ClorDiSys

Material Compatibility

Chlorine Dioxide Gas

Chlorine Dioxide Gas Material Safety

Our Generation Method

Not all chlorine dioxides are equal. Our CD gas generators produce a pure chlorine dioxide gas, without the acidic byproducts typical of other chlorine dioxide products.

Oxidation Potential

The oxidation potential is a scientific value to how corrosive a chemical is. The oxidation potential for chlorine dioxide is 47% lower than the oxidation potential of hydrogen peroxide.

Low Temperature Sterilization

Our CD gas is generated and introduced at room temperatures, meaning there is no concern over temperature sensitive materials or components being affected.

Dry Sterilization

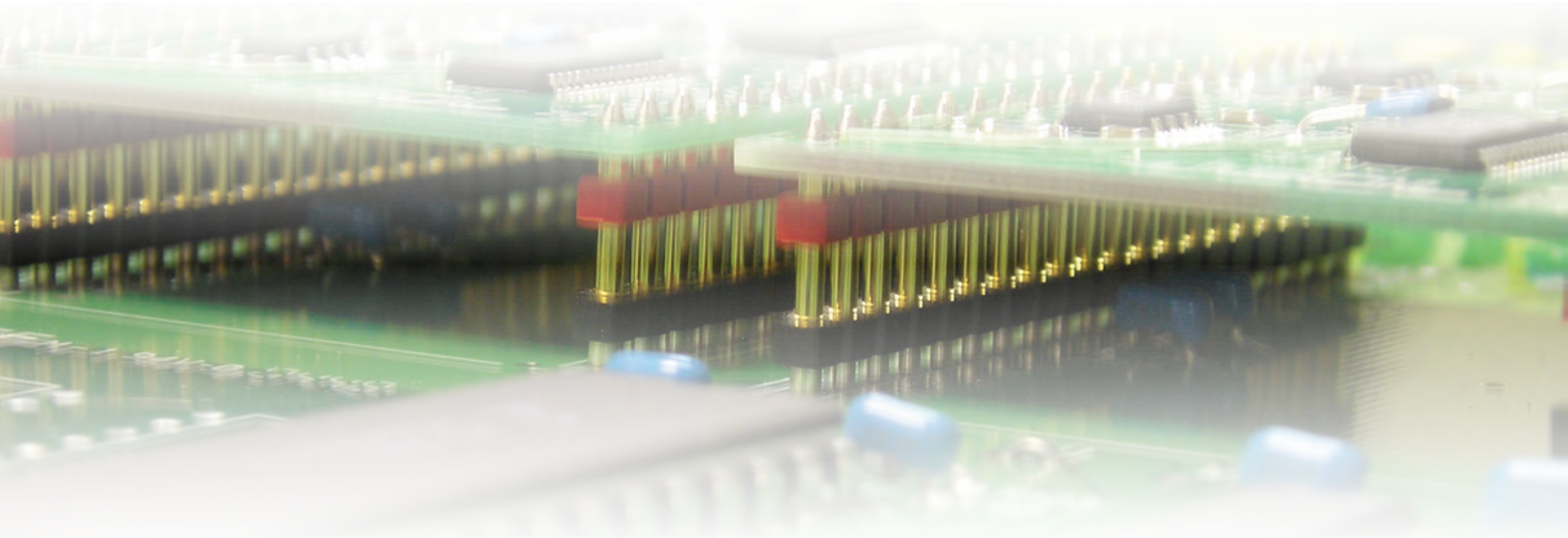
Our CD gas is generated and introduced at as a dry gas, meaning there is no concern over liquid sensitive materials or components being affected.

Chlorine Dioxide Gas Does Not Form Hydrochloric Acid In Water

CD gas does not react with water, and is in fact used for water treatment in hundreds of municipalities in the United States and Europe.

Chlorine Dioxide Gas Does Not Leave Residues

Our CD gas does not leave a residue on equipment and surfaces after a decontamination. Once the gas has been removed, the space is perfectly safe to enter and does not require additional cleanup.



Chlorine Dioxide vs. Chlorine

Similar Names, but Different Chemicals

These two chemicals have similiar names but are very different chemicals. Chlorine kills organisms through chlorination, while chlorine dioxide kills through oxidation. More municipalities are using chlorine dioxide for water treatment instead of chlorine due to the fact that chlorine dioxide eliminates the formation of trihalomethanes, haloacetic acids, and other organic compounds that chlorine produces during water treatment.

Chlorine dioxide does not react with water and is able to maintain its efficacy to decontaminate the water itself as well as the surfaces beneath.. Chlorine reacts with water to form hydrochloric acid. Chlorine dioxide is far more gentle on materials than chlorine.

ClorDiSys Solutions, Inc

ClorDiSys Solutions, Inc. was established in 2001 by our founders who had developed chlorine dioxide gas sterilization technology while at Johnson and Johnson in the 1990s. With over 20 years of experience using chlorine dioxide gas around the world in research laboratories, pharmaceutical facilities, food manufacturing plants, vehicles, hospitals, ductwork, piping, storage tanks and other vessels, we've seen just about everything.

Chlorine Dioxide vs. Chlorine Dioxide

Better Ingredients, Better Chlorine Dioxide

Pizza tastes different everywhere you go. Similarly, every chlorine dioxide product is different as well. The differences come from the ingredients and process used to make them. With pizza, these "manufacturing differences" affect the taste. With chlorine dioxide, manufacturing differences affect its material compatibility. The material compatibility of one chlorine dioxide product therefore does not reflect on the material compatibility of another. The oft referenced Hart Senate Building decon using chlorine dioxide gas was the very first building fumigation using chlorine dioxide gas, and was performed in November 2001 by a company who previously applied its chlorine dioxide gas for controlling odors in oil wells where material compatibility was never an issue so a less refined process of generating chlorine dioxide gas which contained acidic byproducts was acceptable. ClorDiSys was established a month later using a better chlorine dioxide and greater knowledge of decontamination in general. Our generation method is different in that we produce a pure chlorine dioxide, compared to other liquid and gas products that produce acidic byproducts which cause material issues. Our pure chlorine dioxide gas does not leave a residue unlike most other chlorine dioxide products. One of the very first commercial uses for our chlorine dioxide gas was the sterilization of implantable contact lenses, where it was proven to the FDA that there were no measurable residuals.

Oxidation Potential

A Scientific Measure of Corrosivity

Oxidation potential is a chemical property that measures the chemical's tendency to oxidize. This can also be thought of as the corrosion potential. The higher the value, the greater stronger the chemical's oxidizing (or corrosion) power. The graph below shows common sterilants and their oxidation potential.

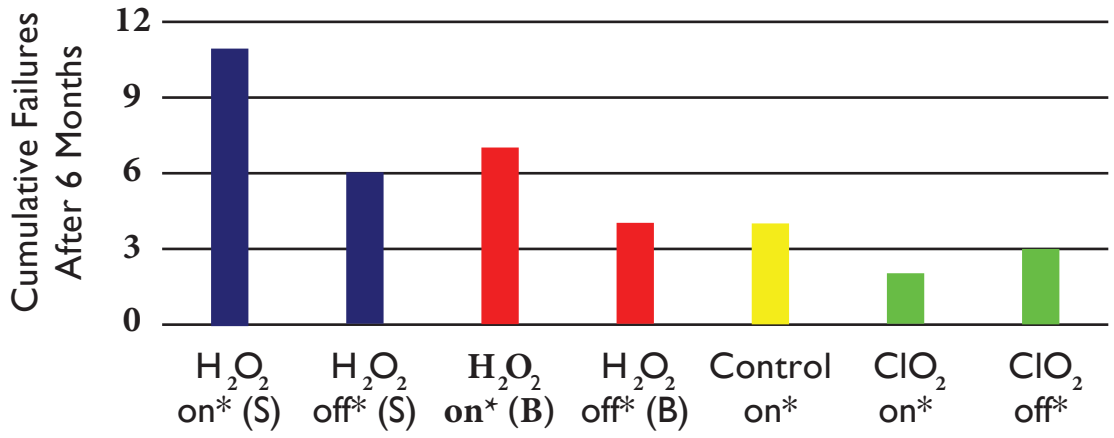
Decontaminating Agent	Oxidation / Corrosion Potential (V)
Ozone	2.07
Peracetic Acid	1.81
Hydrogen Peroxide	1.78
Bleach	1.49
Chlorine Dioxide	0.95

More Corrosive

Chlorine dioxide is scientifically less corrosive than hydrogen peroxide

47% lower oxidation potential than hydrogen peroxide

The US EPA shows that hydrogen peroxide is more corrosive than chlorine dioxide gas



* Computer left on/off during decontamination cycle.

Ref: Emily Snyder, "Indoor and Outdoor Decontamination" Presentation at the EPA Region 9 / ORD Homeland Security Research Workshop, July 14, 2011 San Francisco, CA.

Mythbusting

Chlorine dioxide doesn't have its own episode on TV yet, but there are many myths, half-truths, and misconceptions regarding chlorine dioxide's material compatibility. Below are some of the more well-known myths and their truths.

Corrosion of stainless steel

Chlorine dioxide gas is completely safe on stainless steel, unlike some widely used liquid chlorine dioxide solutions, whose acidic byproducts are corrosive against stainless steel.

Chlorine dioxide is explosive

Not at use concentrations. Chlorine dioxide gas is potentially explosive at extremely high concentrations in a dry environment with an ignition source. ClorDiSys does not generate chlorine dioxide gas at these high concentrations, so there is no danger of explosion when using our process. The use concentration is 250 times less than the potentially explosive level.

Chlorine dioxide leaves residues

Our pure CD gas does not leave a residue. Other chlorine dioxide products may leave residues. One of the first commercial uses of our CD gas was to sterilize implantable contact lenses. As such, it was proven that no residue was left after sterilization.

Chlorine dioxide is a carcinogen

There is no data showing that chlorine dioxide is a carcinogen. Chlorine dioxide is used for the treatment of drinking water in many municipalities and also for the treatment of foods, where the use of a carcinogen would not be allowed. Formaldehyde is a confirmed human carcinogen by most international health agencies and hydrogen peroxide is a confirmed animal carcinogen by the American Conference of Governmental Industrial Hygienists.

Chlorine Dioxide Gas does not form hydrochloric acid in water

Chlorine dioxide does not react with water to form hydrochloric acid. When CD gas contacts water, it actually dissolves into the water and is able to retain its antimicrobial properties, killing organisms in the water and on the surface beneath. Hundreds of municipalities use chlorine dioxide to treat their drinking water as it is the environmentally friendly alternative to using chlorine.

Electron Microscopes

In 2009, we were approached by JEOL USA as they set forth to find a suitable decontamination method for their electron microscopes. They wanted a method to decontaminate the interior chambers of their microscopes to protect their service workers from the pathogens being studied within the microscopes. Identical sets of parts were sent for material testing against chlorine dioxide and hydrogen peroxide vapor. Our chlorine dioxide gas was selected due to its success in the material compatibility trials and is used with the $3 million TEM.

"Our early attempts to use VHP with JEOL microscopes were not successful because of unacceptable level of corrosion of some parts inside the microscope column. Various parts were tested in a chamber filled with VHP and some showed visible discoloration and corrosion after the level of exposure necessary for a single decontamination cycle."

Construction and Organization
of a BSL-3 Cryo-Electron Microscopy Laboratory at UTMB
Authors: Michael B. Sherman, et. al.
Journal of Structural Biology, Dec 2012

Galvanized Ductwork

Hydrogen peroxide vapor has been shown to be incompatible with galvanized ductwork as the galvanization breaks down the hydrogen peroxide. Our chlorine dioxide gas has no such issue with galvanized metals.

"Tests with VHP in a medium-scale HVAC system indicated that galvanized steel reduced the hydrogen peroxide concentration, whereas PVC had less of an effect."

Use of HVAC Systems in Building Decontamination.
Presentation by Tina Carlsen. for "Workshop on Decontamination, Cleanup, and Associated Issues for Sites Contaminated with Chemical, Biological, or Radiological Materials." February 24, 2005.

Isolators

"A few of the unpainted mild steel components in the heat sealer suffered some oxidation... the cold rolled steel shafts in the sealer have remained unaffected by exposure to chlorine dioxide except where slots and flats have been milled in them. Basically uncoated ferrous metals required paint or another coating; Once we discovered what was going on, the affected parts were changed to more compatible materials (stainless steel and some plastics), or coated."

Isolators Selection, Design, Decontamination, and Validation
Nick Barbu and Robert Zwick Aseptic Supplement to Pharmaceutical Engineering, August 2014

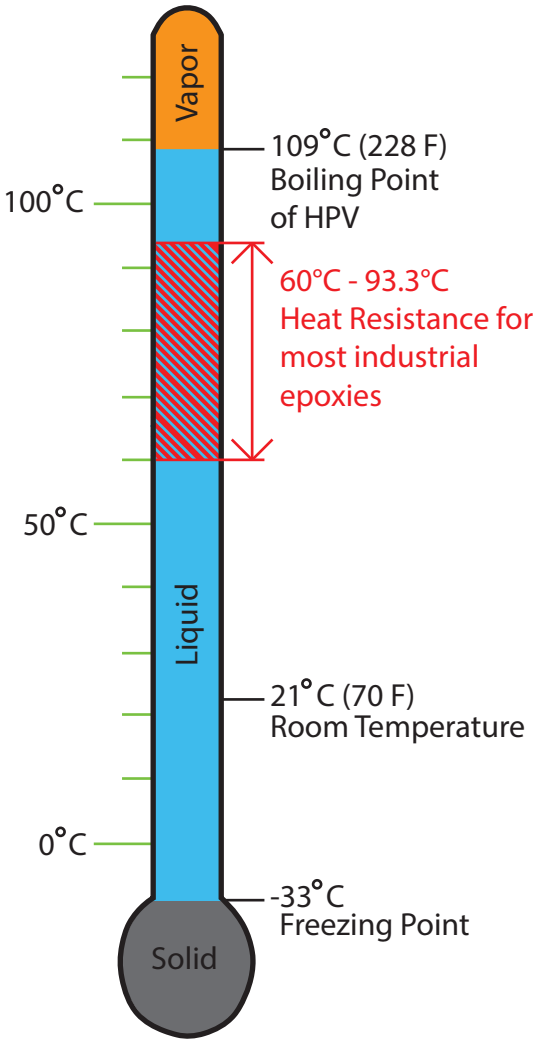
The isolator on the right has since undergone over 2000 CD gas decons with no material degradation.

Epoxy Surfaces

When hydrogen peroxide vapor (~35% H2O2 ~65% H2O) condenses, the hydrogen peroxide and water condense at different rates. HPV condenses out to a 78% H2O2 22% H2O solution. This higher concentration has shown to be corrosive to epoxy floors and other surfaces.

"During one trial in a BSL-3Ag space, excessive VHP condensation on a cold air supply register resulted in liquid hydrogen peroxide dripping and puddling on the epoxy floor, which resulted in costly repairs." - Got Gas? Chlorine Dioxide or Vaporized Hydrogen Peroxide: Which one is right for you? - Megan Sawyer, Joy Pierzynski, and Megan Trapp. Biosecurity Research Institute, Kansas State University, Manhattan, KS. 2012

"The two pictures show epoxy coatings that started to blister and peel due to VHP."
- A Storm in a Tea Cup – Practical Aspects of VHP Room Fumigation - Jorg Frank (Univ. of Zurich), Daniel Kumin (Spiez Laboratory) 2014 ABSA Conference.



"The cause of hydrogen peroxide's effect on epoxy is partly due to the superheated temperature to which it is vaporized and introduced for decontamination. Most industrial epoxies have a heat resistance limitation between 60°C and 93.3°C (140°F–200°F). Since hydrogen peroxide vapor exits a generator at a temperature of at least 109°C, it can cause damage upon contact with epoxy coatings and surfaces."
- Contamination Control in Healthcare Product Manufacturing, Vol 2.

Safe on Materials, Deadly on Organisms

Chlorine dioxide gas generated by our proprietary method provides a gentler decontamination method for equipment, electronics, and surfaces compared to hydrogen peroxide vapor, ozone, bleach, and even other chlorine dioxide products.

Put it to the test

If you have questions about specific components, send us some samples. We offer free material testing* to give confidence that our chlorine dioxide gas will be safe on your equipment, products, components, tools, etc…

*Testing is free for a reasonable amount of items. Shipping not included

ClorDiSys

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