypochlorite with acid while managing pH levels, rather than the previous electrolysis-type method of generation.

Reliability is very important in mixing equipment. The production equipment for Oxidized Water includes pH sensors. A special pump is used to add sodium hypochlorite and acid (primarily hydrochloric acid) to tap water, which is then agitated and mixed in the pipeline while neutral pH levels are stably maintained. (Patent pending)

- **Extremely Low Operating Costs**

Chlorine is not generated through electrolysis, so an electrolysis tank is unnecessary, greatly lowering maintenance costs. In addition, the amount produced per unit of time far outweighs the electrolysis-type method, making it ideal for food production and other facilities where large amounts of weak oxidized water are used. It can even be used at diluted levels. 1.5 tons of disinfectant at 200ppm can easily be turned into 6 tons of disinfectant at 50ppm. It can be used as a cleaning fluid at factories from brewing tanks at breweries to CIP washing at dairy product factories and more.

- **No Salt Residue**

The pH level of water used in production can be freely set between 5.5 and 7.0, making it more multipurpose and at the same time does not require salt like in electrolysis-type production, so there will be no salt left behind or rust resulting from salt residue.

Oxidized Water and Safety

What if it is accidentally swallowed?	→	Single dose oral toxicity test (Acute toxicity test)	-----	Nothing abnormal detected
What if it gets on your skin or in your eyes?	→	Primary skin irritation test	-----	Nothing abnormal detected
	→	Eye irritation test	-----	Nothing abnormal detected
Will it cause an allergic reaction?	→	Skin sensitization test	-----	No sensitizing
	→	Mutation test	-----	Nothing abnormal detected

Oxidized Water Disinfection Efficacy Testing

Main test results	After 15s
Norovirus	Not detected
Influenza virus	Not detected
Legionella	Not detected
E. coli	Not detected
P. aeruginosa	Not detected
S. aureus	Not detected

※Storage temp. 20°C Oxidized Water 50ppm