

Titan Hydroxyl & Vaporized Ionized Hydro-Peroxide Generator's

Role in Mitigating and Helping to Control

Microbial Count in The Air & On Surfaces

The Titan produces a couple air purifying, deodorizing, microbe controlling substances. These agents are known as Reactive Oxygen Species or ROS. A ROS Molecule is a chemical molecule that includes a loosely held reactive oxygen atom.

Reactive oxygen species are chemically reactive chemical species containing oxygen. Examples include peroxides, superoxide, hydroxyl radical, singlet oxygen, and alpha-oxygen. [Wikipedia](#)

The two ROS that the Titan produces are Hydroxyl Radical (OH) and Vaporized Ionized Hydrogen Peroxide (H₂O₂).

Chart #1

<i>Oxidizing Agents Redox</i>	<i>Potential (v)</i>	<i>Government Safety Limits</i>
1 - Fluorine (F)	2.87	Not Safe
2 - Hydroxyl Radical (OH)	2.86	N/A
3 - Ozone (O ₃)	2.07	.04 ppm
4 - Hydrogen Peroxide (H ₂ O ₂)	1.78	1.0 ppm
5 - Chlorine (CL)	1.36	.5 ppm
6 - Oxygen (O ₂)	1.23	19.5% - 23.5%

The two major ROS elements that the Titans produce are Hydroxyl Radical and Hydrogen Peroxide.

The Hydroxyl Radical is the strongest SAFE reactive species that can be utilized in occupied areas for the control of microbials be it bacteria, virus on spores.

Hydroxyl Radicals are half such a short half-life there are no technologies that can read any given amount of OH in an area. The only procedure currently used by the scientific community is to gauge the degradation of a given VOC and assume that OH is the species oxidizing said VOC.

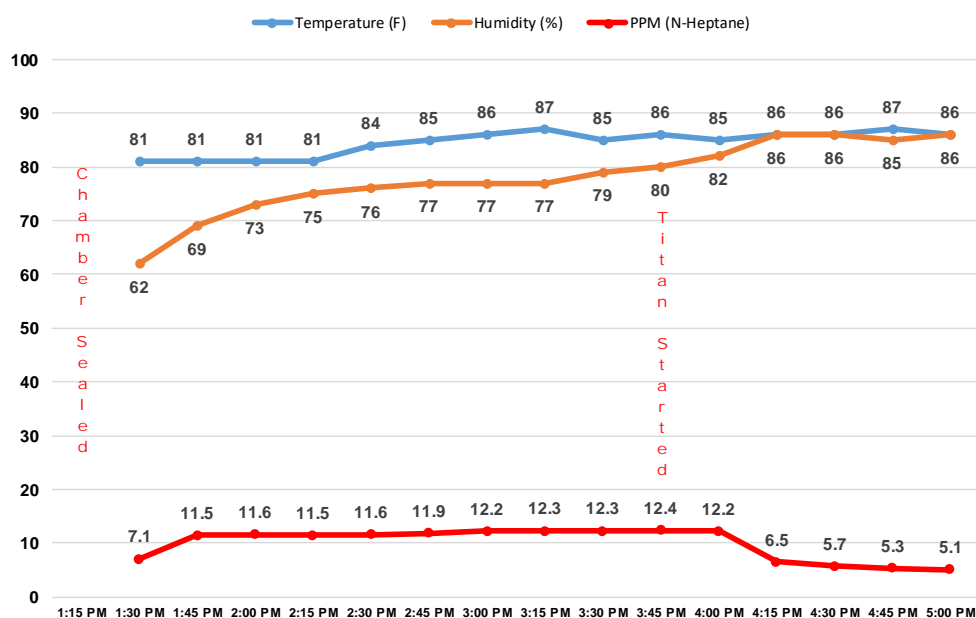
The following is such a test performed on the Titan 1000 Hydroxyl Generator.

Titan Hydroxyl Generator Oxidation of N-Heptane

Comments	Time	Temperature (F)	Humidity (%)	PPM (N-Heptane)
Chamber is sealed with 100 cfm circulating fan running and 1 tbl spoon of heptane in beaker.	1:15 PM			
	1:30 PM	81	62	7.1
	1:45 PM	81	69	11.5
	2:00 PM	81	73	11.6
	2:15 PM	81	75	11.5
	2:30 PM	84	76	11.6
	2:45 PM	85	77	11.9
	3:00 PM	86	77	12.2
	3:15 PM	87	77	12.3
	3:30 PM	85	79	12.3
Titan is powered on.	3:45 PM	86	80	12.4
	4:00 PM	85	82	12.2
	4:15 PM	86	86	6.5
	4:30 PM	86	86	5.7
	4:45 PM	87	85	5.3
	5:00 PM	86	86	5.1

Titan PCO Oxidation of N-Heptane

May 17th. & 18th., 2016



A small plastic container of water was placed in chamber to facilitate raising humidity. Chamber was sealed at 1:15 PM with a 100 cfm circulating fan running and 1 tbl spoon of N-Heptane in a beaker. Chamber was let set dormant for 2 1/2 hours to allow N-Heptane to fully evaporate and come to steady state. A Titan 1000 Hydroxyl Generator was turned on at 3:45 PM. Within 1 hour and 15 minutes the N-Heptane level was reduced from 12.4 PPM to 5.1 PPM a 59% reduction.

This test implies that the Titan 1000 is producing OH in a sufficient amount to oxidize the N-Heptane VOCs.

This test proves in theory that the Titan's Photocatalytic UVA/TiO₂ Process produces large amounts of Atmospheric Hydroxyl Radical.

As shown in Chart #1 above OH is the second strongest SAFE ROS able to be used in occupied areas.

The Titan has proven over 15 years of in field testing with thousands of units in use around the world that it is very capable of oxidizing and eradication odor causing bacteria, VOCs and air-borne spores.

The average half-life of an OH molecule is less than 2 seconds. The average half-life of an Ionized Hydro-Peroxide molecule is 20 minutes.

The Reactive Species with the Longest Half-Life Does the Majority of the Oxidizing.

All the Reactive Species produced by the Titan come from water (H₂O) being disassociated by the Photocatalytic Process to produce the OH and H₂O₂.

In order for the Titan to produce large amount of Oxidizing Reactive Species it must have humidity over 60% entering the rear of the unit.

The Following Chemicals Are Effective Against Human Coronavirus

Per EPA & CDC

Ethyl Alcohol - At concentrations of 60%–80%, is a potent virucidal agent inactivating all of the lipophilic viruses (e.g., herpes, vaccinia, and influenza virus) and many hydrophilic viruses (e.g., adenovirus, enterovirus, rhinovirus, and rotaviruses but not hepatitis A virus (HAV) 58 or poliovirus) 49.

Hydrogen Peroxide - Active against a wide range of microorganisms, including bacteria, yeasts, fungi, **viruses**, and spores.

Chlorine Bleach - One study reported that 25 different viruses were inactivated in 10 minutes with 200 ppm available chlorine.

Wikipedia Classifies Hydrogen Peroxide & Vaporizer Hydrogen Peroxide as:

Hydrogen Peroxide may be used for the sterilization of various surfaces,[61] including surgical tools,[62] and may be deployed as a vapor (VHP) for room sterilization.[63] H₂O₂ demonstrates broad-spectrum efficacy against **viruses**, bacteria, yeasts, and bacterial spores.[64] In general, greater activity is seen against Gram-positive than Gram-negative bacteria; however, the presence of catalase or other peroxidases in these organisms may increase tolerance in the presence of lower concentrations.[65] Higher concentrations of H₂O₂ (10 to 30%) and longer contact times are required for sporicidal activity.[66] Hydrogen peroxide is seen as an environmentally safe alternative to chlorine-based bleaches, as it degrades to form oxygen and water and it is generally recognized as safe as an antimicrobial agent by the U.S. Food and Drug Administration (FDA).[67]

Vaporized Hydrogen Peroxide (trademarked VHP,[1] also known as hydrogen peroxide vapor, HPV) is a vapor form of hydrogen peroxide (H₂O₂) with applications as a low-temperature antimicrobial vapor used to decontaminate enclosed and sealed areas such as laboratory workstations, isolation and pass-through rooms,[2] and even aircraft interiors.[3]

VHP is registered by the U.S. Environmental Protection Agency as a sterilant, which the EPA defines as "a substance that destroys or eliminates all forms of microbial life in the inanimate environment, including all forms of vegetative bacteria, bacterial spores, fungi, fungal spores, and **viruses**".[2] As a sterilant, VHP is one of the chemicals approved for decontamination of anthrax spores from contaminated buildings, such as occurred during the 2001 anthrax attacks in the U.S.[4] It has also been shown to be effective in removing exotic animal viruses, such as avian influenza and Newcastle disease from equipment and surfaces.[5]

Vaporized Hydrogen Peroxide has been investigated as an airborne disinfectant and infection control measure for hospitals [8] and has been shown to reduce incidence of nosocomial infections from a number of pathogens. Clostridium difficile associated disease, VRE and MRSA are all associated with environmental contamination. H₂O₂ vapor has been used in hospitals to eradicate causal agents, e.g., antibiotic-resistant Klebsiella pneumoniae, from the environment and prevent infection of subsequent patients.[9]

The ***Ionized Hydro-Peroxide*** that the ***Titan 4000*** produces is the finest form of **Vaporized Hydrogen Peroxide** and is produced “In Situ” by our Photocatalytic Process at an EPA allowable limit of .01 to .02 Parts Per Million. The EPA allowable limit on Vaporizer Hydrogen Peroxide is 1 PPM.